

POPULATIONS OF TWO *CALOPLACA* SPECIES WITH PECULIAR ECOLOGY OBSERVED IN THE BÜKK MTS, HUNGARY

Ekologické zvláštnosti pozorované u dvou druhů *Caloplaca* v pohoří Bükk v Maďarsku

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Abstract: Species of *Caloplaca* appear to be strongly substrate specific in general. *Caloplaca monacensis* (related to *C. cerina*) and *C. pyracea* (related to *C. holocarpa*) are not exceptions; both are epiphytic species with rather restricted niches. The former is termophilous and baziphilous occurring in central and southern Europe, but the later occurs on nitrogen-rich barks throughout Europe. Possessing different ecology, both species can hardly grow side by side; however, we observed them together in rich populations on cherty limestone in the Bükk Mts. A specific SiO₂ addition in the limestone rocks harbouring these species may explain this ecological abnormality. Identification of both species was confirmed by ITS nrDNA molecular data.

Keywords: *Caloplaca monacensis*, *Caloplaca pyracea*, substrate ecology, substrate specificity, *Teloschistales*

Introduction

In the genus *Caloplaca* Th. Fr. (*Teloschistales*), there is a rather low number of species with wide substrate ecology. It is seen, for instance, in determination keys (e.g. Clauzade & Roux 1985, Laundon 1992, Wirth 1995) where the substrate is used as an important key character. Likewise, in recent studies dealing with taxonomy within *Caloplaca*, strong substrate specificity or at least strong substrate tendencies were evident in most of the considered species in the *Caloplaca cerina* group (Vondrák et al. 2008; Šoun et al., unpublished data), *C. citrina* group (Arup 2006) and *C. holocarpa* group (Arup 2009; Khodosovtsev et al., unpublished data). In contrary to these studies, *Caloplaca* species in cold regions in the Arctic often occur on a wide range of substrates; some of them commonly overgrow drift wood, bones and rocks (Søchting 1989). In temperate regions of Europe, *Caloplaca* species commonly occurring on such wide range of substrates, e.g. epilithic-epiphytic species, do not seem to occur. However, some epilithic species are rarely found there to be epiphytic, mainly on dust-impregnated bark; these are e.g. *Caloplaca crenulatella* (Nyl.) H. Olivier (Vondrák et al. 2007), *C. flavocitrina* (Nyl.) H. Olivier (Arup 2006, Vondrák et al. 2007, 2009a) and *C. holocarpa* (Hoffm.) A.E. Wade (Arup 2009). Examples of mainly epiphytic species rarely observed on concrete, stones or rocks are *Caloplaca obscurella* (J. Lahm ex Körb.) Th. Fr. (Peksa et al. 2007), *C. phlogina* (Ach.) Flagey (Vondrák et al. 2009a) and *C. ulcerosa* Coppins & P. James (Vondrák et al. 2009b).

In this paper, we demonstrate the outstanding occurrence of two largely epiphytic species, *Caloplaca monacensis* (Leder.) Lettau (= *C. cerina* var. *cyanolepra* (DC.) J. Kicks) and *C. pyracea* (Ach.) Th. Fr., in abundant populations on cherty limestone rocks shaded by beech forest. None of the species was observed growing on their typical substrate in the visited localities.

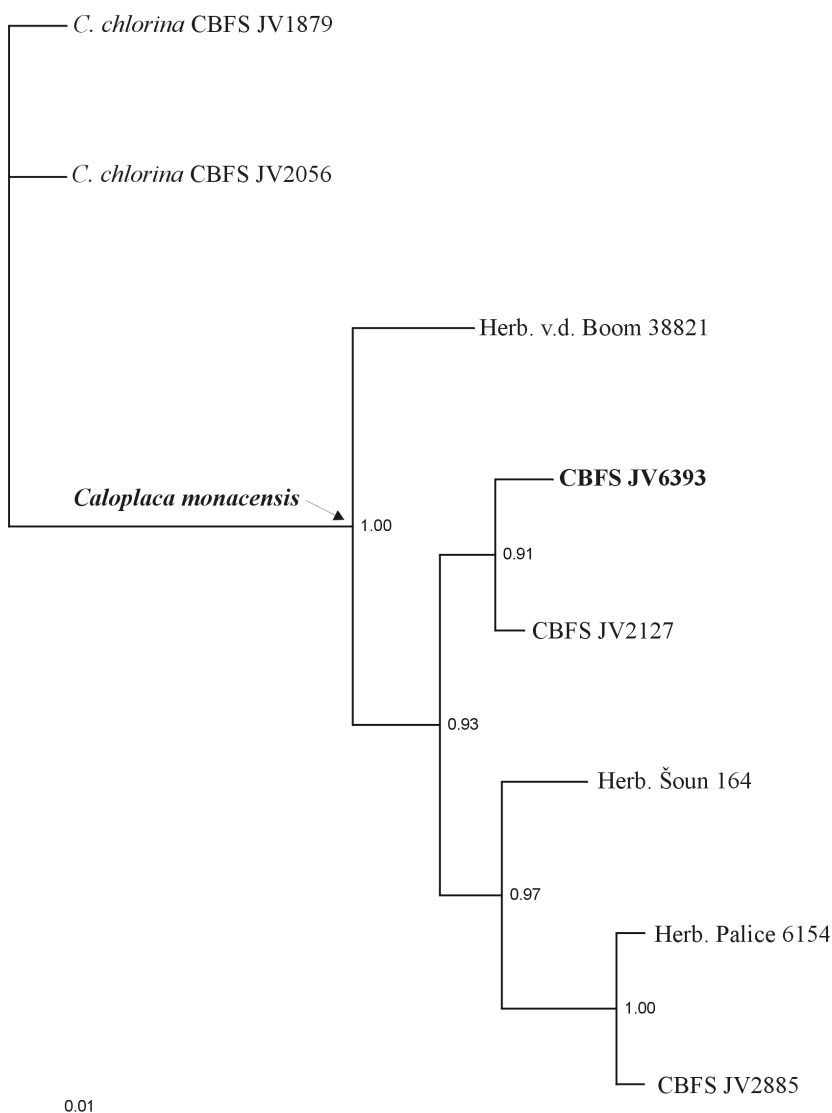


Fig. 1. Bayesian phylogeny of *Caloplaca monacensis* monophyletic group with closely related *C. chlorina* as an outgroup. Numbers at nodes are posterior probabilities. Saxicolous specimen is in bold.

Materials and methods

Saxicolous samples of *Caloplaca monacensis* and *C. pyracea* were collected by Jan Vondrák and Alexander Khodosovtsev on 2 June 2008 on two localities in the Bükk Mts:

1. Borsod-Abaúj-Zemplén county, Mályinka: "Látó-kövek" rock, N48°07'28.7", E20°31'37.3"; Alt.: ca 30 m, on shaded limestone outcrop.
2. Borsod-Abaúj-Zemplén county, Varbó: "Örvény-kő" rock, N48°07'46.6", E20°32'20.8"; Alt.: ca 750 m, on shaded limestone outcrop.

Samples are deposited in the herbaria of CBFS (*C. monacensis* JV6393; *C. pyracea* JV6365) and KHER (*C. monacensis* 3596; *C. pyracea* 3586, 3597, 3599, 3600, 3607).

To identify the species with certainty, ITS nrDNA sequences were obtained from samples of both species and aligned with the most similar sequences from our database and the GenBank (Tab 1). Then we created phylogenetic trees for both alignments using MrBayes 3.0 (Ronquist & Huelsenbeck 2003). Methods of molecular analyses will be explained in future studies regarding the taxonomies of *C. holocarpa* and *C. cerina* groups.

Color images of saxicolous specimens of *Caloplaca monacensis* and *C. pyracea* are available on the web page <http://botanika.prf.jcu.cz/lichenology>.

Caloplaca monacensis is a forgotten name, rather known as *C. cerina* var. *cyanolepra*, and its nomenclature will be discussed in a future paper (Šoun, in preparation).

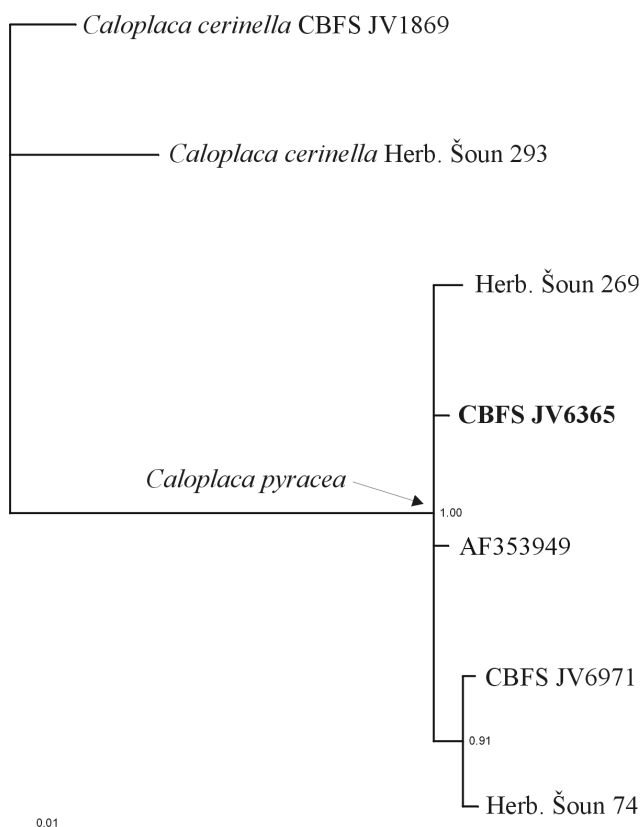


Fig. 2. Bayesian phylogeny of *Caloplaca pyracea* with closely related *C. cerinella* as an outgroup. Number at the node is its posterior probability. Saxicolous specimen is in bold.

Results

Using ITS nrDNA molecular data, we confirmed the sample CBFS JV6393 (from the "Látó-kövek" rock) forming a monophyletic group with epiphytic specimens of *Caloplaca monacensis* (Fig. 1). This intricate taxon belongs to the *Caloplaca cerina* group, which is currently being solved by the second author. Within the group, *C. monacensis* is mainly characterized by its sorediate-granulose thallus, predominantly corticolous occurrence on broadleaf trees such as e.g. *Fraxinus*, *Quercus* and *Tilia* throughout Europe. The species is common on shaded limestone rocks at both localities mentioned above.

The sample CBFS JV6365 (from the "Látó-kövek" rock) was confirmed to be *Caloplaca pyracea* using ITS nrDNA data (Fig. 2). *Caloplaca pyracea*, an epiphytic species, was not always recognized from a predominantly epilithic *C. holocarpa*. However, Arup (2009) found out that these species are phylogenetically and morphologically well-separated and not conspecific. In contrast to *C. holocarpa*, this species is well-characterized by zeorine apothecia with greyish outer thalline exciple. *Caloplaca pyracea* is common throughout Europe on nutrient-rich bark, mainly on *Populus tremula*. This species is very abundant on shaded limestone rocks at both mentioned localities.

Joint and abundant occurrence of both epiphytic species on rocks in Bükk Mts is outstanding in three aspects. 1. Both species could hardly grow together when epiphytic having different ecology. *Caloplaca monacensis* is termophilic and avoid nutrient-rich barks but *C. pyracea* is climatically rather undetermined, but demands nutrient-rich barks. 2. Both species growing on bark are considered heliophilic but they occur in shaded habitats in saxicolous localities in Bükk Mts. 3. There are very few and low-abundant accompanying species (e.g. *Candelariella aurella*, *Lecanora dispersa* and *Phaeophyscia orbicularis*) in the habitat of both species on shaded rock.

Both limestone rocks, "Látó-kövek" and "Örvény-kő" have a specific chemistry; their bedrock is called "cherty limestone" with high SiO₂ admixture. Both species probably found a free niche on such rock and created luxuriant populations there.

Specimen	Collection data
<i>C. cerinella</i> CBFS JV1869	Czech Republic, Tábor, coll. Vondrák 2004
<i>C. cerinella</i> herb. J. Šoun 293	Ukraine, Crimean Peninsula, coll. Šoun 2007
<i>C. chlorina</i> CBFS JV1879	Austria, Weinviertel, Wolfsthal, coll. Vondrák 2004
<i>C. chlorina</i> CBFS JV2056	Czech Republic, Milevsko, coll. Vondrák 2004
<i>C. monacensis</i> herb. P. v. d. Boom 38821	Spain, Extremadura, coll. v.d. Boom & v.d. Boom 2007
<i>C. monacensis</i> CBFS JV6393	Hungary, Bükk Mts, coll. Vondrák & Khodosovtsev 2008
<i>C. monacensis</i> CBFS JV2127	Bulgaria, Eastern Rodopi Mts, coll. Vondrák 2004
<i>C. monacensis</i> herb. J. Šoun 164	Czech Republic, Pavlovské vrchy hills, coll. Vondrák 2007
<i>C. monacensis</i> Z. Palice 6154	Slovakia, Muránska planina Mts, coll. Bayerová, Guttová, Halda, Palice, Peksa & Svoboda 2002
<i>C. monacensis</i> CBFS JV2885	Czech Republic, Podyjí, coll. Vondrák & Šoun 2005
<i>C. pyracea</i> herb. J. Šoun 269	Czech Republic, Konstantinovy Lázně, coll. Šoun 2006
<i>C. pyracea</i> CBFS JV6365	Hungary, Bükk Mts, coll. Vondrák & Khodosovtsev 2008
<i>C. pyracea</i> GenBank AF353949	?
<i>C. pyracea</i> CBFS JV6971	Czech Republic, Prachatice, Husinec, coll. Vondrák 2007
<i>C. pyracea</i> herb. J. Šoun 74	Czech Republic, České Budějovice, coll. Šoun 2006

Tab. 1. Herbarium data to samples aligned for *Caloplaca monacensis* and *Caloplaca pyracea* phylogenetic trees.

Souhrn

Druhy rodu *Caloplaca* jsou převážně substrátově specifické a proto substrát lze většinou použít jako důležitý určovací znak v případě, že dva podobné druhy jsou vázány na odlišné podklady. Na druhou stranu existuje mnoho výjimek, kdy například kortikolní druhy vzácně přecházejí na skály nebo na beton a obráceně. V některých případech nastává problém s určením takových lišejníků rostoucích na netypických substrátech. Určování podle klíčů používajících substrát jako znak (a těch je většina) vedou k nesprávným závěrům a navíc netypický substrát často ovlivňuje morfologii stélky i plodnic, tedy vzhled těchto lišejníků je také netypický. Zde je užitečné použít molekulární data pro potvrzení určení. V tomto článku jsme použili sekvence ITS nrDNA.

Caloplaca monacensis, příbuzná druhu *C. cerina*, a *C. pyracea*, příbuzná *C. holocarpa*, jsou kortikolní druhy s odlišnou ekologií. První druh je teplomilný a obývá spíše bazická stanoviště ve střední a jižní Evropě, zatímco druhý je vázaný na nitrofilní stanoviště, např. na kůru topolů, a je rozšířen po celé Evropě. Přestože oba druhy se zpravidla nevyskytují společně na kůře dřevin, my jsme je našli společně růst v bohatých populacích na zastíněných vápencových skalách v pohoří Bükk v Maďarsku. Tyto zvláštní výskyty lze vysvětlit specifickým chemismem tamních takzvaných křemičitých vápenců s často odvápněným povrchem. Tyto vápence hostí druhově chudou ale velice specifickou lišejníkovou biotu a epifytické druhy *C. monacensis* a *C. pyracea* zde zjevně našly volnou niku.

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