

***Caloplaca aurantia* and *Caloplaca flavescens*
(*Teloschistaceae*, lichen-forming fungi) in the Czech Republic;
with notes to their taxonomy and nomenclature**

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A revision of *Caloplaca aurantia* and *C. flavescens* in the Czech Republic is provided. Both species are confirmed from the territory; their distribution is reviewed and their ecological demands commented upon. Morphological investigations have confirmed the structure of the cortex and shape and colour of the lobes as the best diagnostic characters of both species; the thickness of the cortex has been found to be another useful character. Nomenclatural confusions regarding both species are discussed and clarified.

Key words: Czech Republic, distribution, morphology, nomenclature, *Teloschistales*.

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Jsou presentovány výsledky revize druhů *Caloplaca aurantia* a *C. flavescens* v České republice. Je potvrzen výskyt obou druhů na tomto území. Zrevidováno a opraveno je jejich rozšíření a okomentovány jsou jejich ekologické nároky. Studie morfologických znaků potvrdila, že nejlepšími diagnostickými znaky mezi těmito druhy jsou struktura kůry a tvar a barva laloků. Jako nový užitečný znak byla nalezena výška kůry. Diskutovány a objasněny jsou nomenklatorické nejasnosti týkající se těchto druhů.

INTRODUCTION

The *Caloplaca aurantia* group, characterised by the unique, lemon-shaped ascospores and conspicuous, lobate thalli, currently represents a small group of six saxicolous species: *C. aegaea* Sipman, *C. aurantia* (Pers.) Hellb., *C. flavescens* (Huds.) J.R. Laundon, *C. fuerteventurae* van den Boom & Etayo, *C. scrobiculata* H. Magn. and *C. thallincola* (Wedd.) Du Rietz. *C. aurantia* and *C. flavescens* grow on both inland and maritime calcareous rocks throughout the mild-temperate to subtropical zone of the Old World (e. g. Nordin 1972, Wasser and Nevo 2005).

C. thallincola is a silicicolous maritime species in North and West Europe (e. g. Clauzade and Roux 1985, Laundon 1992, Nordin 1972). The recently described *C. aegaea* is known from maritime siliceous rocks in the Mediterranean (Sipman and Raus 2002) and *C. fuerteventurae* from inland volcanic rocks in Fuerteventura, Canary Islands (van den Boom and Etayo 2006). *C. scrobiculata* is a calcicolous species of the southern Eurasiatic mountains (Poelt and Hinteregger 1993).

The monophyly of *C. aegaea*, *C. aurantia*, *C. flavescens* and *C. thallincola* was corroborated molecularly by Søchting and Arup (2002) and Gaya et al. (2008). *C. scrobiculata* is not related to the other species in the group (Gaya et al. 2008), differing in its morphology by the thin ascospore septa. The position of *C. fuerteventurae* is as yet undetermined.

C. aurantia and *C. flavescens* have been treated in many floras and keys (e. g. Clauzade and Roux 1985, Khodosovtsev et al. 2004, Laundon 1992, Poelt 1969, Wasser and Nevo 2005, Wirth 1995) and also specialised *Caloplaca* papers (Alon and Galun 1971; Laundon 1984; Nordin 1972; Poelt 1954; Verseghe 1970, 1971, 1972; Wade 1965; Wetmore and Kärnefelt 1998). However, in comparison with many European countries, the situation regarding these species has remained unclear in the Czech Republic. *C. aurantia* is the only species of the group included in the Catalogue of Lichens of the Czech Republic (Vězda and Liška 1999), but *C. flavescens* has been also recently recorded from the territory. The aim of this paper is to clarify the situation about the distribution and morphological differences between these species in the Czech Republic.

MATERIAL AND METHODS

Fourty specimens from the Czech Republic and some reference samples from other countries were used for detailed morphological investigations (specimens in bold in the studied material); these specimens are deposited in private herbaria of the first author, D. Svoboda and Z. Palice and the herbarium CBFS. Seven selected quantitative characters were measured: lobe length (from tip to the closest apothecium), maximum lobe width, cortex thickness, length and width of ascospores, width of ascospore septa, and conidium length. Ascospore length / width ratio and ascospore length / septum width ratio were calculated. The characters were measured with a dissecting microscope and light microscope (magnification 1000×). Sections for examination were cut by hand and all structures were measured with an accuracy of 1 µm in water. Measurements are given as (min.–) $X \pm SD$ (–max.), where X = mean value, SD = standard deviation and min./max. = extremes. Ten measurements of each character for 20 specimens of each species were carried out (= 200 measurements), except for lobe length and size of ascospores in *C. flavescens*, where $n = 170$ and 190 , respectively. Qualitative charac-

ters such as colour, shape of lobes, presence of crystalline layer in cortex and surface structure were also recorded. A JEOL 6300 scanning electron microscope was used for a detailed study of the cortex structure.

Distributional data of both species in the Czech Republic were gathered from recent field surveys, herbarium specimens (PRM, PRC, CBFS, and the private herbaria of D. Svoboda, Z. Palice and A. Vězda) and the literature (Ginzberger 1913; Kovář 1908; Kuřák 1911, 1914; Podpěra 1928; Servít 1910, 1911, 1930; Suza 1913, 1914, 1921, 1925, 1933, 1935, 1943a, 1943b, 1947; Vězda 1955; Vězda and Gruna 2000; Svoboda 2007). Distribution maps were drawn using the DMAP mapping software (Morton 2001).

RESULTS

Caloplaca aurantia (Pers.) Hellb. nomen sed non planta, Bih. Kgl. Svensk. Vetensk.-Akad. Handl. 16(3): 60. 1890.

Bas.: *Lichen aurantius* Pers., Neue Ann. Bot. 5: 14. 1794. Typus: Prope Witgenhaussen [Witzenhausen] in Hassia [Hessen] (according to G. Thijssse in litt. absent in Persoon's herbarium in L).

Syn.: *Caloplaca callopisma* (Ach.) Th. Fr.

Short description. Thallus matt, light yellow-white to dull orange. Marginal lobes long, mostly flattened for their whole length. Thallus often faintly pruinose on older parts of lobes, rarely strongly pruinose in thallus centre. Cortex paraplectenchymatous, thinner than in *C. flavescens*, without a crystalline layer (Fig. 3). Ascospores lemon-shaped, slightly wider and shorter with less pointed apices than in *C. flavescens*. For quantitative characters see Table 1.

Variability. The lobes in *C. aurantia* are usually flattened along their whole length, but rarely slightly convex, particularly when overgrowing thalli of other lichens. The thallus has many colour forms: typically, it has dull orange-coloured margins, often with a few narrow alternating zones of lighter (\pm pale yellow) and darker (\pm yellow-orange) strips towards the centre. Individuals with lighter lobe tips and a darker centre of thallus exist, as well as wholly orange-yellow to orange forms. Forms with an almost white pruinose centre and light yellow margins are also known. Dark clusters of cyanobacteria sometimes occur at the surface in the thallus centre.

Chemistry. Thallus and apothecia K⁺ (purple), chemosyndrome A₃ (Søchting and Lutzoni 2003).

Ecology. *C. aurantia* is restricted to natural habitats in limestone areas in the Czech Republic, but outside the territory, it also grows on other calcareous rocks and building materials, including mortar and concrete. It is considered to be a nitrophilous, heliophilous, thermophilous and xerophilous species preferring

slightly inclined surfaces with southern exposition, and occasionally it is found on vertical surfaces with other expositions.

Distribution in the Czech Republic. The species only occurs in the warmest regions of South Moravia (Fig. 1) and is absent from the xerothermic limestone area in central Bohemia (Bohemian Karst) as already pointed out by Suza (1935, 1943b, 1947). It is rather abundant in the Pavlovské vrchy Hills where it has been recorded (as *Caloplaca / Gasparrinia callopisma*) since the beginning of the 20th century (Kovář 1908; Ginzberger 1913; Podpěra 1928; Suza 1913, 1921, 1925, 1943b). A recent field survey revealed a new locality on soft tertiary limestone at Sedlec, close to Pavlovské vrchy Hills.

Another three populations are situated at the rim of the south-Moravian xerothermic vegetation region; two of them have been confirmed by the recent field survey, but one is extinct. In the Podyjí National Park it grows on the Moravian side of the Dyje River valley on several crystalline limestone outcrops in the vicinity of the Austrian Hardegg (Suza 1933, 1943b, 1947; Vězda and Gruna 2000). The locality on Stránská skála Hill at the periphery of Brno (Suza 1914, 1925, 1943b, 1947) is rather small and the lichen grows there unusually also on N-faced rocks. The most outlying population at Čebínka Hill near Tišnov, already cited by Servít (1910) and Suza (1925, 1943a, 1943b, 1947), is extinct and was probably destroyed by a large limestone quarry on the southern slope of the hill. During the revision of Suza's specimens, it was discovered that he wrongly identified the specimens of *C. aurantia* from the last three localities as *C. aurantia* var. *intermedia* (= *C. flavescens*), except for Servít's sample from Čebínka Hill, which was identified as *C. callopisma* by Suza, but he doubted his determination.

The records of *C. callopisma* from the Bohemian Karst by Servít (1911), Bayer, Hora and Pejška (unpublished specimens in PRM) are erroneous and refer to *C. flavescens*. The record of *C. (G.) callopisma* from Vápenný Podol in the Železné hory Mts. (Kuřák 1911, 1914) is also incorrect since its voucher (PRM 763079, sub *G. callopisma*) represents *C. saxicola* (Hoffm.) Nordin. Vězda (1955) mentioned *C. aurantia* from a paved, artificial bank of the river Bečva in Vsetín. Its occurrence at this locality is rather improbable (we did not confirm this occurrence in 2006), because it is an anthropogenic site in a relatively cool region, far from any natural limestone outcrops. However, the voucher specimen (if it exists) has not been seen.

Material studied

Material used for detailed morphological investigations is in bold. The sample data are in their original wording on voucher labels or with small modifications.

AUSTRIA: Lower Austria – Kalkfelsen b. Hainburg, 1887, leg. G. Beck (PRC 14, sub *Amphiloma callopisma*).

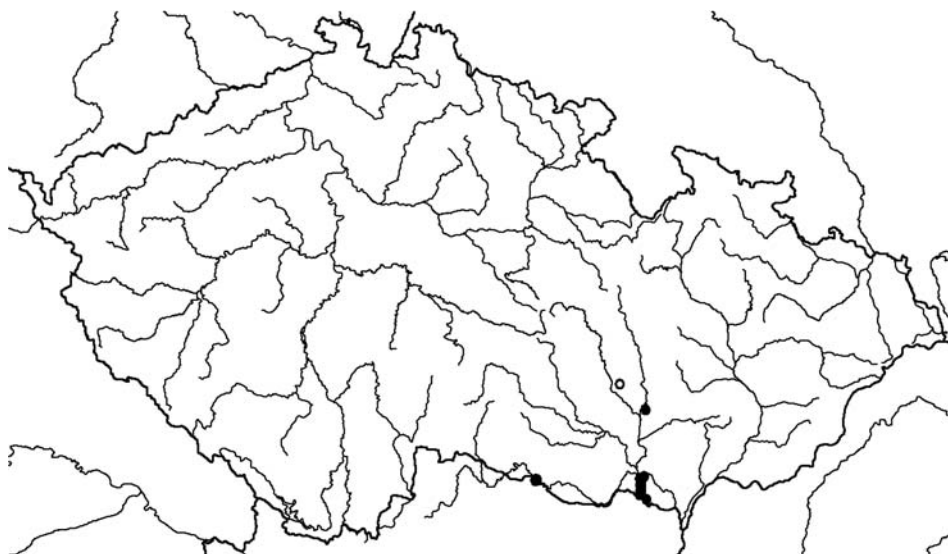


Fig. 1. Distribution of *Caloplaca aurantia* in the Czech Republic; black dots represent recent distribution, open circle marks destroyed historic locality.

BULGARIA: The Rhodopes – ad rupes calcareas in monte Czervenata stena supra monasterium Baczkovo, c. 12–1400 m, 1923, leg. J. Suza (PRM 631187, sub *C. callopisma*); Lyubimets, Malko Gradishte, nearby hill „Svieta Marina“ c. 5 km SW of village, alt. 600 m, 41° 44' N, 26° 00' E, small limestone outcrop in forest, 2004, leg. J. Vondrák (CBFS JV2046); *Ibid.*, Kaloyantsi, Dolishte, limestone rocks in valley c. 1 km W of village, alt. 300 m, 41° 38' N, 25° 35' E, 2004, leg. J. Vondrák (CBFS JV2122); ***Ibid.*, Madzharovo, Silen, Byal Kladenets, limestone rocks in valley below village, alt. 350 m, 41° 37' N, 25° 40' E, hard limestone rocks, 2004, leg. J. Vondrák (CBFS JV2086).**

CROATIA: West Croatia – ad saxa calcarea in vicinitate urbis Fiume [Rijeka], leg. F. Blechschmidt et J. Schuler (PRC 12, PRM 631203; Kryptogamae Exsiccatae 1256b, sub *C. callopisma*). Dalmatia – Župa Dubrovačka, ad rupes calc. prope Kupari, ca 20 m, 1917, leg. R. Dvořák (PRM 631180, sub *G. aurantia*); Obrovac, 1907, leg. M. Servít (PRM 631200, sub *C. callopisma*); Krunjacija, 480 m, 1907, leg. M. Servít (PRM 631198, sub *C. callopisma*); Ragusa [Dubrovnik], ad saxa calcarea, c. 60 m, 1908, leg. A. Latzel (PRM 761023, sub *C. callopisma*); Ins. Rab, Tiguaro, in rupib. calcareis, c. 300 m, 1932, J. Šmarda (PRM 631201, sub *C. callopisma*).

CZECH REPUBLIC: South Moravia – Pavlovské vrchy [Hills], 1908, leg. Dvořák (PRM 631186, sub *G. callopisma*); *Ibid.*, na Turoldě, 1909, leg. J. Suza (PRM 763078, sub *G. callopisma*); Jurské vápence na Turoldu u Mikulova, 1912, leg. J. Suza (PRM 631181, 631184, sub *G. callopisma*); Ad rupes calcareas colli Sv. Hora prope Mikulov, 1912, leg. J. Suza (PRM 631185, sub *C. callopisma*); Pavlovské vrchy [Hills], 1921, leg. A. Hilitzer (PRM 696984, sub *C. callopisma*); Šibeničník prope Mikulov, c. 230 m, 1922, leg. J. Suza (PRM 631191, 631183, sub *C. callopisma*); Pavlovské vrchy [Hills], loco „Soutěska“, calcicola, 1922, leg. J. Suza (PRM 631188, 631189, hb. Vězda, sub *C. callopisma*); Mikulov, limestone rocks under Svatý kopeček Hill, c. 0.2 km E of town, 48° 48' 29" N, 16° 39' 00" E, limestone rock, 2002, leg. J. Vondrák (CBFS JV933); Mikulov, rocks on E slope of Kozí hrádek ruin, c. 270 m, 48° 48' 35" N, 16° 38' 11" E, 2002, leg. J. Vondrák (CBFS JV925); **Mikulov, small limestone outcrops at upper edge of former quarry in Turol Hill, alt. c. 380 m, 48° 48' 58" N, 16° 38' 21" E, 2003, leg. J. Šoun (hb. Šoun 1); Klentnice, small limestone outcrops near Sirotčí hrádek ruin, alt. c. 420 m, 48° 50'**

48° N, 16° 38' 27" E, 2004, leg. J. Šoun (hb. Šoun 5); Mikulov, limestone rocks at SW foothill of Svatý Kopeček Hill, alt. c. 270 m, 48° 48' 21" N, 16° 38' 33" E, 2004, leg. J. Šoun (hb. Šoun 4); Mikulov, limestone rocks at SW foothill of Svatý Kopeček Hill, alt. c. 270 m, 48° 48' 21" N, 16° 38' 33" E, 2004, leg. J. Šoun (hb. Šoun 3); **Mikulov, small limestone outcrops on E slope of Kozí hrádek ruin, alt. c. 270 m, 48° 48' 35" N, 16° 38' 11" E, 2004, leg. J. Šoun (hb. Šoun 2); Bavorý, small limestone rocks at locality Kočičí kámen, alt. c. 350 m, 48° 49' 50" N, 16° 38' 13" E, 2005, leg. J. Šoun (hb. Šoun 23); Mikulov, limestone rocks on Šibeničnický Hill, alt. c. 330 m, 48° 51' 18" N, 15° 52' 15" E, 2005, leg. J. Šoun (hb. Šoun 24); Pavlov, limestone outcrop on SE slope of Děvín Hill, alt. c. 420 m, 48° 52' 1.12" N, 16° 39' 11.34" E, 2006, leg. J. Šoun (hb. Šoun 134); Horní Věstonice, limestone rock on W slope of Obora Hill, alt. c. 430 m, 48° 51' 51.89" N, 16° 38' 4.35" E, 2006, leg. J. Šoun (hb. Šoun 137); Sedlec, small limestone outcrops on Skalky Hill, alt. c. 250 m, 48° 46' 00" N, 16° 40' 42" E, 2004, leg. J. Šoun (hb. Šoun 6); Brno, na Stránské skále u Líšně, 1911, leg. J. Suza (PRM 580964, sub *C. aurantia* var. *intermedia*); **Ibid.: limestone outcrop on N slope of Stránská skála Hill, alt. c. 300 m, 49° 11' 28.6" N, 16° 40' 35.74" E, 2006, leg. J. Šoun (hb. Šoun 138);** Calciocola in colle Čebínka prope Tišnov, c. 400 m, 1922, leg. J. Suza (PRM 580962, sub *C. aurantia* var. *intermedia*); Znojmo, Hardek [Hardegg], c. 350 m, in rup. phylliticis-calcaris, 1932, leg. J. Suza (PRM 580963, sub *G. aurantia* var. *intermedia*); In valle fl. Dyje pr. Hardegg in rup. phylliticis (calc. includ.), c. 250 m, 1932, leg. J. Suza (PRM 580960, sub *G. aurantia* var. *intermedia*); **Čížov, limestone outcrops near road to Hardegg in Dyje valley, alt. c. 350 m, 48° 51' 17.8" N, 15° 52' 09.7" E, 2005, leg. J. Šoun (hb. Šoun 22);** Čížov, limestone outcrop below road to Hardegg in Dyje valley, alt. c. 320 m, 48° 51' 17.59" N, 15° 52' 16.97" E, 2006, leg. J. Šoun (hb. Šoun 133); **Ibid., 48° 51' 17.18" N, 15° 52' 15.93" E, 2006, leg. J. Šoun (hb. Šoun 132).****

GERMANY: Baden-Württemberg – Germania (Württemberg): ad saxa dolomitica ad Eglosheim prope Ludwigsburg, leg. X. Rieber (PRC 15, 24, PRM 761022; Kryptogamae Exsiccatae 1256, sub *C. callopisma*). Hessen – An Kalkfelsen beim Dorfe Wendershausen unweit Witzenhausen an der Werra (ubi Persoon plantam legit), 1883, leg. Dannenberg (PRM 631175, sub *Physcia aurantia*).

ITALY: Sicily – Cavagrande Nature Reserve, limestone rock, 2002, J. Vondrák (CBFS JV421).

ROMANIA: Dobruja – Tirusor, in valle fl. Casimcea prope pagum Casian, c. 50 m., 1974, leg. A. Vězda (hb. Vězda, sub *C. aurantia* var. *aurantia*); **Tulcea, Popina Island in Lake Razim, E coast, alt. 0–1 m, 44° 58' 03.16" N, 28° 58' 57.29" E, limestone rock, 2007, leg. J. Šoun (hb. Šoun 171).**

SLOVAKIA: Little Carpathians – Malé Karpaty: ad rupes calcareas in decl. merid. collis Devínska Kobyla supra pag. Devín, alt. 300 m s.m., 1965, leg. L. Opold, I. Pišút et B. Wagner (PRC 28; Lichenes Slovaciae Exsiccatae. 197, sub *C. c.* var. *heppiana*); Smolenice, Holý vrch pr. pag. Nádaš [Trstín], in rupibus dolomit., c. 230–300 m, 1937, leg. J. Suza (PRM 580958, 580961, sub *C. aurantia* var. *intermedia*); In rupibus calcareis pr. ruinam Dobrá Voda, c. 280–300 m, 1937, leg. J. Suza (PRM 580959, sub *C. aurantia* var. *intermedia*); Čachtické kopce, in colle Veľký Plešivec, in rup. calcar., c. 470–480 m, 1933, leg. J. Suza (PRM 631163, sub *C. aurantia*); Považský Inovec – Piešťany, in colle Holý kopec pr. p. Hubina, in rup. calcareis, c. 200 m, 1930, leg. J. Suza (PRM 631195, sub *G. callopisma*); In rupe dolomitica pr. ruinam Tematín, c. 400 m, 1926, leg. J. Suza (PRM 631197, sub *C. callopisma*); Nové Mesto nad Váhom, Lúka, rocks on S slope below ruin of Tematín castle, alt. c. 530 m, limestone rock, 2006, leg. J. Šoun (hb. Šoun 95). Strážov Mts. – Uhrovské Podhradie, ad pedem occid. m. Rokoš, c. 300 m, in rup. calcareis, 1930, J. Suza (PRM 631194, sub *G. callopisma*). Tribeč – Nitra, in colle calcaris Kalvária, c. 200 m, 1928, leg. J. Suza (PRM 631190, sub *C. callopisma*); Zobor pr. Nitra, in rup. calcareis „Pleška“, c. 400 m, 1934, leg. J. Suza (PRM 631202, sub *C. callopisma*); Zobor, pr. Nitra, apud „Svätý Svorad“ in rup. calcar., c. 350–400 m, 1934, leg. J. Suza (PRM 631199, sub *C. callopisma*); Nitra, calcareous rocks on W slope of Mt Zobor, alt. 400 m, 2004, leg. J. Vondrák (CBFS JV1820, sub *C. flavescens*); **Ibid., 2004, leg. J. Vondrák (CBFS JV6838).** Slovak Karst – Košice, apud ruinam arcis Turňa n. Bodvou ad saxa calcarea, c. 300 m, 1927, leg. J. Suza (PRM 631182, sub *C. callopisma*).

SPAIN: Andalusia – Sierra de Cazorla, Cazorla, on limestone rock c. 2–3 km N of Cazorla village, 950 m, 1998, leg. Z. Palice (hb. Palice s.n.).

Tab. 1. Quantitative characters of *Caloplaca aurantia* and *C. flavescens* investigated in this study compared with the literature.

Characters	Reference	<i>C. flavescens</i>	<i>C. aurantia</i>	
lobe length (mm)	Wade 1965	2–5	5–10	
	Nordin 1972	1.5–3	2–3	
	Wetmore & Kärnefelt 1998	2–3	–	
	Khodosovtsev et al. 2004	1.5–3.5	–	
	this study	(1.55–) 3.05 ± 0.85 (–5.60)	(0.20–) 3.61 ± 1.00 (–6.50)	
max. lobe width (mm)	Wade 1965	0.6–0.75(1)	–	
	Clauzade & Roux 1985	0.5–1	1.5–3	
	Wirth 1995	1(1.5)	1.5–3	
	Wetmore & Kärnefelt 1998	0.5	–	
	Khodosovtsev et al. 2004	0.3–1	±1	
	this study	(0.20–) 0.73 ± 0.20 (–1.30)	(0.40–) 0.94 ± 0.26 (–1.83)	
cortex thickness (µm)	this study	(10–) 37.43 ± 11.65 (–75)	(0–) 17.87 ± 9.86 (–45)	
ascospore length (µm)	Wade 1965	8–15	10–16	
	Poelt 1969	8–15	10–16	
	Versegghy 1971	–	8–15	
	Alon & Galun 1971	–	10–12	
	Nordin 1972	11–15	–	
	Clauzade & Roux 1985	8–16	8–16	
	Laundon 1992	12–15	10–13	
	Wirth 1995	8–15	10–16	
	Khodosovtsev et al. 2004	(10)12–14(16)	9.7–13	
	Wasser & Nevo 2005	9–15	10–13	
	this study	(9–) 11.76 ± 1.35 (–15)	(9–) 11.08 ± 1.19 (–15)	
	ascospore width (µm)	Wade 1965	5–10	7–12
		Poelt 1969	5–10	5–8
Versegghy 1971		–	6–10	
Alon & Galun 1971		–	3–10	
Nordin 1972		6–9	–	
Clauzade & Roux 1985		5–13	5–13	
Laundon 1992		8–10	8–10	
Wirth 1995		5–10	7–12	
Khodosovtsev et al. 2004		(7)8–10(12)	7–13	
Wasser & Nevo 2005		6–10	7–10	
this study		(6–) 8.62 ± 0.80 (–11)	(6–) 9.25 ± 0.95 (–12)	
septum thickness (µm)		Khodosovtsev et al. 2004	1.5–2(2.4)–5	2.5–3.5
		Wasser & Nevo 2005	to 5	to 5
	this study	(4–) 4.68 ± 0.55 (–8)	(3–) 4.83 ± 0.59 (–6)	
conidium length (µm)	Wade 1965	3.6	3.6	
	Khodosovtsev et al. 2004	3–6	–	
	this study	(4–) 5.04 ± 0.34 (–6)	(4–) 5.02 ± 0.33 (–6)	
ascospore length / width	this study	(1.09–) 1.38 ± 0.2 (–2.33)	(0.82–) 1.21 ± 0.14 (–1.67)	
ascospore length / septum thickness	Wasser & Nevo 2005 this study	– (1.25–) 2.54 ± 0.32 (–3.5)	6–3(2) (1.67–) 2.32 ± 0.32 (–3.75)	

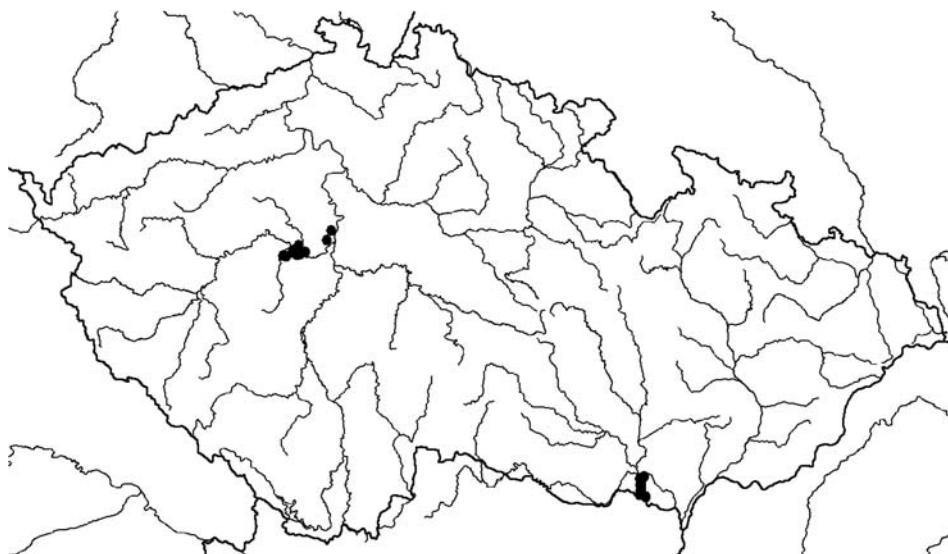


Fig. 2. Distribution of *Caloplaca flavescens* in the Czech Republic.

TURKEY: *Black Sea Coast* – İnebolu, coastal limestone rocks E of Abana, alt. c. 6 m, 41° 58' 52.90" N, 34° 02' 47.26" E, 2007, leg. J. Šoun (hb. Šoun 169). *Sea of Marmara Coast* – Gallipoli Peninsula, coastal limestone cliffs 1 km NE of Abide monument, alt. 1 m, 40° 03' 12.27" N, 26° 13' 41.24" E, 2007, leg. J. Šoun (hb. Šoun 170).

UKRAINE: Crimean Peninsula – Ad rupes calcareas frequentissima prope Sebastopolin, in peninsula Taurica, 1900, leg. A. Elenkin (PRM 631193; Lichenes Florae Rossiae I. 1901, 26, sub *Placodium aurantium*); Bakhchysarai, limestone cliffs above town, alt. c. 300 m, 44° 45' 04.68" N, 33° 53' 06.88" E, 2006, leg. J. Šoun (hb. Šoun 105); Feodosiya, limestone rocks on hill SWW of village Koktebel, alt. c. 300 m, 44° 57' 19.57" N, 35° 12' 39.26" E, 2006, leg. J. Šoun and J. Vondrák (hb. Šoun 106); Kerch Peninsula, Opukskiy zapovednik, coastal limestone cliffs, alt. c. 20 m, 45° 01' 57.18" N, 36° 12' 23.30" E, leg. J. Šoun and J. Vondrák (hb. Šoun 160); Yalta, Nikita, zapovednik "Mys-Martian", limestone rocks in forest near sea, alt. c. 20 m, 44° 30' 26.33" N, 34° 14' 50.83" E, 2007, leg. J. Šoun (hb. Šoun 167, 168).

UNITED KINGDOM: England – Bristol, calcareous rocks in Avon Gorge, next to Clifton Suspension Bridge, 2006, leg. J. Vondrák (hb. Šoun 44).

Caloplaca flavescens (Huds.) Laundon, *Lichenologist* 16: 53. 1984.

Bas.: *Lichen flavescens* Huds., *Fl. Anglica*: 445. 1762. Typus: *Hist. Musc.*: 136, tab. 18, fig. 18A (BM, lectotypus, not seen).

Syn.: *Caloplaca heppiana* (Müll. Arg.) Zahlbr., *Caloplaca aurantia* var. *intermedia* Zahlbr., *Caloplaca aurantia* f. *centrifuga* (A. Massal.) Zahlbr.

Short description. Thallus smooth, light yellow to orange. Marginal lobes mostly convex for their whole length. Thallus sometimes pruinose in the centre, rarely slightly pruinose over whole surface. The cortex is loosely paraplecten-

chymatous, with a continuous layer of hyaline crystals, while in *C. aurantia* it is thinner and crystals are absent (Fig. 3). Ascospores lemon-shaped, slightly narrower and longer with more pointed apices than in *C. aurantia*. For quantitative characters see Table 1.

Variability. The marginal lobes are usually convex, but in some cases they are almost flattened at their tips. The thallus surface is usually single-coloured, never zonate, orange, orange-yellow to pale yellow; sometimes the tips of lobes can be lighter. Central parts of the thallus may be white due to absence of anthraquinone pigments, or the centre dies off with age. Furthermore, the apothecia may be rare and the thallus is covered by small, flat lobules or pustules in the centre of old specimens.

Chemistry. Thallus and apothecia K+ (purple), chemosyndrome A (Søchting 1997).

Ecology. The species possesses almost the same ecology as *C. aurantia*, but there are some differences: it is more frequent not only on pure limestone but also on other calcareous or alkaline rocks and artificial substrata such as concrete, mortar, roofing tiles and monuments, and very rarely on the dusty bark of trees near quarries (Laundon 1992). The occurrence in the Czech Republic is, however, restricted to natural habitats, similarly to *C. aurantia*. There is an evident tendency to grow on more shaded, less xerothermic habitats than *C. aurantia*, but occasionally both species occur side-by-side.

Distribution in the Czech Republic. It is restricted to two larger xerothermic limestone areas (Fig. 2): the Pavlovské vrchy Hills (with one new, related locality on soft limestone at Sedlec) in South Moravia (Kovář 1908, Podpěra 1928, Suza 1925, all as *C. / G. aurantia*) and the Bohemian Karst in central Bohemia (Servít 1911 as *C. callopisma*, Servít 1930 as *C. aurantia*, *C. heppiana* and *C. aurantia* f. *centrifuga*, Suza 1943b as *C. aurantia* var. *intermedia*, Svoboda 2007). In both areas *C. flavescens* is rather common in suitable habitats.

Suza's statements regarding occurrences of *C. flavescens* (as *C. aurantia* var. *intermedia*) in Podyjí (Suza 1933, 1943b, 1947), Stránská skála Hill at the periphery of Brno (Suza 1914, 1925, 1943b, 1947) and Čebínka Hill near Tišnov (Suza 1925, 1943a, 1943b, 1947) are based on incorrect identifications and refer to *C. aurantia*.

Material studied

Material used for detailed morphological investigations is in bold. The sample data are in their original wording on voucher labels or with small modifications.

AUSTRIA: Upper Austria – [Laakirchen] an Conglomeratfelsen beim Traunfall, 1887, leg. A. Zahlbruckner (PRC 23, sub *Physcia Heppianum*).

BULGARIA: West Bulgaria – Dragoman, Petrov Karst, ad rupes calcareas, c. 900–1100 m, 1923, leg. J. Suza (PRM 631168, sub *C. aurantia*).

CROATIA: West Croatia – ad saxa calcarea in vicinitate urbis Fiume [Rijeka], leg. F. Blechschmidt et J. Schuler (PRC 12; Kryptogamae Exsiccatae 1256b, sub *C. callopisma*); Ibid.: leg. F. Blechschmidt et J. Schuler (PRC 29, 31, PRM 580952; Kryptogamae Exsiccatae 2077, sub *C. aurantia* var. *dalmatica*). Dalmatia – Župa Dubrovačka, ad rupes calc. prope Kupari, c. 20 m, 1917, leg. R. Dvořák (PRM 580955, sub *C. aurantia* var. *dalmatica*); Pola [Pula], 1907, leg. J. Steiner (PRM 580944, sub *C. heppiana*); Mezi Albanese a Bibinji, 1907, leg. M. Servít (PRC 33, sub *C. aurantia*); Na pobřeží mezi Razanci [Ražanac] a Vinjeráci, 1907, leg. M. Servít (PRC 30, sub *C. aurantia*); Albanese, 1907, leg. M. Servít (PRC 32, sub *C. aurantia*).

CZECH REPUBLIC: Central Bohemia – [Bohemian Karst], nad Kačákem (PRM 696988, sub *C. callopisma*); Ibid., Kačák, leg. E. Bayer (PRM 696992, sub *C. callopisma*); Císařská rokle u Berouna, leg. J. Podpěra (PRC 18, sub *G. aurantia* var. *areolata*); Sv. Prokop, 1884, leg. P. Hora (PRM 696980, 696986, sub *C. callopisma*); Z okolí Karlova Týna a Srbska, 1887, leg. E. Bayer (PRM 696996, 696994, sub *C. callopisma*); Butovice? (Dáleje) za sv. Prokopem, 1891, leg. E. Bayer? (PRM 696999, sub *C. callopisma*); Diabasové skály u Butovic u Prahy, 1893, leg. E. Bayer (PRM 696997, sub *C. callopisma*); Vápenné skály za Butovicemi ku Prokopu, 1893, leg. E. Bayer (PRM 696995, sub *C. callopisma*); Radotín, 1902, leg. J. Podpěra (PRC 27, sub *G. aurantia*); Radotín. Skála nad mlýnem, 1903, leg. E. Bayer (PRM 696991, sub *C. callopisma*); Severní skála hradu Karlštejna, 1906, leg. M. Servít (PRC 19, sub *G. aurantia*); Diabasy v Prokopském údolí, 1919, leg. A. Hilitzer (PRM 696900, sub *C. aurantia*); Sv. Prokop, již. stráň, vápence, skalka v lese, 1920, leg. A. Hilitzer (PRM 696902, sub *C. aurantia*); In valle St. Procopii prope Pragam supra Daleje in summis rupibus calcareis, 1920, leg. E. Bayer (PRM 696993, sub *C. callopisma*); Daleje, 1921, leg. E. Bayer (PRM 696983, sub *C. callopisma*); U Srbska nad Kačákem na vápenných skalách, 1922, leg. A. Pejška et E. Bayer (PRM 696989, 696990, 696982, 696998, sub *C. callopisma*); Císařská rokle u Berouna. 1923, leg. J. Podpěra. (PRC 22, sub *C. aurantia*); Ad rupes calcareas prope „Dáleje“ in valle Scti Procopii ad urbem Praga. 1924, leg. A. Pejška (PRM 696987, 697001, sub *C. callopisma*); Radotín, 1925, leg. A. Hilitzer (PRM 696901, sub *C. aurantia*); Praha, Prokopské údolí, in rup. calcar., c. 230 m, 1933, leg. J. Suza (PRM 631162, sub *C. aurantia*); In valle St. Prokop, c. 250 m, in rupibus calcareis, 1938, leg. J. Suza (PRM 631157, sub *C. aurantia*); In valle Prokopské údolí, in clivo cumuli Špičák dicto, ad rupam calcaream, alt. 270 m s.m., 1994, leg. J. Horáková (PRM 886362, sub *C. aurantia*); Prague, Prokopské údolí, Nová ves, in colle Hradiště, ad saxam calcaream, alt. 310 m, 1999, leg. D. Svoboda (hb. Svoboda: Lichenes Bohemiae 396); Beroun, in clivo saxae-stepposo in montis Hřebenec apud Svatý Jan pod Skalou (contre Skála), ad saxam calcaream, alt. 320 m, 2002, leg. D. Svoboda (hb. Svoboda: Lichenes Bohemiae s.n., sub *C. aurantia*); Beroun, secundum viam ferream (km 36,4) prope Tetín in valle fluminis Berounka, in fissura rupis calcareis, alt. 240 m, 2002, leg. D. Svoboda (hb. Svoboda: Lichenes Bohemiae s.n., sub *C. aurantia*); Beroun, in valle rivuli Berounka prope Tomáškův lom prope Srbsko pagum, in valle angusta parva cum rivulo, saxo calcareo in declivibus faucis, alt. 230 m, 2002, leg. D. Svoboda (hb. Svoboda: Lichenes Bohemiae 539); **Beroun, Srbsko, near Barrandova jeskyně cave in valley of Berounka River, alt. 230 m, 49° 56' N, 14° 07' E, 2002, leg. D. Svoboda (hb. Svoboda, Lichenes Bohemiae 389); Beroun, Srbsko, near Tomáškův lom quarry in valley of Berounka River, alt. 240 m, 49° 55' 43" N, 14° 08' 50" E, 2002, leg. D. Svoboda (hb. Svoboda, Lichenes Bohemiae 597, sub *Caloplaca aurantia*); Praha, Nová Ves, Prokopské údolí valley, limestone outcrop on S slope at Hradiště plateau hill, alt. c. 290 m, 50° 2' 20.02" N, 14° 21' 21.16" E, 2006, leg. J. Šoun (hb. Šoun 163); Tetín, limestone rocky slopes in Koda nature reserve, 1 km SW of village, alt. c. 400 m, 49° 56' 11.3" N, 14° 05' 12.8" E, 2006, leg. J. Šoun (hb. Šoun 99); Srbsko, Císařská rokle gorge, alt. c. 370 m, 49° 55' 33.9" N, 14° 07' 38.6" E, 2006, leg. J. Šoun (hb. Šoun 98); Praha, Hlubočepy, Prokopské údolí valley, S-exposed limestone rock 100 m SE of Dalejský Mlýn, alt. c. 260 m, 50° 2' 28.55" N, 14° 22' 32.21" E, 2006, leg. J. Šoun (hb. Šoun 162).** South Moravia – [Pavlovské vrchy Hills], Kesselberg montium, calcicola, 450 m, 1921, leg. J. Suza (PRM 631161, sub *C. aurantia*); Ibid., loco „Soutěska“, ad rupes calcareas, c. 380 m, 1922, leg. J. Suza (PRM 580954, sub *C. aurantia*); Ibid., Tabulová, c. 450 m, ad saxa calcarea, 1962, leg. A. Vězda (hb. Vězda, sub *C. heppiana*); **Horní Věstonice, locality „Soutěska“, limestone outcrops, alt. c. 350 m, 48° 51' 55" N, 16° 38' 29"**

E, 2003, leg. J. Šoun (hb. Šoun 8, 9, 10, 11); Klentnice, limestone rocks on W slope of Tabulová Hill, alt. c. 420 m, 48° 50' 30" N, 16° 38' 12" E, 2004, leg. J. Šoun (hb. Šoun 12, 13, 14, 15, 16); Klentnice, small limestone outcrops near Sirotčí hrádek ruin, alt. c. 420 m, 48° 48' 35" N, 16° 38' 11" E, 2004, leg. J. Šoun (hb. Šoun 17, 18, 19); Mikulov, small limestone outcrops on E slope of Kozí hrádek ruin, alt. c. 270 m, 48° 48' 35" N, 16° 38' 11" E, 2004, leg. J. Šoun (hb. Šoun 20); Klentnice, small limestone outcrops in forest on S slope of Tabulová Hill, alt. c. 370 m, 48° 50' N, 16° 38' E, 2005, leg. J. Šoun (hb. Šoun 29); Pavlov, small limestone outcrops on SE slope below Děvičky ruin, alt. c. 420 m, 48° 52' 33" N, 16° 39' 42" E, 2005, leg. J. Šoun (hb. Šoun 28); Mikulov, Kočičí skála Hill, limestone outcrops, alt. c. 360 m, 48° 49' 34" N, 16° 38' 30" E, 2005, leg. J. Šoun (hb. Šoun 7); Bavory, small limestone rocks at locality Kočičí kámen, alt. c. 350 m, 48° 49' 50" N, 16° 38' 13" E, 2005, leg. J. Šoun (hb. Šoun 26); Mikulov, limestone rocks on Šibeničnický Hill, alt. c. 250 m, 48° 47' 21" N, 16° 37' 48" E, limestone rock, 2005, leg. J. Šoun (hb. Šoun 25, 27); Horní Věstonice, limestone rock on W slope of Obora Hill, alt. c. 420 m, 48° 51' 50.34" N, 16° 38' 1.5" E, 2006, leg. J. Šoun (hb. Šoun 136); Pavlov, limestone outcrop on ridge of Děvín Hill, alt. c. 450 m, 48° 52' 26.35" N, 16° 39' 27.34" E, 2006, leg. J. Šoun (hb. Šoun 135); Sedlec, small limestone outcrops on Skalky Hill, alt. c. 250 m, 48° 46' 00" N, 16° 40' 42" E, 2004, leg. J. Šoun (hb. Šoun 21).

FRANCE: Rhône-Alpes – Salève, leg. J. Müller Arg. (PRM 580941, 580943, sub *Amphiloma Heppianum*).

GERMANY: Schleswig-Holstein – Krs. Flensburg, an der Kirche in Översee, 1932, C.F.E. Erichsen (PRM 631177, sub *C. aurantia*).

HUNGARY: Bükk Mts. – Repáshuta, Három-kő rock on main edge, 3 km NEE of village, alt. c. 900 m, limestone rock, 2006, leg. J. Šoun (hb. Šoun 57).

ROMANIA: Dobruja – Tulcea, Jurilovca, rocky cliff at Dolosman Cape, 0–20 m, 44° 45' 31.70" N, 28° 56' 27.09" E, calcific claystone, 2007, leg. J. Šoun (hb. Šoun 179); Tulcea, Popina Island in Razim Lake, limestone rock on E coast, 0–1 m, 44° 58' 03.16" N, 28° 58' 57.29" E, 2007, leg. J. Šoun (hb. Šoun 180).

RUSSIA: Black Sea Coast – Tuapse, coastal calciferous sandstone rocks NW of town, alt. 3 m, 44° 06' 42.35" N, 39° 01' 58.02" E, 2007, leg. J. Šoun (hb. Šoun 172).

SLOVAKIA: Little Carpathians – Smolenice, in rupibus calcareis Ostrý Kameň – Burian, c. 450–550 m, 1937, leg. J. Suza (PRM 631171, sub *C. aurantia*). Považský Inovec – Ad ruinam arcis Tematín supra rupes dolomiticas, c. 4–600 m, 1926, leg. J. Suza (PRM 580956, sub *C. aurantia* v. *dalmatica*); Nové Mesto nad Váhom, Lúka, limestone rocks on south slope below ruin of Tematín castle, alt. c. 530 m, 2006, leg. J. Šoun (hb. Šoun 96). White Carpathians – Vršatec, in rup. calcar. Červený Kameň, c. 400–500 m, 1930, leg. J. Suza (PRM 631170, sub *G. aurantia*). Strážov Mts. – Uhrovské Podhradie, in valle dolina Rokoše, c. 500 m, in rup. calcareis, 1930, leg. J. Suza (PRM 631179, sub *C. aurantia*); Uhrovské Podhradie, ad ped. occ. m. Rokoš, c. 300 m, 1930, leg. J. Suza (PRM 631169, sub *G. aurantia*); Beluša, in rup. dolomiticis intre pag. Slatiny et Mojtn, c. 400 m, 1930, leg. J. Suza (PRM 580948, sub *C. aurantia* var. *centrifuga*); Beluša, Slatiny – Mojtn, in rup. dolomit., c. 400 m, 1930, leg. J. Suza (PRM 631176, sub *C. aurantia*); Beluša, Malenica, 800–900 m, dolomit., 1930, leg. J. Suza (PRM 631159, sub *G. aurantia*); calcicola in valle Manínska soutěska prope Záskanie, com. Trenčín, c. 350 m, 1922, leg. J. Suza (PRM 580953, sub *C. aurantia* v. *dalmatica*); Ad rupes arenosas (calcar.) inter Jablonové et Súľov, com. Trenčín, c. 350–500 m, 1922, leg. J. Suza (PRM 631167, sub *C. aurantia*); Žilina, in rupibus calcareis prope ruinam supra pag. Súľov, c. 600 m, 1926, leg. J. Suza (PRM 631174, sub *C. aurantia*, etiam cum f. *centrifuga*). Lesser Fatra – Kláštor pod Znievom, Zniev Hill, c. 980 m, vertical side of limestone rock, 2003, leg. J. Vondrák (CBFS JV1273). Greater Fatra – Plešovica, pr. p. Turč. Blatnica, c. 600 m, in rup. calcareis, 1930, leg. J. Suza (PRM 631165, sub *G. aurantia*); Ostré brdo, c. 1200 m, ad latus in rup. calcareis, 1930, leg. J. Suza (PRM 580950, sub *G. aurantia* var. *centrifuga*). Chočské vrchy Mts. – In valle Prosiecka dolina, c. 800 m, 1930, leg. J. Suza (631178, sub *G. aurantia*). Muráň Plateau – In rupibus calcareis "Cigánka" supra pag. Muráň, c. 950 m, 1929, leg. J. Suza (PRM 631153, 631155, sub *C. aurantia*); Mt. Kľak – S-slope, vertical S-facing rocks near red tourist footpath not far from crossings „Nižná Kľaková“, limestone rock, alt. c. 1250 m, 1999, leg. A. Guttová, J. Halda and Z. Palice (hb. Palice: Lichenes Slovakiae 2058).

Belianske Tatras – In valle rivi Biela prope Tatranská Kotlina, c. 800 m, 1925, leg. J. Suza (PRM 631172, sub *C. aurantia*). Slovak Paradise – „Havrania skala“ pr. pag. Stratená, c. 1050–1100 m, in rupibus calcareis, 1937, leg. J. Suza (PRM 580946, sub *C. aurantia* var. *centrifuga*); Hrabušice nature reserve „Prielom Hornádu“ – upper part, 48° 57' 30" N, 20° 24' 20" E, limestone rock, alt. c. 540 m, 1998, leg. Š. Bayerová, J. Halda and Z. Palice (hb. Palice: Lichenes Slovakiae 913). Volovské vrchy Hills – Rožňava, pr. p. Krásnohorské Podhradie in rup. calcar., c. 330 m, 1933, leg. J. Suza (PRM 631158, sub *G. aurantia*). Slovak Karst – Košice, in valle Zádielska dolina ad rupes calcareas, c. 250 m, 1927, leg. J. Suza (PRM 631173, sub *C. aurantia*). Spiš – Spišské Vlachy, Dreveník, c. 600 m, in rupibus calcareis, 1930, leg. J. Suza (PRM 631154, sub *C. aurantia* v. *centrifuga*). Branisko – Rudník-Rajtopíky, in rupibus dolomit., c. 950–1000 m, 1938, leg. J. Suza (PRM 631156, sub *G. aurantia*). Vihorlat Mts. – Humenné: in monte Krivošťianka 500 m, 1930, leg. J. Nádvozník (PRM 760997, sub *C. aurantia* var. *dalmatica*).

SWEDEN: Gotland – Hoburgen, on sandstone by shore, 1918, leg. H. Magnusson (PRM 580945, sub *C. heppiana*); Ljugarn, 1918, leg. G.O. Malmé (PRM 580940, sub *C. heppiana*).

SWITZERLAND: Basel-Country – An Kalkfelsen bei Liestal, Kant. (PRC 26, PRM 580942; Rabenhorst: Lichenes europaei 671, sub *Amphiloma heppianum*).

TURKEY: Black Sea Coast – İnebolu, coastal limestone rocks E of Abana, alt. c. 6 m, 41° 58' 52.90" N, 34° 02' 47.26" E, 2007, leg. J. Šoun (hb. Šoun 173); Cide, coastal sandstone rocks near Denizkonak, alt. 4 m, 41° 56' 54.30" N, 33° 08' 10.63" E, 2007, leg. J. Šoun (hb. Šoun 174); Amasra, claystone coastal rocks near Çakrazboz, alt. 2 m, 41° 46' 55.44" N, 32° 29' 07.96" E, 2007, leg. J. Šoun (hb. Šoun 175); Zonguldak, limestone coastal rocks near Ilksu, alt. 5 m, 41° 24' 36.97" N, 31° 40' 49.10" E, 2007, leg. J. Šoun (hb. Šoun 176). Sea of Marmara Coast – Armutlu, coastal limestone rocks 5.5 km SW of Esenköy, alt. 1–3 m, 40° 35' 06.68" N, 28° 53' 44.72" E, 2007, leg. J. Šoun (hb. Šoun 177); **Bandırma, coastal limestone rocks near Yenice, alt. c. 20 m, 40° 22' 44.78" N, 28° 04' 16.09" E, 2007, leg. J. Šoun (hb. Šoun 178).**

UKRAINE: Crimean Peninsula – Bakhchysarai, limestone cliffs above town, alt. c. 300 m, 44° 45' 04.68" N, 33° 53' 06.88" E, 2006, leg. J. Šoun and J. Vondrák (hb. Šoun 104); Kerch Peninsula, Opukskiy zapovednik, coastal limestone cliffs, alt. c. 20 m, 45° 01' 57.18" N, 36° 12' 23.30" E, 2006, leg. J. Šoun and J. Vondrák (hb. Šoun 159).

UNITED KINGDOM: England – Ruins of Tong Priory, Shropshire, leg. W. Leighton (PRM 631192; Leight. Exs. 113, sub *Parmelia murorum*); **Bristol, calcareous rocks in Avon Gorge next to Clifton Suspension Bridge, 2006, leg. J. Vondrák (hb. Šoun 43).**

DISCUSSION

Morphology and anatomy. The basic morphology of *C. aurantia* and *C. flavescens* is described in e. g. Alon and Galun (1971), Clauzade and Roux (1985), Khodosovtsev et al. (2004), Nordin (1972), Verseghe (1970, 1971, 1972), Wade (1965), Wasser and Nevo (2005), Wetmore and Kärnefelt (1998) and Wirth (1995), but the diagnostic value of the characters has never been tested. Therefore, this study tries to pin-point diagnostic characters of the treated species. Data from our morphological investigations along with literature data (see Tab. 1 for quantitative characters) show the main differences in shape and colour of lobes and thallus, structure and thickness of cortex, and ascospore shape. However, the intraspecific variability in some characters, such as colour and lobe shapes, has resulted in descriptions of many varieties and forms in both species in the past.

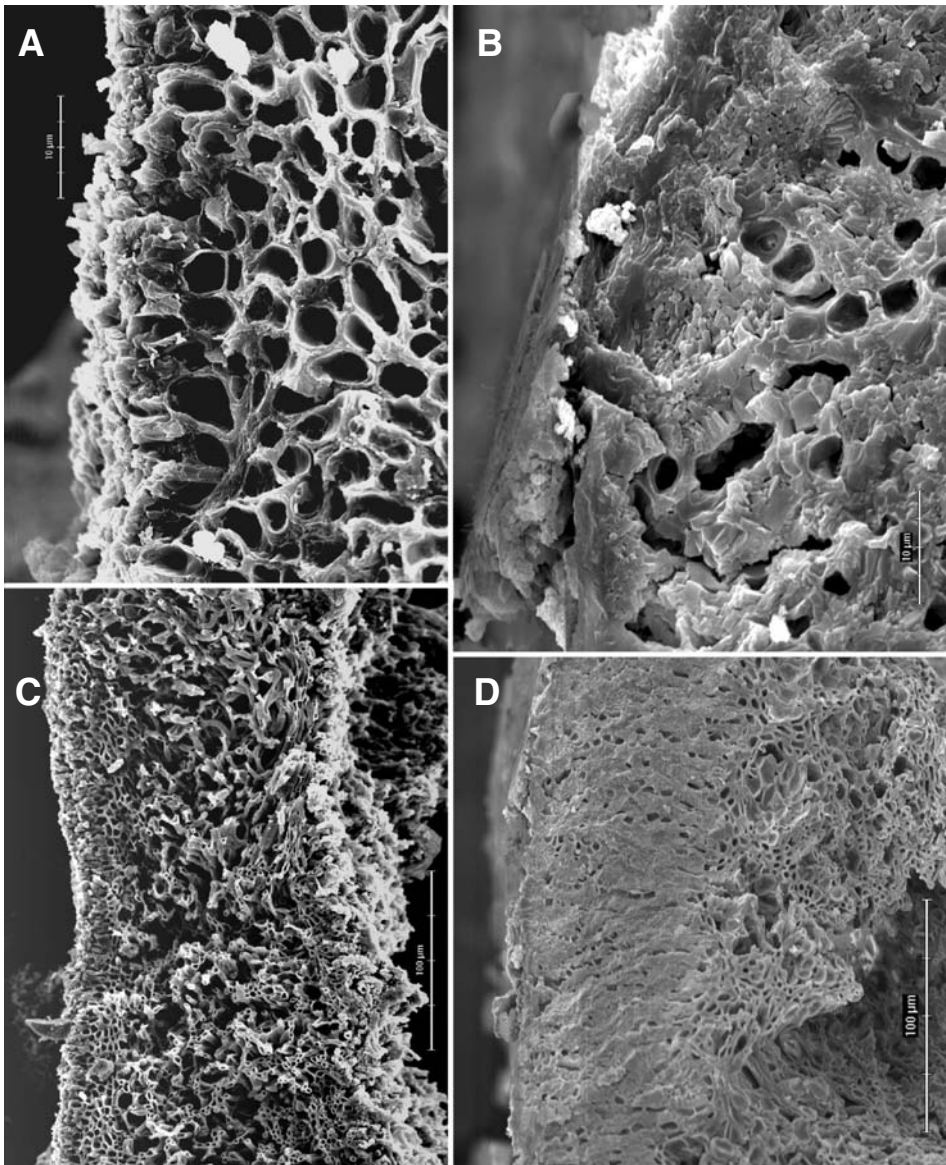


Fig. 3. Transverse sections of marginal lobes (C, D) with detailed views of cortical layer structure (A, B) of *Caloplaca aurantia* (A, C) and *C. flavescens* (B, D) from a scanning electron microscope.

The presence vs. absence of a crystalline layer in the cortex seems to be the most reliable character distinguishing *C. aurantia* and *C. flavescens*, because colouring and thallus morphology of some untypical specimens can be confusing.

The presence of crystals as a crucial character is missing from some publications (Alon and Galun 1971; Laundon 1984, 1992; Nordin 1972; Wade 1965; Wasser and Nevo 2005; Wetmore and Kärnefelt 1998), but noted in others (Clauzade and Roux 1985; Khodosovtsev et al. 2004; Poelt 1954, 1969; Verseghe 1971, 1972; Wirth 1995). The thickness of the cortex is another useful diagnostic feature as described here for the first time.

As Verseghe (1971) already pointed out, ascospores in *C. flavescens* are on average slightly narrower and longer with more pointed apices than in *C. aurantia*, but since the variations in ascospore shape considerably overlap in both species (Tab. 1), this is not a reliable character.

Nomenclature. The nomenclature of *C. aurantia* and *C. flavescens* has undergone an intricate and somewhat confusing development since the 18th century. This matter will be treated in detail in another publication and only the circumstances concerning the Czech Republic are mentioned here. In the Czech literature (cf. Vězda and Liška 1999, Servít 1930) various names have been used for these species. *C. aurantia* has been named by its younger synonym *Caloplaca / Gasparrinia callopisma*. *C. flavescens* has been named as *C. heppiana*, *C. aurantia* var. *intermedia* and *C. aurantia* f. *centrifuga*. The last name was only used by Servít (1930: 45) and *C. heppiana* by Servít (1930: 8); these names are not included in the Catalogue of Lichens of the Czech Republic (Vězda and Liška 1999). The name *C. aurantia* var. *intermedia* was used by Suza for Bohemian populations of *C. flavescens*, but also incorrectly for some morphotypes of *C. aurantia* from Moravia.

Herbarium specimens of *C. flavescens* collected in the first half of the 20th century by some Czech authors (Kovář, Podpěra, Servít, Suza) were incorrectly named *C. aurantia* (Pers.) Hellb., *C. aurantia* (Pers.) J. Steiner and *Gasparrinia aurantia*. This confusion was caused by an incorrect concept of the name *C. (G.) aurantia* as an older and favoured synonym for *C. heppiana* or *C. sympagea* (= *C. flavescens*) established by some mainly central-European authors from the 19th to the middle of the 20th century (e. g. Steiner 1896, 1919; Sydow 1887; Zahlbruckner 1931).

These nomenclatural difficulties and confusions probably resulted in the omission of *C. flavescens* in Vězda and Liška (1999) and incorrect allocations of some references to *C. aurantia*. The name *C. flavescens* was published for the first time from the Czech Republic by Svoboda (2007).

Distribution. *C. aurantia* occurs in subtropical and temperate zones of the Old World, but recently, it was surprisingly reported from Argentina (Calvelo and Liberatore 2002). Its occurrence in North America mentioned by some authors (Esslinger and Egan 1995, Laundon 1992, Nimis 1993) was denied by Wetmore and Kärnefelt (1998). *C. flavescens* shows a similar distribution pattern to *C. aurantia*, but extends to higher altitudes and higher latitudes (up to south-

ern Scandinavia). In the Czech Republic, Moravian occurrences of both species probably represent extensions of their continuous ranges in the Eastern Alps, Carpathians and Pannonia. Somewhat striking is the absence of *C. flavescens* at the three localities of *C. aurantia* at the rim of south-Moravian xerothermic region. Both species are missing in the Moravian Karst where apparently favourable niches exist. The populations of *C. flavescens* in the Bohemian Karst, Central Bohemia, may be related either to its distribution in Germany or Moravia. However, *C. aurantia* is absent there, although it occurs in higher latitudes, e. g. in Germany and Poland (Fałtynowicz 2003, Scholz 2000).

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