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Lichenological notes 4: a revision of *Acarospora gallica* (*Acarosporaceae*)

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Abstract — *Acarospora gallica* from Europe and Asia is revised and a neotype is designated. *Acarospora hungarica* is proposed as a synonym of *A. gallica.* The anamorphic stage is reported for the first time from the species.

Key words — *Acarospora fuscata*, *Acarospora janae,* Czech Republic

Introduction

The study of the genus *Acarospora* in Europe rests on the strong foundation of the great Swedish lichenologist A.H. Magnusson, whose primary work is his classical monograph (Magnusson 1929). Nonetheless, some of the species he described are known only from the type specimens or today are poorly known by lichenologists in general. *Acarospora gallica* is among those poorly known species, mainly because of confusion with *A. fuscata,* which it can superficially resemble. It also may be a rare or infrequent species in many countries. In this paper we revise *A. gallica* as part of our study of *Acarosporaceae* in the Czech Republic. We hope this paper will lead to easier and more confident determinations of the species and to new discoveries.

Materials & methods

Specimens were studied from GZU, PRA, UPS, and the Hb. Mycologicum J. Kocourková & K. Knudsen (Hb. Myc. JK & KK). Specimens were examined using standard microscopical techniques with an Olympus SZX 7 stereomicroscope or an Olympus BX 51 fitted with Nomarski differential interference contrast. Hand-made sections were studied in water and 10% KOH [K]. Amyloid reactions were tested in Lugol's iodine [I] with and without pretreatment with K. Ascospores were measured in

water with an accuracy of 0.5 µm. Macrophotographs were taken with a digital camera Olympus DP72 mounted with QuickPhoto Camera 2.3 on the stereomicroscope. The illustrations were prepared using Adobe Photoshop.

Taxonomy

Acarospora gallica H. Magn., Kungl. Svenska Vetensk.-Acad. Handl., Ser. 3, 7(4): 282. 1929. PLATES 1–2

TYPE: France. Puy-de-Dôme: Arlane, près d.Ambert, 1900, Brevière (Hb. B. de Lesdain, Holotype, n.v., probably lost). Provence-Alpes-Côte d'Azur: Var, La Courtines près Ollivules. Sur rochers volcaniques. May, 1923, de Crozals (UPS, **Neotype designated here**).

= *Acarospora hungarica* H. Magn., Kungl. Svenska Vetensk.-Acad. Handl., Ser. 3, 7(4): 284. 1929, **syn. nov.**

TYPE: Hungary. Saro; Eperjes, 1868, Lokja (Holotype, W!).

Thallus arising from an endosubstatic hypothallus, sometimes with well-developed rhizohyphae or expanding through vegetative division. Thallus indeterminate, of dispersed or contiguous areoles, or dispersed or crowded squamules, 0.2–0.6(–1.5) mm diam., ≤ 0.2–0.5 mm thick. Areoles angular to irregular or round, broadly attached, sometimes with a single apothecium the thallus becoming reduced to a pseudothalline margin forming verrucae. Areoles becoming squamulose and lobulate in well-developed specimens, with a distinct lower surface, the elongated mycelial base broad (gomphate) or forming a stipe. Upper surface pale to dark brown, epruinose, matt. Lacking either an epinecral layer or syncortex of polysaccharides. Lower surface pale brown or white in well-developed areoles, or darkened by substrate interaction. Cortex relatively thin, 20–35 µm thick, of paraplectenchymatous cells mostly 2–4 µm diam.; upper layer brown to 10 µm thick, lower layer hyaline. Algal layer 50–100 µm, continuous, sometimes with edges of stratum uneven, algal cells mostly 10 µm diam. Medulla up to 100 µm thick, of intricate thick-walled hyphae, mostly 3–4 um thick, continuous with attaching hyphae.

Apothecia 1–12 per areole or squamule, sometimes in agglomerations; disc usually smooth, usually reddish when wetted, epruinose, 0.1–0.6 mm diam., but sometimes scabrid with ontogenic remnants of thalline plectenchyma or merging with other apothecia especially when in agglomerations. Exciple indistinct to 10–15 µm wide. Hymenium 75–100(–130) µm tall, hyaline, I+ red, blue or greenish, epihymenium 10–20 µm thick, reddish-brown. Paraphyses 1.5–2.0 µm diam., not branching, apices slightly expanded to 3 µm, sometimes wider. Asci 50–80 × 15–30, 100–200 ascospores per ascus. Ascospores hyaline, simple, mostly (2.0–)4.0–5.0(–6.5) × 1.5–2.0 µm, usually narrowly ellipsoid, but shorter ascospores broadly ellipsoid. Subhymenium usually 10–30(–50) µm tall, usually I+ blue. Hypothecium narrow, to 15 µm wide, continuous with exciple.

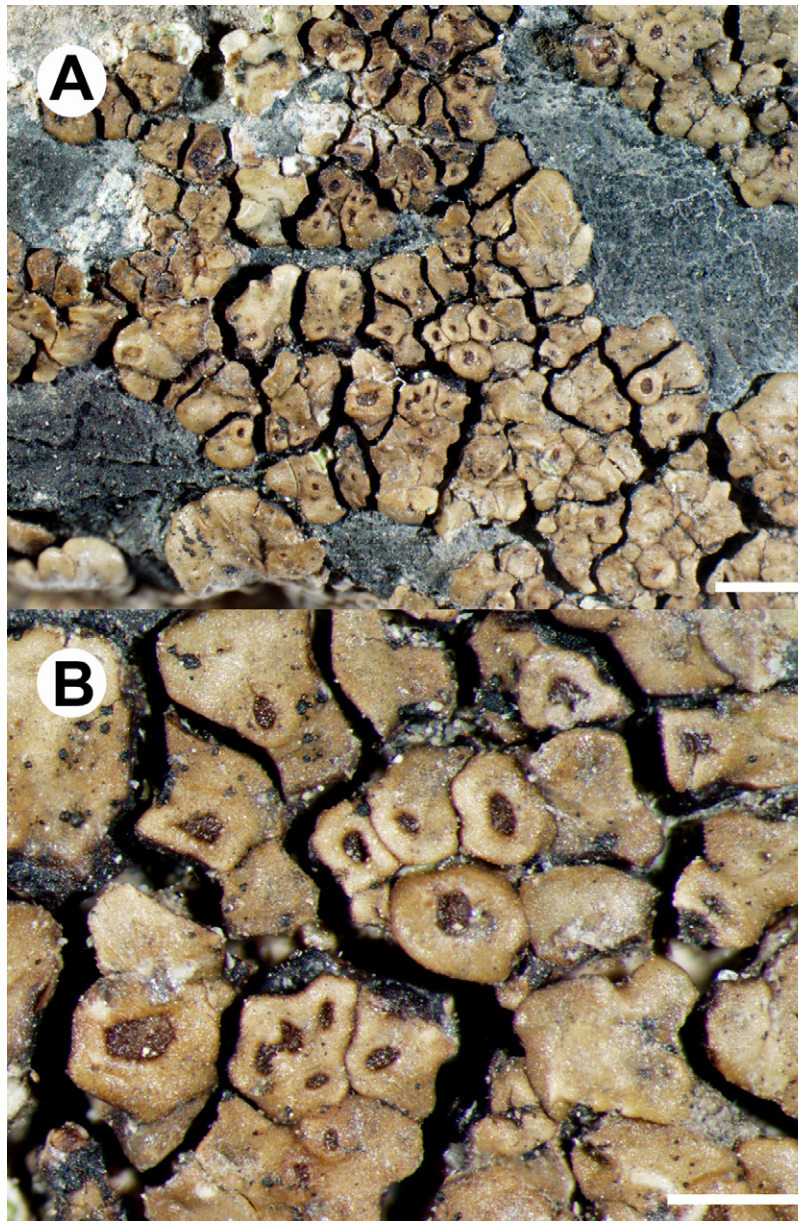

Plate 1. *Acarospora gallica* (Knudsen 12447). A, Thallus. Angular, squamulose, and lobate areoles with apothecia. B, Single and confluent apothecia. Some areoles with fungus *Lichenothelia convexa*. Scales = A = 1 mm; B = 0.5 mm.

Pycnidia usually visible as red dots, globose, to 100 µm diam., sometimes rare or absent. Conidia hyaline, simple, mostly 2.5 × 1 µm.

Chemistry— Gyrophoric/lecanoric acid, cortex and/or medulla KC+ reddish. Other spot tests negative.

Ecology & distribution— In sunny, open locations on diabase, mica-schist, sandstone, serpentine, shale, silicate-rich and volcanic rock, mostly at low (100–300 m) elevations in Asia (Siberia, Turkey) and Europe (Austria, Bulgaria, Czech Republic, Denmark, France, Germany, Hungary, Italy, Spain, Slovakia, Switzerland, Ukraine) (Magnusson 1929, 1936; John & Nimis 1998). Golubkova's reports of *Acarospora gallica* from the former Soviet Union appear to be based on Magnusson's reports, indicating that the species may be rare in the Russian Federation (Golubkova 1988). The most well developed specimens were collected in central Europe at low elevations. The highest elevation was 1820 m in Italy, collected by H. Mayrhofer (GZU).

Selected specimens examined: **Austria:** Tirol, on a roof of mica-schist, 900 m, Aug. 7, 1927, A.H. Magnusson 10954 (UPS). **Bulgaria:** Rhodope, inter Bečkovo et Staminaka, 250-330 m, ad rupes gneissaceas ad vicum publicam, Aug. 9, 1923, J. Suza s.n. (PRM 578430). **Czech Republic:** Central Bohemia, České středohoří mountains, Verneřice, a phonolit scree above Bobří soutěska pass, 420-480 m, Sept. 26, 1995, Z. Palice s.n. (PRA); Křivoklátsko Highland, distr. Rakovník, between Nezabudice and Roztoky villages, Nezabudické skály Nature Reserve, above Berounka River, 50°1'26.101"N 13°50'41.882"E, 390 m, on steep SW-facing slope, on schist outcrop in oak thin scree forest, Feb. 16, 2002, J. Kocourková 1142 (PRM 896203); Hracholusky, Čertova skála Nature Reserve, 320 m, at top of steep slope of rock outcrops, on spilite, June 28, 1996, J. Horáková 2141 (PRM 891402); ibid., 290 m, on steep slope of rocks, on spilite, July 14, 1997, J. Kocourková 3436 (PRM 906656); Pražská plošina plateau, distr. Praha-západ, Máslovice, Větrušická rokle Nature Reserve, 200 m, on SSE-facing rocky slopes, on rich shale, July 16, 2002, J. Kocourková 3310 & V. Orthová (PRM 906851); Pražská plošina plateau, Praha, Malá Ohrada, Albrechtův hill at Prokopský brook, 300 m, on diabase rock, Sept. 23, 1999, J. Kocourková 6747 (PRM 909496); Praha, Motol, natural monument "Kalvárie, Rock with cross", W-facing diabase crest with the cross on top, 50°03'96"N, 14°19'65"E, 320 m, on low diabase outcrop, Apr. 3, 2007, Z. Palice 11396 (PRA); Praha, Pitkovice, Pitkovická stráň, 50°01'26"N, 14°34'21"E, 276 m, on shale, Sept. 21, 2010, J. Kocourková 7755 & K. Knudsen 12447 (Hb. Myc. JK & KK), K. Knudsen 12457 & J. Kocourková (Hb. Myc. JK & KK, UCR). East Bohemia, the Labe valley, Chvaletice, sedimentation basin NNW of the power station, a dumped stone-terrace, ca 50°02'20"N, 15°26'40"E, 220 m, on schist, Oct. 27, 2002, Z. Palice 7956 & Z. Soldán (PRA). South Moravia, in valle fluminis Jihlavka, prope pag. Hrubšice, ad rupe arenacea, 230 m, 1919, J. Suza s.n. (UPS); Ad rupe arenacea prope Hrubšice, ca 230 m, Aug. 5, 1919, J. Suza s.n. (PRM 578429); Distr. Třebíč, Mohelno, S-SSW-facing slopes above the valley of Jihlava river, a terrace with well-lit pine-forest, 49°06'26.5"N, 16°11'08" E, 290 m, on small serpentine stone semi-immersed in the ground, Mar. 31, 2011, Z. Palice 14204 (PRA). West Bohemia, Český les, distr. Cheb, Železná hůrka, 49°59'29.5"N, 12°26'29.5"E, 575 m, on eutrophicated iron-eich phyllitic boulders, June 24, 2011, J. Halda, Z. Palice & P. Uhlík 14298 (PRA); North Bohemia: Protected Landscape Area Kokořínsko, former quarry, 300 m, Nov. 27, 1997, Z. Palice s.n. (PRA).

Plate 2. *Acarospora gallica* (Knudsen 12447).
Areoles. Stipe and well developed rhizohypha. Scale = 1 mm.

Denmark: Jylland, Schleswig-Holstein, Insel Alsen, Norburg, Sept. 11, 1913, C.F.E. Erichsen s.n. (UPS); **France:** Provence-Alpes-Côte d'Azur, Alpes-Maritimes, Nice, Peira Cava, on sandstone, Apr., 1927, J. Suza s.n. (UPS). Gallia merid., Nice, Peira Cava, ad saxa arenacea, ca 1500 m, (sepes maritim.), Apr., 1927, Suza s.n. (PRM 578431). **Italy:** Arcipelago Toscano, Prov. Livorno, Isola di Capraia, 120 m, Apr. 23, 1988, Nimis et al. s.n. (GZU). Nordl. Apennin, Prov. Pistoria: Umgebung von Abetone, Val di Luce, Alpe Tre Potenze, 1820 m, Oct. 27, 1978, H. Mayrhofer s.n. (GZU). **Russia:** Primorye, Oriente Extremo, Ditio Ussuriensis, Distr. Vladivostok, in peninsula Bassargin, Sept. 6, 1927, A. Oxner s.n. (UPS). **Slovakia:** Vihorlat, Choňkovce, andesit, 1930, J. Nádvorník s.n. (PRM 783230). **Spain:** Catalania: Vora l'osca, on volcanic rock, Sept. 1934, J. Maheu s.n. (UPS). **Switzerland:** Graubünden, Engadin, Ardez, 1400 m, Aug. 4, 1927, A.H. Magnusson 11178 (UPS). **Ukraine:** Užhorod, balvany u řeky, 1929, J. Nádvorník s.n. (PRM 783229).

Discussion

Our description of *Acarospora gallica* differs from Magnusson (1929) in understanding that the thallus is variable, from areolate to squamulose in a continuous range of developmental variation. This is probably influenced by microhabitat conditions. It is often a solitary pioneer found in sunny open sites on sharp-edged volcanic rocks, serpentine stones, diabase, shale, and even on toxic substrates in the abandoned sedimentation basins of Chvaletice and Bukovina in East Bohemia (Palice & Soldán 2004). These populations consist

usually of small broadly attached areoles, often with a single apothecium and the thallus reduced to a pseudothalline margin. On smooth substrates in microhabitats with more moisture and possibly nitrogen, particularly in central Europe, the areoles are larger, usually with multiple apothecia, and are often lobulate and squamulose, with a broad elongated mycelial base (gomphate) or a narrow stipe.

Specimens of *Acarospora gallica* with several apothecia per areole correspond to Magnusson's original concept of the species (see drawing in Magnusson 1936). *Acarospora gallica* var. *vinealis* H. Magn. has its type locality of Svätý Jur (St. Georgen) in Slovakia. The name was applied to three specimens with an even, more contiguous thallus, with areoles with multiple apothecia (Magnusson 1929). The type material of this variety was not available for study, but the description matches some specimens collected by the second author from Czech Republic. We observed that areoles with multiple apothecia were usually in the process of vegetative division or the apothecia eventually merged into a large irregularly shaped disc. Magnusson (1929) inconsistently referred thalli with predominately dispersed areoles with a single apothecium (sometimes with the thallus reduced to a pseudothalline margin) to *A. gallica* var. *devastata* (Eitner) H. Magn. Actually areoles with a single apothecium dominate in the specimens we examined, possibly because they are easier to distinguish from *A. fuscata*. We do not recognize Magnusson's two varieties as infraspecific categories but only as typological abstractions of a normal variation. *Acarospora hungarica* was described from a single specimen with well-developed ≤ 1 mm wide squamules (Magnusson 1929). We treat *A. hungarica* as a synonym of *A. gallica*.

Acarospora gallica is easily confused with *A. fuscata* (Ach.) Th. Fr., which it can resemble in color and which also produces gyrophoric/lecanoric acids. *Acarospora fuscata* has a black lower surface and is broadly attached, usually forming a contiguous areolate crust. It is the most common species throughout the range of *A. gallica*. Macromorphological characters are diagnostic for separating the two species. *Acarospora gallica* is easily distinguished from *A. fuscata* either by its lobulate squamules with pale underside or by predominance of small areoles with a single apothecium. Poorly developed specimens of *A. gallica* may be almost impossible to determine and may be reported as *A. fuscata* (as in Palice & Soldán 2004). Squamulose *A. gallica* specimens with lower sides darkened by substrate interactions can be distinguished from *A. fuscata* by the presence of a well-developed mycelial base or stipe, lobulate margins, and usually multiple apothecia per areole, sometimes growing in agglomerations. Careful examination of the thallus, may also reveal some pale lower surfaces.

Though *A. gallica* is widespread in Europe and Asia, collections are sparse, making its distribution, abundance, and conservation status uncertain for each

country where it occurs. It may be undercollected or collections may have been misdetermined as the ubiquitous *A. fuscata.* For instance, it was known in the Czech Republic from several early 20th century collections (Magnusson 1929; Suza 1928, 1931, 1947) but reported only once by Vězda (1998). But our study has established its presence in eleven localities in Bohemia and Moravia. Several vouchers were originally identified as *A. fuscata* or other species. It is frequent in Czech Republic and not threatened.

Magnusson (1929, 1930) reported *A. gallica* var. *devastata* from North America. We do not recognize *A. gallica* as occurring in North America and all the specimens from North America identified by Magnusson belong to *A. janae* K. Knudsen (Lumbsch et al. 2011; Knudsen et al. 2011). *Acarospora janae* especially differs from *A. gallica* in forming small areoles or verrucae that never become squamulose.

Galloway (2007) reported *A. gallica* from New Zealand, but we are skeptical of his determination based on the current known distribution of the species. His taxon may be conspecific with an undescribed taxon from South America collected by Adam Flakus that we are currently studying.

Another photograph of *Acarospora gallica* is available on Italic, the Information System of Italian Lichens (Nimis 2003).

Lichenothelia convexa Henssen is the only lichenicolous fungus we have collected on *Acarospora gallica* (Kocourková & Knudsen 2011). At PRM some specimens we observed were infected by *Lichenostigma gracile* Calat. et al.

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