

## FLAVOPARMELIA SOREDIANS (PARMELIACEAE, LICHENISED ASCOMYCETES), A SPREADING LICHEN SPECIES IN HUNGARY

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**Abstract:** *Flavoparmelia soredians*, an Atlanto-Mediterranean foliose lichen species seems to be spreading in Hungary, as well. It was discovered in nine Hungarian localities between 2011 and 2016. Contrary to its known ecological requirements, it occurred mostly in urban habitats with no oceanic climate.

**Key words:** floristics, immigrant, lichen-forming fungi, new for Hungary, newcomer

### INTRODUCTION

*Flavoparmelia soredians* (Nyl.) Hale (Parmeliaceae, Ascomycota) was described by William Nylander (as *Parmelia soredians*) from rocks in the Pyrenees Mts (Força Réal), southern France (NYLANDER 1872a, b). It was transferred into *Pseudoparmelia* and later into *Flavoparmelia* by HALE (1974, 1986). Up to 1976 it was known from Central and South Africa, Argentina, Chile, New Zealand and in Europe only from England, France, Ireland, Italy, and Portugal (HALE 1976). In the last decades more and more occurrences were reported worldwide, e.g. from Australia and Tasmania (ELIX 1994, KANTVILAS *et al.* 2002), Belgium (SÉRUSIAUX *et al.* 1999), Bulgaria (SPIER *et al.* 2008), Germany (WIRTH 1997, HEIBEL 1999, DOLNIK *et al.* 2008, STORDEUR *et al.* 2015), Ireland (SIMMS 1998), Luxembourg (SÉRUSIAUX *et al.* 2004), Montenegro (KNEŽEVIĆ and MAYRHOFFER 2009), Morocco (EGEA 1996), the Netherlands (APTROOT and VAN HERK 1999, VAN HERK and APTROOT 2004), Norway (NYGAARD and TØNSBERG 2015),

Russia (SKIRINA 1995), Spain (FONT and FIOLE 1984, LLIMONA and HLADUN 2001), Sweden (FRÖDÉN and THELL 2010, THELL and MOBERG 2011), Switzerland (APTROOT and HONEGGER 2006), Transkei (THOMAS and BHAT 1994, 1996), and Turkey (JOHN 1992, YAZICI *et al.* 2010). It is regarded as an Atlanto-Mediterranean species, since it is widely distributed in warm and humid habitats of southern and western Europe, especially in the Mediterranean sea coast of Italy (NIMIS 1993, TRETIACH *et al.* 2012) and Spain (LLIMONA and HLADUN 2001), and in SE England (JAMES and ROSE 1973, SEAWARD and COPPINS 2004).

It grows predominantly on bark (or wood) of several broad-leaved (rarely also coniferous) trees (e.g. *Acer*, *Alnus*, *Castanea*, *Corylus*, *Fagus*, *Fraxinus*, *Populus*, *Quercus*, *Salix*, *Sorbus*, *Tilia*, *Ulmus* spp.) in open, well-lit places (forests or roadsides) and more rarely also on sunny, siliceous rocks.

*Flavoparmelia soledians* (Fig. 1) differs from the close species *F. caperata* by its smaller thallus with narrower and more adpressed lobes, by the type of soralia (discrete, orbicular soralia with powdery, farinose soredia in *F. soledians* and diffuse, coarse soralia with granular soredia in *F. caperata*), and by its different chemistry (medulla K+ yellow turning red, Pd+ orange (salazinic acid and usnic acid) in *F. soledians*, and medulla K– or + dirty yellow, P+ red (caperatic acid, protocetraric acid, and usnic acid) in *F. caperata*).



Fig. 1. General habit of *Flavoparmelia soledians* (Nagy-Strázsa-hegy, Hungary, 2011) (scale bar = 1 mm).

Recently *Flavoparmelia soledians* was also discovered in Hungary at several localities in different geographical regions with different climatic situations. No specimens were known from Hungary before 2011. Our aim was to give an overview on the Hungarian occurrences of this species and possible explanations for its spreading.

## MATERIAL AND METHODS

Specimens are deposited in BP (Hungarian Natural History Museum, Budapest, Hungary) and ZC (Bakony Natural History Museum of the Hungarian Natural History Museum, Zirc, Hungary). Herbarium acronyms follow the Index Herbariorum online (THIERS 2016) with the exceptions of ZC. SMITH *et al.* (2009) and WIRTH *et al.* (2013) were used for identification. Morphological-anatomical investigations and KOH spot test were carried out by standard methods (ORANGE *et al.* 2010) using Olympus SZX-7 binocular dissecting microscope and Olympus CX-41 stereomicroscope. HPTLC analysis for chemical substances was applied in solvent system C according to ARUP *et al.* (1993). The distribution map of *Flavoparmelia soledians* (Fig. 2) was prepared by the computer program for geographical information system, Quantum GIS (QGIS 2.14 Essen, 2016) based on the Central European grid system of 5 km  $\times$  6 km units (BORHIDI 1984, NIKLFELD 1971).

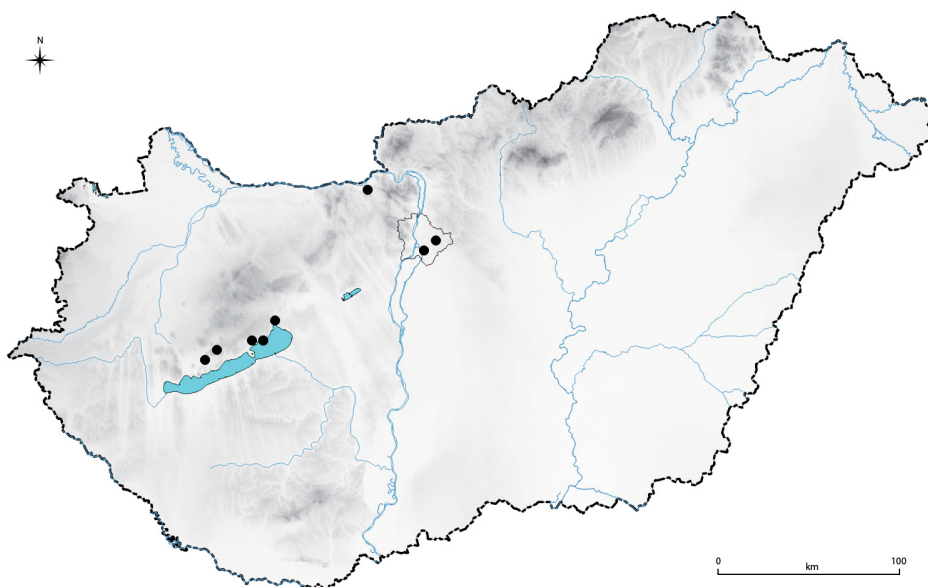


Fig. 2. Localities of *Flavoparmelia soledians* in Hungary (grid system of 5 km  $\times$  6 km units)

### The studied species

Thallus tightly adnate, small foliose, rosette-shaped, (1.5–)3–5(–10) cm diam., lobes narrow, yellow-green, 1–3(–5) mm wide, soralia orbicular or in irregular patches, soredia farinose. Apothecia not seen in Hungarian specimens. Cortex K–, medulla C–, K+ yellow slowly turning red, KC–, Pd+ yellow-orange to orange, UV– (usnic acid and salazinic acid) (according to HALE 1976, SMITH *et al.* 2009).

## RESULTS AND DISCUSSION

### Hungarian occurrences of *Flavoparmelia soredians*

Locality information data are given as it is originally on the label.

**Balaton-felvidék** – Comit. Veszprém, ad cortex *Quercus petraea*, in vallem carpinetis-quercetum „Hársas-völgy”, in monte „Megye-hegy” prope pag. Balatonalmádi. Lat.: 47° 04' 09.95" N; Long.: 18° 00' 41.01" E; Alt. ca. 179 m s. m. Coll.: Sinigla, M., 21.07.2015 [ZC 2116]. – Comit. Veszprém, ad cortex *Quercus cerris*, in siccus quercetum cerris-petraea, in loci „Felső-erdő 1.”, prope opp. Balatonfüred. Lat.: 46° 59' 46.19" N; Long.: 17° 51' 05.43" E; Alt. ca. 379 m s. m. Coll.: Sinigla, M., 15.04.2015 [ZC 1941]. – Balatonhenye, Fekete-hegy, Öreg-hegy, felnyíló cseres tető, ct. *Quercus cerris*. Lat.: 46° 54' 15.74" N; Long.: 17° 35' 47.03" E; Alt. ca. 377 m s. m. Coll.: Sinigla, M., 09.06.2016. [ZC 2335]. – Csopak, Napsugár utca, ct. *Tilia*. Lat.: 46,9725' N; Long.: 17,9347' E; Alt.: 115 m a.s.l. Coll.: Lajtha-Tabajdi, Á., 07.07.2015 [BP 95053]. – Csopak, Dózsa György utca 15, ct. *Acer*. Lat.: 46,977918' N; Long.: 17,927997' E; Alt.: 140 m a.s.l. Coll.: Lajtha-Tabajdi, Á., 14.07.2015 [BP 95054]. – Szentbékáll, Kis-hát, középkorú zárt cseres-kocsánytalan tölgyesben, ct. *Quercus cerris*. Lat.: 46° 53' 52.51" N; Long.: 17° 34' 10.70" E; Alt. ca. 215 m s. m. Coll.: Sinigla, M., 17.05.2016 [ZC 2334].

**Budapest** – Soroksári Botanikus Kert, ct. *Robinia pseudoacacia*. Lat.: 47° 23' 59.61" N; Long.: 19° 09' 15.04" E; Alt.: 115 m a.s.l. Coll.: Lőkös, L., 24.08.2013 [BP 95055]. – Új Köztemető, ct. *Quercus cerris*. Lat.: 47° 28' 17.59" N; Long.: 19° 12' 19.98" E; Alt.: 140 m a.s.l. Coll.: Paczkó, L., 2015 [BP 95056].

**Visegrádi-hegység** – Hungary, Esztergom, Nagy-Strázsa-hegy, on wooden fence around “DINPI bemutatóház”. Lat.: 47° 44' 52.28" N; Long.: 18° 44' 15.29" E; Alt.: 130 m a.s.l. Coll.: Lőkös, L., Molnár, K., 12.06.2011 [BP 95057].

*Flavoparmelia soredians* occurs on different phorophytes in Hungary, e.g. *Acer*, *Quercus cerris*, *Q. petraea*, *Robinia pseudoacacia*, *Tilia*, and decaying wood mostly in anthropogenic, eutrophicated urban habitats. Diameter of the

Hungarian specimens is rather small ranging between 12 and 27(–30) mm. The size of the thalli may refer to that they are young. The appearance at urban, semi-natural sites as young thalli may confirm the newcomer status of the species.

The presence of salazinic and usnic acids in the Hungarian *F. soledians* specimens was confirmed by spot test and HPTLC. All Hungarian specimens of *Flavoparmelia caperata* from BP were revised; critical specimens were checked by HPTLC against control specimens of *F. soledians* from Italy. None of the *F. caperata* specimens turned to be *F. soledians*.

WIRTH (1997) discussed the possibilities for establishing the status of immigrant species in Germany. In the case of 27 species discovered in the last decades of the 20th century it is questioned whether they are newcomer or just overlooked because 1) they are really very rare species, 2) easily mistaken for other species or 3) extremely inconspicuous species. There are arguments confirming real immigrant species in his opinion: 1) the species is collected at a site earlier often visited, 2) the species is not rare and 3) not less striking than other species. According to the above, *Flavoparmelia soledians* was considered to be immigrant in Germany. The species was known before in northern France and the Netherlands. It is a sub-Atlantic species, which became spreading most probably because of the change in air pollution condition (decrease of SO<sub>2</sub>), as well as the change of climate – milder temperature. Wirth mentioned that though it is similar to *F. caperata*, none of the 134 specimens in the lichen herbarium Stuttgart (STU) was identified as *F. soledians* after a careful revision – investigating the soredia and the chemical content (*F. soledians* is K+ red, containing salazinic acid). Wirth also suggested the possibility of the expansion of its area.

This idea correlates well with the fact that the species became spreading also in Great Britain (SEAWARD and COPPINS 2004) during the same period (from 1980 to 2003). The British authors thought of the effect of hypertrophication, declining background SO<sub>2</sub> concentrations, and climate change: global warming.

Furthermore, according to Norwegian lichenologists (NYGAARD and TØNSBERG 2015) *Flavoparmelia soledians* appears to be the first lichen species for which there is a strong evidence for having been introduced to Norway by human commercial activity. They supposed that the lichen species was introduced from the Netherlands transported together with young trees in 1996.

Its occurrences without any characteristic distribution pattern in Hungary are perhaps too recent to decide on its status. It needs confirmation whether it is invasive or not, however the size of thalli, the climatic changes, and air pollution conditions are similar to those that helped to establish the status of this species in other countries. It might supply with explanations on its spreading. It is most probably an immigrant species also in Hungary and its discovery further south from Germany also confirms Wirth's area-expansion hypothesis.



\* \* \*

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