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NOTES ON SOREDIATE *PORPIDIA* SPECIES WITH A RUSTY COLOURED THALLUS FROM THE CZECH REPUBLIC

Poznámky k sořediosním druhům rodu *Porpidia* s rezavě zbarvenou stélkou z České republiky

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Abstract: The soorediate *Porpidia* species with orange thallus from the Czech Republic are reviewed. *P. melinodes* is recorded for the first time in the country. *P. soredizodes* and *P. tuberculosa*, which occasionally develop an orange/rusty thallus, are also included in the text.

Key words: lichen taxonomy, chemotaxonomy, Lecideaceae, *Porpidia*, lichenized Ascomycota

Sorediate crustose lichens are one of the most difficult groups of species to identify since the thallus morphology is very often modified by various substrate and environmental factors, particularly the chemical and physical quality of the substrate which can modify the appearance of such lichens. In some crustose iron-tolerant lichens, the normally whitish to grey coloured thallus becomes yellowish, ochraceous to deep red or 'rust' coloured, when growing on iron-rich rocks. The colour is caused by iron containing granules in the upper layer of the cortex (e.g. Noeske et al. 1970, Schwab 1986, Purvis et al. 1987, Rambold 1989, Purvis & Halls 1996). The commonest genera containing some species tolerant to high metal content include *Acarospora* A. Massal., *Aspicilia* A. Massal., *Cladonia* Hill ex P. Browne, *Lecanora* Ach., *Lecidea* Ach., *Rhizocarpon* Ramond ex DC., *Stereocaulon* Hoffm. nom. cons., *Tremolecia* M. Choisy (Nash 2008), but also some species of the genus *Porpidia* Körb. (Schwab 1986, Buschbom & Mueller 2004, Fryday 2005, Hertel & Schuhwerk 2010).

In Europe, five *Porpidia* species with an obligately orange thallus have been reported: *P. melinodes* (Körb.) Gowan & Ahti, *P. aff. melinodes* sensu Fryday (2005), *P. flavicunda* (Ach.) Gowan (= *P. flavicoerulescens* (Hornem.) Hertel & A. J. Schwab), *P. flavocruenta* Fryday & Buschbom and *P. ochrolemma* (Vain.) Brodo & R. Sant. In addition, some other species (e.g. *P. tuberculosa* (Sm.) Hertel & Knoph, *P. soredizodes* (Lamy ex Nyl.) J. R. Laundon, *P. macrocarpa* (DC. in Lam. & DC.) Hertel & A. J. Schwab) may have a 'rust' coloured thallus, but this morphotype is a modification caused by the habitat and environmental factors. Because of such morphological variation, secondary lichen chemistry

plays a significant role in species identification and taxonomy of the genus (e.g. Gowan 1989, Fryday 2005). Furthermore, a reaction of medulla with iodine solution is also a very useful feature in identification, especially in chemically similar sorediate *Porpidia* species.

During the revision of some specimens of sorediate *Porpidia* species with an orange thallus from the Czech Republic, it turned out that the determinations of these taxa cause many problems. Since there has been no specific study of *Porpidia* in the Czech Republic, the aim of this paper is to present results of some pioneer research on the sorediate *Porpidia* species with a rusty thallus from this country.

Material and methods

The present study is based on recent collections deposited in PRA, UGDA and the private herbarium of Jiří Malíček. Following morphological characters were examined under the stereomicroscope: thickness and colour of the thallus, colour, shape and size of soralia, and the presence of apothecia. The lichen substances were identified by chromatographic methods as described by Orange et al. (2001). The chromatograms were developed in solvent system C. Spot-test-reactions with I (iodine solution) were applied under dissecting microscope.

The species

In the Czech Republic, four sorediate species that form or may form orange thalli have been found to date: *P. melinodes* (Körb.) Gowan & Ahti (in this paper recorded as new to the Czech Republic), *P. ochrolemma* (Vain.) Brodo & R. Sant., *P. soredizodes* (Lamy ex Nyl.) J.R. Laundon and *P. tuberculosa* (Sm.) Hertel & Knoph.

The identification of sterile specimens of *Porpidia* with an orange thallus causes many problems since the thallus is very often modified by various substrate and environmental factors. All the above-mentioned species can occur on iron-rich rocks and the accumulation of the heavy metal compounds in the cortex layer causes a deep red or orange colour of the thallus. Therefore, morphology on its own is often a weak character for identification. A main difference between those taxa lies in the amyloid reaction of the medulla and in the content of different lichen substances.

Key to sorediate *Porpidia* species with an orange/rusty thallus occurring in the Czech Republic

- 1 Thallus with stictic acid (K+ yellow, Pd+ orange), or rarely lacking secondary compounds, medulla I- **2**
- 1* Thallus with confluent acid and 2'-O-methylperlatolic acid; medulla I+ or I- **3**
- 2 Thallus medium thick (c. 0.2–0.6 mm), smooth or rimose, creamy yellow to orange yellow; soralia numerous round to irregular, tuberculate, soredia grey-white ***P. ochrolemma***
- 2* Thallus thin or endolithic, in shades of grey, rarely with orange tinge; soralia usually urceolate, also tuberculate, soredia white, light grey to greenish ***P. soredizodes***
- 3 Thallus in shades of gray, rarely 'rust' coloured; medulla I+ blue; soredia white, grey or concolorous with thallus ***P. tuberculosa***
- 3* Thallus orange or sometimes pale orange-grey; medulla I-; soredia whitish to bluish-gray ***P. melinodes***

Porpidia melinodes (Körb.) Gowan & Ahti

This species belongs to the *P. speirea* group, and within this, the *flavicunda* subgroup (see Buschbom & Mueller 2004, Fryday 2005, Jabłońska 2009). The thallus of this species is orange to pale orange-grey, usually moderately thick, smooth, cracked-areolate or cracked rimose. It produces soralia, which are discrete, often rounded, scattered; soredia are granular and whitish to bluish-grey. It is characterized by the I– medulla and the presence of confluent and 2'-O-methylperlatolic acids or norstictic acid (Gowan & Ahti 1993, Fryday 2005). The studied Bohemian specimens contain confluent and 2'-O-methylperlatolic acids.

This taxon is morphologically and chemically very similar to *P. tuberculosa*, which can also have an orange thallus, but the latter has an amyloid (I+ blue) medulla (Gowan & Ahti 1993, Fryday 2005).

The distribution range of *P. melinodes* is circumpolar in Northern Hemisphere (Hertel 1977, Schwab 1986, Gowan & Ahti 1993). It is widespread and common throughout the boreal-arctic zones, where according to Fryday (2005) it occurs usually on metal-rich siliceous rocks in upland areas. The species is here reported as new to the Czech Republic.

- Specimens examined – Czech Republic, W Bohemia, Slavkovský les Mts, former town Litrbachy (= Čistá), WGS-84: N50°06'16" E12°43'55", the bottom of old heap covered in upper part with forest, on gneiss rock, 18. 04. 2009, M. Kukwa 7352 & 7358 (UGDA).
- Additional specimens examined – Sweden, Torne Lappmark, Låktatjåkka: Kärkevagge valley, WGS-84: N68°24'43" E18°18'33", 640 m a.s.l., on mica-schist boulder, 23. 07. 2002, Z. Palice 7365 (PRA); Norway, Sør-Trøndelag, Selbu, ca 4,5 km NW of Flora, Langsmoen, E-facing slope above the Nea River, WGS-84: N63°08'35" E11°14'89", on mica-schist rock, 11. 09. 2005, Z. Palice 9340 (PRA).

Porpidia ochrolemma (Vain.) Brodo & R. Sant. (syns. *Hymenelia ochrolemma* (Vain.)

Gowan & Ahti; *Porpidia pseudomelinodes* A.J. Schwab)

This species has been recently reported from the Czech Republic by Palice (1999). It is distinguished by its smooth, ± continuous or rimose, creamy yellow or pale orange thallus with numerous unpigmented or grey-white soredia. It differs from *P. melinodes* in its more creamy-yellow, smoother and rimose thallus, the presence of stictic acid rather than confluent acid, and its occurrence on semi-inundated rocks. *P. ochrolemma* is chemically similar to *P. soredizodes*, but the latter is distinguished by its much thinner, sometimes disappearing grey thallus with farinose to granular, often blue-grey or cream-coloured soredia (Fryday et al. 2007, Jabłońska 2009). The apothecia have not been reliably recorded for this species.

Ecologically this is a hydrophilic species, usually growing on damp rocks (semi-immersed or splashed by water) by brooks and lakes (Gowan & Ahti 1993, Fryday 2005). Surprisingly, the it was omitted by Thüs & Schultz (2008) in their freshwater lichen flora of Central Europe.

The distributional range is insufficiently known but seems to be holarctic. Currently, *P. ochrolemma* is known only from the British Isles, continental Europe and North America (Fryday 2005), the region of Lake Baikal in Siberia (Urbanavichene & Urbanavichus 1998) and the Czech Republic, where it is a rare lichen collected only from the Sudeten mountains.

- Specimens examined – Czech Republic, E Bohemia, W Sudetes, Krkonoše Mts: Obří důl valley, along the waterfall "Dolní Úpský vodopád", WGS-84: N50°43'40" E15°43'45", 980 m a.s.l., on dripping siliceous vertical rock, 25. 09. 1998, J. Halda & Z. Palice 1366 (UGDA, PRA; Palice 1999); N Bohemia, Krkonoše Mts, Velký Kotel corrie – a bedrock of Kotelský potok brook, WGS-84: N50°44'55" E15°32'15", 1070–1120 m a.s.l., on wet rocks near the stream, 28. 08. 2002, Z. Palice 6926 (PRA); N Moravia, E Sudetes, Jeseníky Mts, Velký kotel corrie, Vitásek ravine, nearby the rock-wall of Šmarda, 1300–1320 m a.s.l., on damp gneiss/schist rock, 10. 06. 2002, J. Halda & Z. Palice 7019 (PRA).

- Additional specimen examined – Sweden, Torne Lappmark, Abisko N.P.: Rihtonjira valley, WGS-84: N68°21'29" E18°44'25–35", 700–750 m a.s.l., on splashed mica-schist rock in the bedrock, 10. 07. 2002, Z. Palice 7353 (PRA).

***Porpidia soledizodes* (Lamy ex Nyl.) J.R. Laundon**

This species is characterized by its thin, usually grey thallus with a non-amyloid medulla, the presence of numerous, small (c. 0.3 mm diam.), discrete, usually excavate soralia containing blue-grey or cream-coloured soredia, and the production of stictic acid (sometimes absent) (see Fryday 2005, Fryday et al. 2007). Occasionally, when *P. soledizodes* grows on iron-rich substrata, it may have a thallus with an orange tinge.

P. soledizodes is frequent in northern and central Europe, where it occurs on siliceous rocks and pebbles in lowland situations (Fryday 2005); it has also been reported from Australia (Rambold 1989) and North America (Fryday et al. 2007). Some populations of this species in central European regions regularly occur in splash-water communities, especially on well-buffered substrates (Thüs & Schultz 2008). In the Czech Republic it is a rather common species (see Vězda & Liška 1999).

- Specimens with an orange tinged thallus examined – Czech Republic, E Bohemia, W Sudetes, Krkonoše Mts, Mt. Sněžka, Koulový potok brook valley below Růžohorské sedlo saddle, WGS-84: N50°43'40" E15°45', 1200 m a.s.l., on wet mica-schist stones in the bedrock of the brook, 30. 08. 2000, Š. Bayerová, J. Liška & Z. Palice 5059 (PRA); N Moravia, Rychlebské Hory Mts, W of Bílá Voda town, valley of the stream, WGS-84: N50°26'18" E16°53'14", ca. 350 m a.s.l., on basaltic rocks, 24. 04. 2004, M. Kukwa 3167 (UGDA-L–11743).

***Porpidia tuberculosa* (Sm.) Hertel & Knoph**

This species is characterized by its usually medium thick, smooth to cracked-rimose, light to dark grey, sometimes white to bluish-grey thallus and round to irregular soralia with white or grey, often with bluish tinged soredia. It produces confluent acid and in minor amounts 2'-O-methylmicrophyllinic and 2'-O-methylperlatolic acids, and additionally, very rarely, contain stictic or norstictic acids (Fryday 2005). This is the only sorediate species in the Czech Republic which has an amyloid medulla (I+ blue). This character, as well as the presence of confluent acid with minor to trace amounts of additional substances, make this species very distinctive (Fryday 2005).

Sometimes *P. tuberculosa* can have a partly or almost entirely orange thallus, and in the Czech Republic can be confused with morphologically and chemically similar *P. melinodes*: both produce confluent and 2'-O-methylperlatolic acids, but *P. tuberculosa* has an amyloid (I+ blue) medulla, whereas medulla of *P. melinodes* is non-amyloid (I–) (e.g. Gowan & Ahti 1993, Fryday 2005).

P. tuberculosa is common in Europe (e.g. Fryday 2005), North America (Gowan 1989) and southern South America (Fryday 2002). It grows on siliceous rocks, walls, pebbles, and rarely on worked timber in different environmental conditions (Galloway & Coppins 1992). According to Gowan & Ahti (1993), it prefers rather dry, but often shaded rocks in forests and along shores; it is also very rarely found on tree bark (Tønsberg 1992). In the Czech Republic it is rather common species (Vězda & Liška 1999).

- Specimens examined – Czech Republic, W Bohemia, distr. Sokolov, Slavkovský les Protected Landscape Area, Horní Slavkov, "Jáma Hubert" mine, 1 km S of town, 600–650 m a.s.l., on metal-rich siliceous pebbles, 10. 04. 2009, J. Malíček et al. (herb. Malíček 1732); C Bohemia, České středohoří landscape area, Litoměřice, Mt. Plešivec, basaltic boulder scree on SW slope, 400–450 m a.s.l., on basaltic stone, 18. 09. 1999, Š. Bayerová, F. Berger & Z. Palice 5056 (PRA).

Souhrn

Porpidia je taxonomicky obtížný rod korovitých saxikolních lišejníků. V současném pojetí jsou sem řazeny druhy s lecideoidními plodnicemi, tmavým hypotheciem a tubulární

válcovitou strukturou v apikálních částech věcka. Stélka je obvykle světle zbarvená a dobře vyvinutá. Řada druhů je však často sterilní a tyto většinou vytvářejí vegetativní propagule, obvykle soledie. Solediozní druhy rodu *Porpidia* mohou být někdy oranžově až rezavě zbarveny a z nich lze považovat dva naše taxony za tzv. ferrofilní druhy, jelikož je nacházíme pouze na horninách bohatých na železo a jsou vždy (alespoň zčásti) oranžově až rezavě zbarvené (*Porpidia melinodes*, *P. ochrolemma*), v jiných případech se však jedná o vzácnější barevné modifikace obvykle světle zbarvených druhů s širší ekologickou amplitudou (*Porpidia tuberculosa*, *P. soledizodes*). V příspěvku jsou zmíněny všechny od nás dosud známé solediosní druhy rodu *Porpidia*, které mají (díky inkrustaci stélky sloučeninami železa) obligátně či fakultativně rezavé zbarvení stélky. Tato práce vznikla na základě revize recentně sbíraného materiálu nejen z území České republiky, ale byly studovány i některé skandinávské exempláře, které jsou rovněž citovány. U všech uváděných vzorků byly detekovány chemické látky pomocí TLC. Příspěvek obsahuje rovněž klíč k určování čtyř dosud sbíraných druhů na území ČR. *Porpidia melinodes* je od nás uváděna vůbec poprvé.

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PŘÍNOS BOTANIKŮ 19. STOLETÍ NAROZENÝCH A PŮSOBÍCÍCH NA ČESKÉM ÚZEMÍ K NOMENKLATUŘE A TAXONOMII MECHOROSTŮ. II. AUGUST KARL [CARL] JOSEPH CORDA

Contribution of botanists of 19th century born and working in the area of present Czech Republic to the nomenclature and taxonomy of bryophytes. II. August Karl [Carl] Joseph Corda

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Abstract: The second article of the series is devoted to August Karl [Carl] Joseph Corda, Czech mycologist and botanist, for some time working also on bryophytes and algae. Short biography, his contribution to bryology, information about his herbarium and publications about bryophytes (mostly concerning only liverworts) are presented. The core of the article is the list of taxa of bryophytes published or only named (in sched.) by Corda; valid taxa are printed in boldface. Complete bibliographic references and the information about the revision and present categorization of these taxa are given.

Keywords: A. K. J. Corda, biography, herbarium, publications, bryophytes, taxonomy, nomenclature

August Karl [Carl] Joseph Corda se narodil 22. 10. 1809 v Liberci jako syn zámožného obchodníka se sukny, ale zhruba po roce života ztratil během několika týdnů oba rodiče. Až do jeho desíti let se o něj starala nemocná a slepá babička pod poručnictvím pana Römhelda z Horního Litvínova. V té době Corda navštěvoval školu v Liberci a kromě toho byl současně připravován soukromým učitelem pro gymnázium. Po smrti babičky v r. 1819 byl přes dva roky ponechán cizím lidem a neúčastnil se v té době vyučování. V roce 1822 byl dán na vychování ke strýci Vojtěchu Cordovi do Prahy; zde navštěvoval gymnázium na Novém Městě, záhy byl však nucen jej ukončit. Navštěvoval ale také 4. třídu na škole piaristů na Novém Městě, kde botaniku vyučoval prof. I. F. Tausch. Pro nerozhodnost při volbě životní dráhy se