

## Eleven *Verrucaria* species new to Finland

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**Abstract:** Eleven *Verrucaria* species are reported as new to Finland from calcareous rocks in Lohja, inland SW Finland. Species marked by asterisk are also new to Fennoscandia: *Verrucaria amylacea*\*, *V. caliacrensis*\*, *V. dufourii*, *V. elaeina*, *V. fusca*, *V. gudbrandsdalensis*, *V. illinoisensis*\*, *V. memnonia*, *V. mimicrans*\*, *V. olivacella*\*, and *V. transfugiens*\*. Comments on habitats and a short description are provided for each species.

**Zusammenfassung:** Elf kalkbewohnende *Verrucaria*-Arten werden erstmals aus Finnland gemeldet. Die mit einem Sternchen gekennzeichneten Arten sind gleichzeitig neu für Fennoskandien: *Verrucaria amylacea*\*, *V. caliacrensis*\*, *V. dufourii*, *V. elaeina*, *V. fusca*, *V. gudbrandsdalensis*, *V. illinoisensis*\*, *V. memnonia*, *V. mimicrans*\*, *V. olivacella*\* und *V. transfugiens*\*. Kurze Beschreibungen der Arten und Bemerkungen zu ihrem Vorkommen werden beigelegt.

Occurrence of species of *Verrucaria* is rather poorly known in Finland and in northern Europe in general. VAINIO (1921) treated eight currently accepted species of *Verrucaria* from calcareous rocks in Finland based only on about 30 specimens. Later species of *Verrucaria* growing on calcareous rocks have been somewhat neglected in Finland. VITIKAINEN & al. (1997) mention only three additional species of *Verrucaria* from calcareous rocks in Finland.

During recent years *Verrucaria* species have been intensively searched from calcareous rock outcrops in Lohja, inland SW Finland (land area 278 km<sup>2</sup>) and 20 species new to Finland have been reported (PYKÄLÄ 2007).

In the present paper 11 additional species of *Verrucaria* new to Finland are reported from calcareous rocks in Lohja. These species include several poorly known species with only one or few previous records globally. Six of the species are new to Fennoscandia. Lohja belongs to the biogeographical province Varsinais-Suomi (V).

## Material and methods

All specimens were collected by the first author. Collection number is given after the date of collection. Most specimens have been identified by the second author during 2006-2007. Additional specimens for some species are also presented from other habitats and outside the Lohja area, but from the same biogeographical province. All specimens are stored in H.

The specimens have been investigated using standard microscopical techniques. Microscopical measurements refer to material examined in water.

## The species

### *Verrucaria amylacea* HEPP

*Verrucaria amylacea* is a common and widely distributed species in Central and Southern Europe (ZSCHACKE 1933). In the study region, *V. amylacea* is a variable species and may include more than one taxon. Descriptions of the species moderately differ between different sources (ZSCHACKE 1933, SERVÍT 1950 a, WIRTH 1995, BREUSS 2008 a). The following description is based on the Finnish specimens. Perithecia are 1/4-1/2-immersed, 0.2-0.35 mm in size. The involucrellum may cover more or less than half of the perithecia (apical or almost reaching to the base of perithecia). The exciple is pale to brown. The thallus is white to pale grey and can be endolithic or thinly epilithic. Spore size is  $15-22 \times 5-9 \mu\text{m}$ .

*Verrucaria amylacea* is one of the most common *Verrucaria* species on calcareous rocks and lime quarries in Lohja occurring in ca. 20 sites. The species grows mostly in shady habitats, but sometimes also in relatively sun-exposed sites. Concerning northern European *Verrucaria* species *V. amylacea* may be confused with *V. dufourii* DC. and *V. muralis* ACH. In *V. muralis* spores are larger ( $17-25 \times 8-13 \mu\text{m}$ ), and perithecia are 3/4-immersed and slightly larger (0.25-0.4 mm). Spore size of *V. dufourii* is similar to *V. amylacea*. *Verrucaria dufourii* has a strongly carbonaceous involucrellum, which is thicker and the perithecia are slightly larger (0.25-0.5 mm) than in *V. amylacea*.

**Selected specimens examined:** Finland: Lohja, Paavola, Hausnummi, lime quarry, on wall,  $60^{\circ}13'N$ ,  $23^{\circ}52'E$ , 18. 6. 1996, 16832, det. O. BREUSS 2006; - Lohja, NE of Kiviniemi lime quarry, quarry waste ground, young deciduous forest, on pebbles,  $60^{\circ}15'N$ ,  $24^{\circ}03'E$ , 9. 11. 2004, 26170, conf. O. BREUSS 2006; - Lohja, Hermala, Painiemi, clear cut forest, on 0.5 m high E-facing wall of calcareous rock outcrop,  $60^{\circ}13'N$ ,  $23^{\circ}52'E$ , 6. 6. 2005, 26967, det. O. BREUSS 2007; - Lohja, Pohjolanmäki, on small flat calcareous rock outcrop,  $60^{\circ}15'N$ ,  $24^{\circ}04'E$ , 24. 9. 2005, 28065, det. O. BREUSS 2006.

### *Verrucaria caliacrensis* SERVÍT

*Verrucaria caliacrensis* was described by SERVÍT (1950 a) based on a specimen on calcareous rock on the seashore in Bulgaria. In the type specimen the thallus is white to greyish and thinly epilithic with a somewhat powdery surface. The perithecia are about 0.2 mm in diameter and hemispherically protruding. The thin involucrellum reaches to the base of the perithecium and the exciple is black. Spore size reported by SERVÍT (1950 a) is  $15-20 \times 8-9 \mu\text{m}$ , but it was found to be  $17-22 \times 9-10 \mu\text{m}$  in the type specimen.

In the Lohja specimen the thallus is somewhat thicker and pale brownish grey, and the involucrellum is slightly thinner than in the type material. Otherwise the Finnish material agrees very well with the type. Perithecia are 0.20-0.25 mm, 1/2-3/4-immersed.

The exciple is black. The involucrellum covers at least half of perithecia and usually extends to exciple-base level, with slightly diverging bases. Spore size is  $20\text{--}23 \times 10\text{--}12 \mu\text{m}$ . The small sizes of spores and perithecia given by SERVIT (1950 a) and the colourless exciple bases reported by him most probably refer to immature perithecia.

**Specimens examined: Finland:** Lohja, Paloniemi, Ollisaari island, on small flat calcareous rock outcrop on the shore of lake Lohjanjärvi,  $60^{\circ}15'N$ ,  $24^{\circ}01'E$ , 17. 8. 2004, 25524b together with R. MURTO, det. O. BREUSS 2007.

### *Verrucaria dufourii* DC.

This widely distributed species occurs in several places in northern Europe (SANTESSON & al. 2004). In the Lohja specimens the involucrellum is thinner than usually within the species. Furthermore, the perithecia tend to be smaller (0.25-0.4 mm). However, *V. dufourii* is considered to be quite a variable species (SERVIT 1950 a, BREUSS 2008 b). Typical for the species is the strong carbonisation of the involucrellum. The exciple is pale (but may turn brown in overmature perithecia). *Verrucaria dufourii* usually grows on shady calcareous rocks.

**Selected specimens examined: Finland:** Lohja, Askola, Ylitalo, on calcareous rock,  $60^{\circ}14'N$ ,  $23^{\circ}53'E$ , 20. 6. 1998, 18505, cf. det. O. BREUSS 2006; - Lohja, Seppälä, Mustasaari, calcareous rock outcrop, on NW-facing wall,  $60^{\circ}14'N$ ,  $23^{\circ}51'E$ , 10. 8. 2004, 25427, det. O. BREUSS 2006; - Lohja, Torhola, Torhola cave, calcareous rock outcrop, on N-facing wall,  $60^{\circ}15'N$ ,  $23^{\circ}51'E$ , 20. 9. 2004, 25682.

### *Verrucaria elaeina* BORRER

The species is characterised by a normally pale green (rarely pale or mid-brown) epilithic, usually areolate thallus (ORANGE 2000). Perithecia are  $\frac{1}{2}$ - $\frac{3}{4}$ -immersed, 0.2-0.4 mm in size. The exciple is pale. The conical involucrellum covers more than half of the perithecium and often reaches to its base. Spore size is  $16\text{--}23 \times 6\text{--}9 \mu\text{m}$ .

Previously reported once from Fennoscandia (Norway), the species is apparently overlooked (ORANGE 2000). However, *V. elaeina* seems to be rare in Finland. It is one of the most shade-preferring *Verrucaria* species. It may be confused with *V. hydrela* ACH., *V. muralis* ACH., and *V. amyloacea* HEPP. *Verrucaria hydrela* has a subgelatinous green thallus and its involucrellum is more strongly spreading (in *V. elaeina* involucrellum only moderately spreading). Rare morphs of *V. muralis* with pale green epilithic thallus (if they belong to *V. muralis* at all) can be superficially rather similar to *V. elaeina*. In *V. muralis* the involucrellum covers less than half of the perithecium and the spores are broader. Specimens of *V. elaeina* lacking green colour in thallus may be confused with *V. amyloacea*, which has, however, a white and very thinly epilithic or endolithic, non-areolate thallus and non-conical involucrella.

**Specimens examined: Finland:** Lohja, Pohjolanmäki, on small flat calcareous rock outcrop,  $60^{\circ}15'N$ ,  $24^{\circ}04'E$ , 24. 9. 2005, 28062, det. O. BREUSS 2006; - Nummi-Pusula, Hyönölä, 100 m SW of Kuivala, lime quarry, on bottom on pebbles,  $60^{\circ}28'N$ ,  $23^{\circ}55'E$ , 9. 9. 2006, 29345.

### *Verrucaria fusca* PERS.

This species is widely distributed in Europe but has been previously only once reported from Fennoscandia from northern Sweden (MAGNUSSON 1946). *Verrucaria fusca* is characterised by small (0.2-0.25 mm) perithecia, medium spores ( $17\text{--}24 \times 9\text{--}12$

$\mu\text{m}$ ), dark exciples, and an involucrellum reaching to exciple-base level and often thickening towards base (ZSCHACKE 1933, SERVÍT 1949) The thallus is thin and brown and often fleck-like and becomes  $\pm$  gelatinous when wet. In several of the Lohja specimens the spores are more slender ( $16\text{-}22 \times 7\text{-}8 \mu\text{m}$ ) than reported in literature. These specimens are reported here as *V. cf. fusca*. *Verrucaria memnonia* (KÖRBER) ARNOLD is similar to *V. fusca* in most characters, but spores are smaller:  $11\text{-}18 \times 5\text{-}8 \mu\text{m}$ . *Verrucaria fusca* grows in Lohja both on shady and sun-exposed calcareous rock outcrops, pebbles and in lime quarries.

**Selected specimens examined: Finland:** Lohja, Tytyri, by a lime quarry, road bank, on pebbles,  $60^{\circ}16'N$ ,  $24^{\circ}04'E$ , 14. 1. 2005, 26224; - Lohja, Askola, Pasasveräjä, on flat calcareous rock outcrop,  $60^{\circ}13'N$ ,  $23^{\circ}53'E$ , 18. 6. 2005, 27055, det. O. BREUSS 2006; - Lohja, Hermala, Kalkkimäki, small lime quarry, on bottom, on pebble,  $60^{\circ}13'N$   $23^{\circ}51'E$ , 1. 9. 2005, 27806, cf. *fusca* det. O. BREUSS 2007; - Lohja, Pohjolanmäki, on small flat calcareous rock outcrop,  $60^{\circ}15'N$ ,  $24^{\circ}04'E$ , 24. 9. 2005, 28055, 28067, cf. *fusca* det. O. BREUSS 2007; - Lohja, Kiviniemi, lime quarry waste land on shore of lake Lohjanjärvi, young deciduous forest, on pebbles,  $60^{\circ}15'N$ ,  $24^{\circ}03'E$ , 28. 2. 2007, 30568.

### *Verrucaria gudbrandsdalensis* ZSCHACKE ex H. MAGN.

This species is characterised as follows: Thallus whitish grey, thin and indistinct, slightly rimose; perithecia hemispherically protruding; exciple pale or darkening, up to 0.3 mm in diameter; involucrellum extending to exciple-base level, appressed to the exciple except near the base; periphyses about 30-35  $\mu\text{m}$  long; ascospores  $19\text{-}25 \times 9\text{-}12 \mu\text{m}$ .

*Verrucaria gudbrandsdalensis* is a rarely collected species of siliceous rocks. It is known from Norway (MAGNUSSON 1932), Sweden (MAGNUSSON 1952) and Austria (BREUSS 2004). *Verrucaria gudbrandsdalensis* can be confused with *V. amylicea* and *V. schindleri*. *Verrucaria amylicea* has noticeably smaller spores. In *V. schindleri* the involucrellum covers less than half of the perithecia and the species is calcicolous.

**Specimen examined: Finland:** Lohja, Hermala, Kalkkimäki, road cutting of calcareous rock outcrop, on siliceous pebbles,  $60^{\circ}13'N$ ,  $23^{\circ}51'E$ , 6. 6. 2005, 26951, det. O. BREUSS 2006.

### *Verrucaria illinoisensis* SERVÍT

*Verrucaria illinoisensis* is a poorly known species close to *V. muralis*. It has been known only from North America (SERVÍT 1950 b) and was recently reported as new to Europe from Austria (BREUSS 2008 c). Perithecia are smaller (0.2-0.25 mm) than in *V. muralis* (0.25-0.4 mm) and its periphyses shorter: 20-25  $\mu\text{m}$  (SERVÍT 1950 b) versus 30  $\mu\text{m}$  (SERVÍT 1950 a) or 30-60  $\mu\text{m}$  (HARADA 1996). According to SERVÍT (1950 b) spore size is  $18\text{-}20 \times 8\text{-}10 \mu\text{m}$ , but this given magnitudinal range is certainly too narrow. In the Lohja collection spores are  $20\text{-}24(-27) \times 8\text{-}10(-12) \mu\text{m}$ .

**Specimen examined: Finland:** Lohja, Hermala, Kalkkimäki, lime quarry, on S-facing wall,  $60^{\circ}13'N$ ,  $23^{\circ}51'E$ , 1. 9. 2005, 27855, det. O. BREUSS 2006.

### *Verrucaria memnonia* (KÖRBER) ARNOLD

The species occurs on both calcareous and siliceous rocks (BREUSS 2004), preferring shady habitats. However, in some sites in the study area *V. memnonia* grows also on rather sun-exposed rock habitats. It is characterised by a subgelatinous brown or blackish thallus that is often very small and fleck-like. The half-immersed perithecia

are 0.2-0.3 mm in size. The exciple is dark and the involucrellum reaches to the base of perithecia. Spore size in the Lohja specimens varies between  $11-18 \times 5-8 \mu\text{m}$ .

**Selected specimens examined: Finland:** Lohja, Seppälä, Mustasaari island, calcareous rock outcrop, on NW-facing wall,  $60^{\circ}14'N$ ,  $23^{\circ}52'E$ , 10. 8. 2004, 25422, det. O. BREUSS 2006; - Lohja, Paloniemi, Luhtalahti, road cutting, on SW-facing wall of calcareous quartz-feldspar rock outcrop,  $60^{\circ}16'N$ ,  $24^{\circ}01'E$ , 28. 4. 2005, 26711, det. O. BREUSS 2007; - Lohja, Pitkäniemi,  $60^{\circ}15'N$ ,  $24^{\circ}03'E$ , on shore of lake Lohjanjärvi, on flat calcareous rock outcrop, 19. 8. 2005, 27585, and in a lime quarry, on pebbles, 23. 8. 2005, 27700; - Lohja, Paloniemi, N of Mustasaari, small island, deciduous forest, on concrete block,  $60^{\circ}15'N$ ,  $24^{\circ}00'E$ , 16. 3. 2007, 30319; - Lohja, Koski, Varkaanuunimäki, *Picea abies*-dominated forest, on siliceous boulder,  $60^{\circ}21'N$ ,  $24^{\circ}05'E$ , 2. 6. 2007, 31040; - Pohja, Kuovila, SE of Kalkkuunimäki, *Picea abies*-dominated herb-rich forest, in abandoned lime quarry, on SE-facing wall,  $60^{\circ}08'N$ ,  $23^{\circ}24'E$ , 9. 10. 2006, 29655.

### *Verrucaria mimicrans* SERVÍT

*Verrucaria mimicrans* is close to *V. muralis*, but spores are larger:  $25-31 \times 12-15 \mu\text{m}$  (SERVÍT 1950 a),  $25-27 \times 13.5-15 \mu\text{m}$  (BREUSS 2004) or  $23-30 \times 12-15 \mu\text{m}$  (BREUSS 2008 a) and periphyses are longer ( $40-60 \mu\text{m}$ ) and branched-anastomosing (BREUSS 2008 a, b). In the Lohja specimen spores are narrower:  $25-30 \times (10-11-13 \mu\text{m})$ . The exciple is initially pale, but may turn dark rather early in mature perithecia. The involucrellum covers the upper third to upper half of the perithecium and is more or less diverging from the exciple.

*Verrucaria mimicrans* has been previously known from former Yugoslavia (SERVÍT 1950 a), Germany (SCHOLZ 2000), Austria (BREUSS 2004) and North America (BREUSS 2008 a).

**Specimen examined: Finland:** Lohja, Torhola, Kallioranta, young pine plantation, S-slope, on small wall of calcareous rock,  $60^{\circ}15'N$ ,  $23^{\circ}53'E$ , 22. 7. 2004, 25278, det. O. BREUSS 2006.

### *Verrucaria olivacella* SERVÍT

*Verrucaria olivacella* resembles *V. dolosa* HEPP. However, the spores are larger in *V. olivacella*. In the Lohja specimens spore size is  $(13-15-24 \times 6-9 \mu\text{m})$ . In the original description spore size is  $17-24 \times 7-11 \mu\text{m}$  (SERVÍT 1953).

*Verrucaria olivacella* has previously been reported from Italy (SERVÍT 1953) and North America (BREUSS 2008 a). The habitats seem to be similar in both species. *Verrucaria olivacella* prefers shady habitats; it occurs on calcareous rocks and pebbles and also on bricks.

**Specimens examined: Finland:** Lohja, Ojamo, Liessaari island, by shore of lake Lohjanjärvi, on NW-facing wall of calcareous rock outcrop,  $60^{\circ}14'N$ ,  $24^{\circ}01'E$ , 15. 4. 2005, 26529, det. O. BREUSS 2006; - Lohja, NE of Kiviniemi lime quarry, quarry waste land, young deciduous forest, on pebble,  $60^{\circ}15'N$ ,  $24^{\circ}03'E$ , 28. 3. 2007, 30569; - Lohja, Hermala, Tolpoonkallio, lime quarry, on pebbles,  $60^{\circ}13'N$ ,  $23^{\circ}50'E$ , 21. 6. 2007, 31127; - Nummi-Pusula, Röhkölä, Kalkkimäki, small calcareous rock outcrop, on pebble,  $60^{\circ}25'N$ ,  $23^{\circ}55'E$ , 20. 5. 2007, 30993.

### *Verrucaria transfugiens* ZSCHACKE

The species has  $\frac{3}{4}$  to fully immersed perithecia 0.2-0.3 mm in size, leaving deep pits in the rock. The thallus is endolithic. The involucrellum is small and apical and the exciple is dark. Spore size is  $18-26(-28) \times 9-13 \mu\text{m}$  (BREUSS 2004, 2006). Externally, *Verrucaria transfugiens* comes close to *V. foveolata* (FLÖRKE) A. MASSAL., which, how-

ever, has no involucrellum and larger spores. *Verrucaria dolomitica* (A. MASSAL.) KREMP. (unknown from Finland) has a similar apical involucrellum, but it differs by larger spores (BREUSS 2002). *Verrucaria transfugiens* may also be confused with *V. schindleri*. In *V. schindleri* the perithecia are not fully immersed and not leaving pits or pits are shallow and indistinct, and there is a distinct involucrellum. Based on the Finnish sites *V. transfugiens* may prefer half-shady habitats.

**Specimens examined: Finland:** Lohja, Seppälä, Seppälänsaari, on shallow calcareous rock outcrop, 60°14'N, 23°51'E, 16. 8. 2004, 25497; - Lohja, Moisio, Lohjanharju esker, *Pinus sylvestris*-heath forest, on a calcareous boulder, 60°15'N, 24°06'E, 18. 6. 2005, 27019, det. O. BREUSS 2007; - Lohja, Pitkäniemi, lime quarry, on NW- to W-slope, 60°15'N, 24°02'E, 23. 8. 2005, 27734, det. O. BREUSS 2006; - Lohja, Hermala, Kalkkimäki, lime quarry, on S-facing wall, 60°13'N, 23°51'E, 1. 9. 2005, 27811; - Lohja, Hermala, Tolpoonkallio, lime quarry, on pebbles, 60°13'N, 23°50'E, 21. 6. 2007, 31126b.

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