

Caloplaca subpallida (Teloschistaceae), a lichen species new to Poland: distribution, ecology and taxonomic affinities

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Abstract

Caloplaca subpallida is reported from basic and altered ultrabasic rocks (i.e. basalt, greenstone, and serpentinite) at nine sites in SW Poland. A detailed description of the species and a discussion on its taxonomic affinities are provided.

Keywords: lichenized fungi, *Caloplaca oxfordensis*, *C. ferruginea* group, lichen taxonomy, Sudety Mts

Introduction

Caloplaca subpallida, described from Europe by Magnusson [1], belongs to the *C. ferruginea* group [2,3], which includes species with whitish, greyish or blackish thalli lacking anthraquinones, and ferruginous apothecia, which contain anthraquinones. The species of the group are characterized by their content of chemosyndromes based on 7-chloroemodin [4]. This is a large group of ca. 35 species [2,3], which have different habitat preferences, growing on siliceous or calcareous rocks, bark of trees, wood or bryophytes. According to Gaya et al. [5], the *C. ferruginea* group is polyphyletic and taxonomically very problematic; therefore the group is in urgent need of a thorough revision worldwide. However, some recent contributions to its understanding have been undertaken by Vondrák & Hrouzek [6], Arup et al. [7] and Arup & Åkelius [8].

The *C. ferruginea* group, represented by ca. 22 species in Poland [9–13], has not been subjected to detailed studies, although taxonomic notes on some species are included in the papers by Wilk & Flakus [10], Wilk & Śliwa [11] and Wilk [12], which refer to the following taxa: *C. albolutescens* (Nyl.) H. Olivier, *C. conciliascens* (Nyl.) Zahlbr., *C. percrocata* (Arnold) J. Steiner, *C. soralifera* Vondrák & Hrouzek and *C. teicholyta* (Ach.) J. Steiner. Furthermore, the two first authors of the present study have paid special attention on this species group during lichenological studies in SW Poland. Based on these surveys,

Kossowska [13] reported *C. cf. atroflava* (Turner) Mong. from serpentinites of the Sudety Mts and the Przedgórze Sudeckie foreland; more recent work has shown that *C. subpallida* was included in the material published by Kossowska [13], and subsequent studies carried out in the same area by the first author yielded additional records of the latter species.

In this paper, *C. subpallida* is reported as new to Poland, and a detailed description of the species with notes on its habitat and distribution are provided. Taxonomic affinities of the species with other taxa are discussed, with particular reference to *C. oxfordensis* based on the type material examination.

Material and methods

The study is based on material collected from the Sudety Mts (including the Pogórze Zachodniosudeckie foothills and the Przedgórze Sudeckie foreland) in SW Poland. Voucher material is lodged in WRSB and the private herbarium of K. Szczepańska (Hb. Szczepańska). Reference material from KRAM, MICH and MIN was also investigated.

Morphological characters were examined on dry material using a dissecting microscope and anatomical characters were observed on hand-cut sections and squash preparations mounted in water. The structure of paraphyses was observed in 25% KOH (K). K and 65% nitric acid (N) were used for chemical reactions.

The terminology for tissues follows Bungartz [14] and Ryan et al. [15] and pigment nomenclature for non-anthraquinones follows Meyer & Printzen [16].

Results

Description of the species

Caloplaca subpallida H. Magn., Bot. Not. 1945: 305.

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TYPE. Sweden, Bohuslän. Jorlanda, Rannekarr, 1939, Degelius (UPS; not seen).

Thallus epilithic, thin to thick, rimose at the periphery, rimose-areolate to subsquamulose in the central part, irregular in shape, pale to dark grey, epruinose; prothallus occasionally present, blackish; vegetative propagules absent. Areoles irregular, flat or slightly convex. Thallus cortex inconspicuous, ca. 15 µm wide, paraplectenchymatous, the upper part K+ and N+ very weakly violet (sedifolia-grey pigment), without granules/crystals; algal layer continuous.

Apothecia zeorine, numerous, usually crowded and in groups, at first partially immersed in the thallus, then broadly sessile, round to angular and flexuose due to mutual compression, 0.1–0.7 mm diam. (Fig. 1). Disc at first concave, then flat, orange to dark orange; proper margin persistent, thinner with age, at first raised above the disc, then at the same level with disc, smooth, distinctly paler than disc; thalline margin usually not visible macroscopically, occasionally present at base of apothecia. Parathecium well developed, prosoplectenchymatous, lumina of cells elongated, anthraquinone crystals present. Amphithecium with abundant algae, cortex indistinct, without granules/crystals. Epihymenium interspersed with orange-yellow crystals of anthraquinones (K+ red). Hymenium hyaline, 75–85(–110) µm high. Paraphyses simple to slightly branched, apical cells not thickened to slightly thickened, up to 5 µm wide. Hypothecium hyaline, with irregular hyphae. Asci 8-spored, spores polarilocular, thin-walled, narrowly ellipsoid,

(10–)12–15.5(–19) × (4.5–)5–6.0(–7.0) µm, isthmus 2.5–4.0 µm wide. Pycnidia not observed.

Ecology and distribution

Caloplaca subpallida grows on non-calcareous rocky substrata, especially mineral-rich siliceous rocks or slightly dust-impregnated surfaces, from boreal to Mediterranean regions [17]. In Poland, *C. subpallida* was recorded from basic and altered ultrabasic rocks (i.e. basalt, greenstone, serpentinite). These rocks are rich in compounds of Ca and Mg, and relatively poor in silicon dioxide (SiO₂). At the collecting sites, the species was accompanied by silicolous lichens with a wide range of habitat preferences [e.g. *Acarospora fuscata* (Nyl.) Arnold, *Candelariella vitellina* (Hoffm.) Müll. Arg., *Lecanora muralis* (Schreb.) Rabenh., *Scoliciosporum umbrinum* (Ach.) Arnold, *Umbilicaria hirsuta* (Sw. ex Westr.) Hoffm., *Xanthoparmelia conspersa* (Ach.) Hale], as well as lichens typical of neutral and slightly basic non-calcareous substrata [e.g. *Lecanora rupicola* (L.) Zahlbr., *Lecidella carpathica* Körb., *Polysporina lapponica* (Ach. ex Schaer.) Degel.], or metal- and mineral-enriched substrata [e.g. *Catillaria atomarioides* (Müll. Arg.) H. Kiliias, *Lecidea fuscoatra* (L.) Ach., *Rhizocarpon distinctum* Th. Fr., *Rinodina oxydata* (A. Massal.) A. Massal. and *Trapelia glebulosa* (Sm.) J. R. Laundon]. It is worth noting that the occurrence of *C. subpallida* seems to be a characteristic trait of serpentinitic rocky substrata in SW Poland. Its typical lead-grey thalli were found on most of the exposed serpentinite outcrops (Fig. 2), sometimes constituting the dominant component of lichen



Fig. 1 *Caloplaca subpallida*, thallus with apothecia.

vegetation [13]. Recent records of *C. subpallida* on basalt and greenstone, however, may reflect a wider ecological amplitude in the region. It is possible that under favorable environmental conditions, this lichen could be found also on other rocky substrata of similar mineralogical and chemical properties such as amphibolites and gabbro.

All known Polish localities of *C. subpallida* are concentrated in the SW of the country, within the Sudety Mts, including Przedgórze Sudeckie foreland and Pogórze Zachodniosudeckie foothills (Fig. 3), the nine collecting sites located in natural outcrops or abandoned quarries.

EXSICCATE EXAMINED. Vězda, Lich. Sel. Bohem. Exs. 110 (det. H. Magnusson; KRAM).

SPECIMENS EXAMINED. Poland, **Pogórze Zachodniosudeckie foothills**, Pogórze Kaczawskie foothills: Rataj hill, abandoned basalt quarry Małe Organy Myśluborskie, alt. 350 m, 2008 Aug 15, K. Szczepańska (Hb. Szczepańska); Pomocne village, greenstone outcrop next to church, alt. 380 m, 2008 Oct 4, K. Szczepańska (Hb. Szczepańska). **Przedgórze Sudeckie foreland**, Ślęza Massif: Radunia Mt., serpentinite outcrop at the summit, alt. 573 m, 1999 Oct 29, M. Kossowska (WRSL); Świerczyna Mt., abandoned serpentinite quarry on the SE slope, 2000 Mar 24, M. Kossowska (WRSL); Świętniki village, abandoned serpentinite quarry ca. 1.5 km E of village, 2000 Oct 21, M. Kossowska (WRSL); Szczytna Mt., serpentinite outcrop at the summit, alt. 480 m, 2000 Apr 15, M. Kossowska (WRSL). Wzgórze Niemczańsko-Strzelińskie hills, Szklary

village, abandoned serpentinite quarry, 2000 Jun 28, M. Kossowska (WRSL). Grochowa Massif, Brzeźnica Mt., serpentinite outcrop at the summit, 2000 Apr 8, M. Kossowska (WRSL). **Sudety Mts**, Góry Kaczawskie Mts, Janowice Stare village, abandoned serpentinite quarry above the village, 2000 Sep 19, M. Kossowska (WRSL).

REFERENCE MATERIAL SEEN. *C. subpallida*: Sweden, Västmanland County, Arboga, Landuberget, 1951 Sep 10, G. Kjellmert (MIN 735455); The Czech Republic, Protected Landscape Area Křivoklátsko, Tyterský stream valley, Valachov nature reserve, 2005 Apr 23, M. Kukwa 3910 (KRAM). *C. oxfordensis*: USA, Ohio, Butler Co., near Oxford, 1909 Aug 9, Fink (MICH!, holotype, isotype).

Discussion

Caloplaca subpallida is a taxonomically difficult European species, its position being discussed for decades (e.g. [18]). In the 1990s, it was regarded as a member of the *C. sideritis* group and synonymized with *C. oxfordensis* Fink [19], the taxon described from North America. Subsequently, the latter species was reported from several European countries, e.g. Austria [20], France [21], Greece [22] and Germany [23]. However, according to Arup [24], recent molecular studies reveal that *C. oxfordensis* and *C. subpallida* are two distinct species.

The studied material of *C. subpallida* is homogeneous, and morphologically and anatomically identical to Vězda's



Fig. 2 Abandoned serpentinite quarry at Świerczyna Mt. as a typical habitat of *Caloplaca subpallida*.

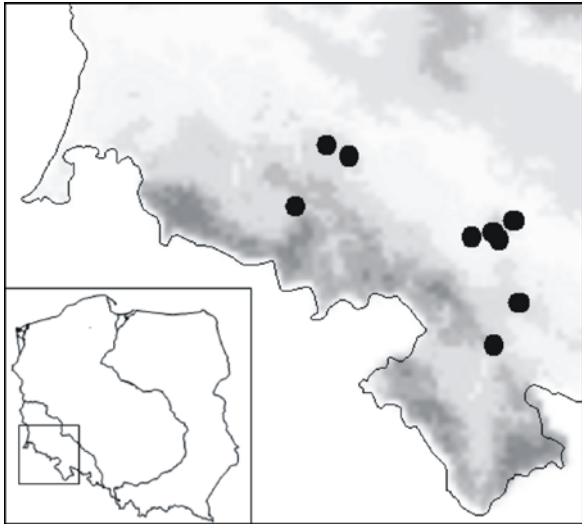


Fig. 3 Known localities of *Caloplaca subpallida* in Poland.

exsiccate specimen of *C. subpallida* determined by Magnusson. The species is characterized by its grey, rimose-areolate to subsquamulose thallus, and distinctly orange apothecia, usually without grey thalline margins. The apothecia are broadly sessile on the thallus, grouped and usually flexuose due to mutual compression. The spores are narrowly ellipsoid and its isthmus is moderately wide, 2.5–4.0 μm . It is worth noting that a comparison of *C. subpallida* with the type material of *C. oxfordensis* revealed that the anatomy of apothecia of both taxa is very similar, but the thallus development varies significantly, being thick and distinct in *C. subpallida* and extremely thin and almost invisible in *C. oxfordensis*. Although morphological evidence for separating the two species is not strong, their distinction is confirmed by molecular data [24].

Alternatively, *C. subpallida* was considered by some authors as conspecific with *C. arenaria* (Pers.) Müll. Arg. [25,26]. The latter species, however, differs from *C. subpallida* by its very thin or endolithic thallus, reddish-brown apothecia constricted at the base and usually scattered (rarely also in groups). *C. atroflava* is another similar species, but is distinguished by its distinctly widely ellipsoid spores (14–17 \times 8–10 μm) with wider isthmus (6–8 μm), and thinner, blackish-grey thallus, often with a faint violet shade [2]. According to Arup [24], *C. subpallida* is related to *C. tristiuscula* H. Magn., but the latter species can be distinguished from *C. subpallida* by its apothecia with both proper and thalline margins, usually clearly visible macroscopically, and thicker, larger and more verruculose thalli [2,24].

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Authors' contributions

The following declarations about authors' contributions to the research have been made: field researches: KS, MK; determination of the specimens: KS, KW, MK; taxonomic analyses: KW; writing of the manuscript: KS, KW, MK; preparation of the distribution map: MK; photographs: KS, MK.

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