
MYCOTAXON

ISSN (print) 0093-4666 (online) 2154-8889 Mycotaxon, Ltd. ©2017

October–December 2017—Volume 132, pp. 857–865

<https://doi.org/10.5248/132.857>

New reports of *Myriospora* (Acarosporaceae) from Europe

KERRY KNUDSEN¹, JANA KOCOURKOVÁ¹ & ULF SCHIEFELBEIN²

¹ Czech University of Life Sciences Prague, Faculty of Environmental Sciences, Department of Ecology,
Kamýčká 129, Praha 6 - Suchbátka, CZ-165 21, Czech Republic

² Blücherstraße 71, D-18055 Rostock, Germany

* CORRESPONDENCE TO: knudsen@fzp.czu.cz

ABSTRACT—*Myriospora dilatata* is newly reported for the Czech Republic and *M. myochroa* new for Italy. *Myriospora rufescens* was rediscovered in Germany almost 100 years after its first collection. A neotype is designated for *Acarospora fusca*, which is recognized as a synonym of *M. rufescens*.

KEY WORDS—*Myriospora hassei*, *Silobia*, *Trimmatothelopsis*

Introduction

The genus *Myriospora* in the *Acarosporaceae* is a well-supported clade distinguished by a constellation of morphological characters (non-lecideine apothecia, high hymenium, thin paraphyses, interrupted algal layer, short conidia, no secondary metabolites or norstictic acid) (Wedin et al. 2009; Westberg et al. 2011, 2015). The genus currently contains 12 species that occur in Antarctica, Asia, Europe, and North and South America (Knudsen 2011, Westberg et al. 2011, Knudsen et al. 2012, Knudsen & Bungartz 2014, Schiefelbein et al. 2015, Purvis et al. in press). *Myriospora fulvoviridula* (Harm.) Cl. Roux is a synonym of *M. scabrida* (H. Magn.) K. Knudsen & Arcadia (Knudsen et al. 2017, Roux et al. 2014). The most common species in the genus is *M. smaragdula* (Wahlenb.) Nägeli ex Uloth, which occurs in Asia, Europe, North and South America (Magnusson 1929, Knudsen 2007, Westberg et al. 2011, Knudsen et al. 2012). The center of diversity of the genus appears to be in Europe where nine species occur. The genus was originally treated as *Silobia*

(Westberg et al. 2011, Knudsen 2011) and briefly as *Trimmatothelopsis* [(Roux & Navarro-Rosinés 2011); for a current circumscription of *Trimmatothelopsis* see Knudsen & Lendemer 2016]. It is now treated under its oldest available name *Myriospora* (Arcadia & Knudsen 2012).

While the reported diversity of *Acarosporaceae* is high in Europe (Magnusson 1929, 1956), no species is particularly frequent except for *Acarospora fuscata* (Schrad.) Arnold. It is not unusual to collect all day on rocks and soil in the Czech Republic, Germany, or the Italian Alps and only find one or two species of *Acarosporaceae* besides *A. fuscata*. Because of this diversity of taxa and infrequency of populations, not to mention problems identifying many species, there are possibilities for new discoveries. In this paper, we report three new records of *Myriospora* species in Europe.

Materials & methods

Myriospora specimens from institutional herbaria (PRM, STU, TBS, UCR, UPS) and personal herbaria of Jana Kocourková and Kerry Knudsen (hb. K & K) and Ulf Schiefelbein (hb. Schiefelbein) were determined using key and descriptions by Westberg et al. (2011). They were analyzed with standard microscopy and spot tests (Nash et al. 2002). Undiluted fresh Lugol's solution (Merck) was used to test amyloid reactions of the hymenium and subhymenium. The description of *M. rufescens* according to Westberg et al. (2011) was revised. Jana Kocourková photographed *M. rufescens* using a digital camera Olympus DP72 attached to an Olympus SZX7 Stereomicroscope and Olympus BX51 fitted with a Nomarski differential interference contrast and image stacks processed with software Olympus Deep Focus 3.1.

Taxonomy

Myriospora dilatata (M. Westb. & Wedin) K. Knudsen & Arcadia,

Opusc. Philolich. 11: 21, 2012.

≡ *Silobia dilatata* M. Westb. & Wedin, Lichenologist 43(1): 12, 2011.

TYPE: Sweden. Torne Lappmark. Jukkasjärvi par., Tornehamn, shore of Lake Torneträsk, on silicate rock, 3 Sept. 2006, E. Baloch SW116 (S [n.v.], holotype).

≡ *Trimmatothelopsis dilatata* (M. Westb. & Wedin) Cl. Roux &

Nav.-Ros., Bull. Soc. Linn. Provence 62: 176, 2011.

DESCRIPTION. See Westberg et al. (2011, as *Silobia dilatata*). For pictures see Westberg et al. (2011) and Wirth et al. (2013).

ECOLOGY & DISTRIBUTION. Ferrophilous, heavy metal tolerant, often in moist habitats near streams. Czech Republic (Bohemia), Germany (Wirth et al. 2011, 2013), Norway (Westberg et al. 2011), Sweden (Westberg et al. 2011).

SPECIMEN EXAMINED. CZECH REPUBLIC. NORTHERN BOHEMIA. Krkonoše Mts, Sněžka Mt., SSE of former mine 'Kovářna', 50°43'35"N 15°43'58.7"E, alt. 1075 m, humid

lower edge of boulder scree, mica-schist outcrop enriched of heavy metals (copper ores and arsenopyrite), 8 Sept. 2016, J. Kocourková 9083 & K. Knudsen (hb. K & K).

DISCUSSION. *Myriospora dilatata* is easily identified among *Myriospora* by its orange to reddish areoles, non-punctiform apothecia, lack of secondary metabolites, and occurrence on substrates rich in iron and other heavy metals (Westberg et al. 2011). The species is reported as rare in Bohemia in the Czech Republic. In the Krkonoše Mountains *M. dilatata* was growing on a mica-schist outcrop enriched with heavy metals (copper ores and arsenopyrite) in a relatively moist habitat with abandoned mining pits. In these same mountains, the often red-powdered ferrophilous species *Acarospora sinopica* (Wahlenb.) Körb. is common (hb. K & K) and there have been several collections by Zdeněk Palice (PRA) and V. Kuřák (PRM) of the orange ferrophilous species *M. tangerina* (M. Westb. & Wedin) K. Knudsen & Arcadia (Westberg et al. 2011, Knudsen et al. 2017). Punctiform apothecia easily distinguish *A. sinopica* from *M. dilatata* with its areoles with dilated apothecia. With difficult specimens the full description and discussion of *A. sinopica* in Magnusson (1929) is informative. Punctiform apothecia also distinguish *M. tangerina* from *M. dilatata* as well as large squamules. An apparently cryptic ferrophilous taxon of *Myriospora*, similar in appearance to *M. dilatata* and sometimes identified as *Acarospora smaragdula* f. *subochracea* H. Magn., was reported in an unpublished molecular analysis of specimens from the Alps but not yet described (Westberg et al. 2011). This report extends the range of *M. dilatata* from Fennoscandia to Central Europe.

Myriospora myochroa (M. Westb.) K. Knudsen & Arcadia,

Opusc. Philolich. 11: 22, 2012.

≡ *Silobia myochroa* M. Westb., Lichenologist 43(1): 14, 2011.

TYPE: Sweden. Bohuslän. Orust, Morlanda Parish, near car park at Stocken, grid ref: (RT90) 6456258 1241653, c. 1 m, on the vertical surface of a SW-facing rock, 16 Sept. 2003, A. Crewe & O. W. Purvis 719 (S [n.v.], holotype).

≡ *Trimmatothelopsis myochroa* (M. Westb.) Cl. Roux & Nav.-Ros., Bull. Soc. Linn. Provence 62: 176, 2011.

DESCRIPTION. For description and pictures Westberg et al. (2011, as *Silobia myochroa*). For picture and map of Italian distribution, see Nimis & Martellos (2017).

ECOLOGY & DISTRIBUTION. Asia, Europe. Often on silicate rock underhangs at low to high elevations. In salt spray zone along Atlantic coast. Czech Republic (Malíček & Vondrák 2016), Finland (Westberg et al. 2011), France (Roux et al. 2014), Germany (Wirth et al. 2013, Schiefelbein et al. 2015), Italy, Norway

(Westberg et al. 2011), Poland (Flakus 2014), Russia (Siberia) (Zhdanov 2013), Sweden (Westberg et al. 2011).

SELECTED SPECIMEN EXAMINED. ITALY. FRIULI. *Giogaia dei Fleors*: sen tiero vs la cima, 2406 m, in silicate rock underhang, 17 Aug. 1996, M. Tretiach 24565 (TBS).

DISCUSSION. Our discovery of specimens of *Myriospora myochroa* in TBS extends the species range into Italy. If spot tests are negative and crystals of norstictic acid are not observed in the cortex with polarized light, *M. myochroa* is sometimes misidentified as *M. hassei* (Herre) K. Knudsen & Arcadia, a species we currently consider endemic to the Pacific Plate Lichen Bioregion on the south and central coast of California (Knudsen 2011, Knudsen & Bungartz 2014, Nimis 2016, Nimis & Martellos 2017).

Myriospora rufescens (Ach.) Hepp ex Uloth, Flora 44: 618, 1861.

FIG. 1

≡ *Sagedia rufescens* Ach., Lichenogr. Univ. 329, 1810.

TYPE: Great Britain. England. Turner 23 (H-ACH-980[n.v.]), lectotype (designated in Westberg et al. 2011).

≡ *Lecanora rufescens* (Ach.) Nyl., Flora 55: 364, 1872.

≡ *Acarospora rufescens* (Ach.) Kremp., Lich.-Fl. Bayern.: 173 (1861).

≡ *Silobia rufescens* (Ach.) M. Westb. & Wedin, Lichenologist 43(1): 18, 2011.

≡ *Trimmatothelopsis rufescens* (Ach.) Cl. Roux & Nav.-

Ros., Bull. Soc. Linn. Provence 62: 176, 2011.

= *Acarospora fusca* B. de Lesd., Recherch. Lich. Dunkerque 1(Suppl.): 100, 1914, syn. nov.

TYPE: France. Dunkerque. Malo Terminus, dunes, 1910, B. des Lesdain s.n. (holotype [n.v.]). Presumed lost in bombing of Dunkirk in WW2). Germany. Mecklenburg. West Pomerania, Vorpommern-Greifswald, Greifswald, Koos Island, eastern edge of the island, 54°10'13"N 13°25'19"E, c. 1 m, on single boulder on boulder beach, 6 Aug. 2004, U. Schiefelbein 4446 (*Neotype designated here*, NY; *isoneotype*, hb. Schiefelbein).

HYPOTHALLUS endosubstratic, I-. THALLUS epilithic, areolate, areoles verruciform [areoles with an immersed apothecium dilating until the thallus is reduced to a thallose margin around the disc and often resembling *Lecanora* apothecia and/or areoles not verruciform, rounded to angular, 0.4–0.9(–1.5) mm diam., on smooth surfaces forming a contiguous indeterminate crust, becoming dispersed on uneven rock surface, replicating by the division of the areoles, the upper surface dark grey to dark greyish or reddish brown, epruinose, smooth to rugulose, flat to somewhat convex, lower surface broadly attached, epicortical layer lacking, upper cortex (10–)40–60 µm thick, paraplectenchymatous but individual cells difficult to distinguish, ≤5 µm diam. Algal layer with or without distinct interruption by thin hyphal bundles, ca. 100 µm tall, continuous beneath apothecia. Medulla continuous with attaching

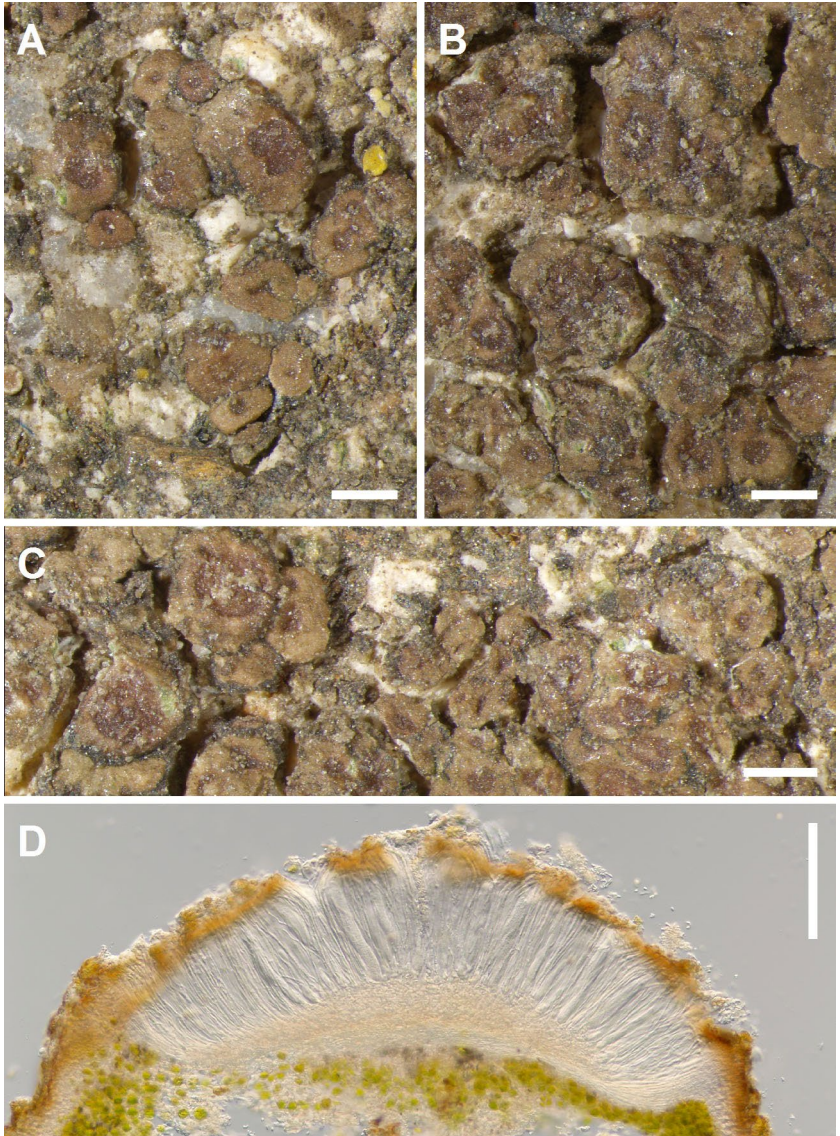


Fig. 1. *Myriospora rufescens* (*Acarospora fusca* neotype, Schiefelbein 4446): A. Dispersed areoles of the thallus with solitary apothecia; B. Areoles with mostly solitary apothecia forming a contiguous indeterminate crust; C. Apothecia 1–(2–4) per areole in contiguous crust; D. Vertical section of ascus. Scale bars: A–C = 500 μ m; D = 100 μ m.

hyphae, mostly 2–3 μm wide, mixed with substrate particles. APOTHECIA 1–(2–4) per areole, immersed, disc rounded, 0.07–0.25(–0.60) mm diam., reddish brown to blackening, flat, smooth or rough, epruinose, parathecium colorless in section, ca. 15 μm below the hymenium, expanding up to 60 μm near the surface, uppermost cells with dark brown caps, forming an indistinct perithecial crown concolorous with the thallus or becoming blacker, epihymenium reddish brown to dark brown. HYMENIUM (100–)120–140(–160) μm tall (as low as 85 μm per Magnusson 1929), I– red. PARAPHYSES 1–1.5 μm wide at midlevel, sparsely branched, tips cylindrical to clavate, widened to 2.5 μm , asci up to 150 \times 27 μm . ASCOSPORES narrowly ellipsoid to bacilliform, 3–6 \times (1–)1.5(–2) μm . SUBHYMENIUM opaque, (20–)40–55 μm tall interspersed with oil drops, I+ blue. PYCNIDIA not observed.

ECOLOGY & DISTRIBUTION. Usually on smooth or rough surfaces of silicate rock. Czech Republic (Magnusson 1929), France (Roux et al. 2014), Germany (Magnusson 1929, Westberg et al. 2011), Norway (Westberg et al. 2011), Sweden (Westberg et al. 2011), United Kingdom (Magnusson 1929, Fletcher et al. 2009, Westberg et al. 2011).

OTHER SPECIMENS EXAMINED. GERMANY. LOWER SAXONY. District Stade, Neßsand island: c. 250 m W of the Inselwarthaus, 53°33'20"N 9°45'25"E, c. 5 m, acidophilous, nutrient-poor grassland with single shrubs, on siliceous stone in the grass, 26 Sept. 2015, U. Schiefelbein 4415, (hb. Schiefelbein); c. 200 m S of the Inselwarthaus, 53°33'15"N 9°45'40"E, c. 5 m, pile of stone in a nutrient-poor grassland, forming large patch on siliceous boulder, 26 Sept. 2015, U. Schiefelbein 4416 (hb. Schiefelbein).

DISCUSSION. *Myriospora rufescens* is distinguished from other members of the genus by its small (≤ 0.5 mm diam.) apothecia with a relatively short (usually 120–140 μm) hymenium with thin paraphyses and tall subhymenium interspersed with oil drops (Westberg et al. 2011). As in *M. dilatata*, the apothecia are not punctiform but dilated, often forming verruciform areoles reminiscent of *Lecanora* apothecia.

Magnusson (1929) considered *Acarospora rufescens* and *A. fusca* to represent distinct species, but we consider them conspecific, representing two different morphotypes that can intergrade even in the same population. Thus in Magnusson (1929), *A. rufescens* was the morphotype with verruciform areoles often resembling *Lecanora* apothecia (see FIG. 1A and also lectotype photo in Westberg et al. 2011) while *A. fusca* represented the morphotype with mostly contiguous non-verruciform areoles, often with two or more apothecia and usually forming a thin indeterminate crust (FIG. 1B,C). The holotype of *A. fusca* in Bouly de Lesdain's herbarium is presumed to have been lost in World War II during the 1940 bombing of Dunkirk, as were many other specimens cited by



Fig. 2. *Acarospora fusca* neotype locality on boulder beach in Koos Island, Mecklenburg, Germany.

Magnusson in his *Acarospora* monograph (Magnusson 1929, Abbeyes 1966). The only recorded collection of *M. rufescens* in Germany was made in Anhalt, Bernburg, by G.H. Zschacke in 1907 (Magnusson 1929, Westberg et al. 2011, Wirth et al. 2013). This German collection of *M. rufescens* was identified as *A. fusca* (Magnusson 1929). We designate a modern collection by Ulf Schiefelbein from Koos Island in Germany as the neotype of *A. fusca*, deposit it in NY, and formally recognize *A. fusca* as a synonym of *M. rufescens*. It has been over 100 years since *M. rufescens* was last collected in Germany in 1907. A return trip to Koos Island revealed no additional *M. rufescens* on the other rocks along the shore.

Myriospora rufescens is a small species that can be overlooked, especially in a mixed saxicolous community. The three 21st century German collections suggest that *M. rufescens* prefers microhabitats with high annual relative humidity. The neotype locality for *Acarospora fusca* on Koos Island is a boulder beach on the western edge of Greifswalder Bodden, a bay of the Baltic Sea (FIG. 2). The neotype population occurred on the top of a large boulder that was not usually inundated but regularly sprayed by waves of brackish water, leaving salt crystals embedded in the cortex and apothecia. The two other modern German sites for *M. rufescens* were on the small narrow island of Neßsand, located just downstream from Hamburg at the mouth of Elbe River.

Acknowledgments

We thank our reviewers, J.C. Lendemer (NY) and J. McCarthy, S.J. (Canada). We thank for their assistance P.L. Nimis (TBS) and the curators of PRA, PRM, STU, TBS, UCR, and UPS. The work of Jana Kocourková and Kerry Knudsen was financially supported by 42900/1312/3166 [Environmental aspects of sustainable development of society], a grant from the Faculty of Environmental Sciences, Czech University of Life Sciences Prague.

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