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CONTRIBUTIONS TO THE LICHEN-FORMING AND LICHENICOLOUS FUNGI OF THE AGGTELEK NATIONAL PARK (NE HUNGARY)

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Abstract: Recent lichenological investigations add new and noteworthy records of lichen-forming and lichenicolous fungi to the Aggtelek National Park, especially from the Szalonna-Karst region (Mt Esztramos near Bódvarákó, Mt Szár-hegy near Martonyi). Altogether 64 records of 38 species of lichen-forming fungi and 13 species of lichenicolous fungi are presented and annotated. *Agonimia globulifera*, *Lecanora compallens* and *Thalloidima physaroides* have been reported from the Aggtelek National Park for the first time, and all the lichenicolous fungi (*Athelia arachnoidea*, *Bryostigma parietinarium*, *Bryostigma phaeophysciae*, *Didymocyrtis slaptonensis*, *Illosporiopsis christiansenii*, *Lichenochora obscuroides*, *Lichenoconium erodens*, *Lichenodiplis lecanorae*, *Pronectria robergei*, *Pyrenochaeta xanthoriae*, *Roselliniella cladoniae*, *Xanthoriicola physciae*, *Zyzygomyces physciacearum*) are also new to the Aggtelek National Park.

Key words: Aggtelek National Park, biodiversity, floristics, Hungary, lichen-forming fungi, lichenicolous fungi

INTRODUCTION

Based on more than 1,500 herbarium specimens (from nine herbaria) and 30 literature sources, a total of 308 lichen-forming fungi was recognised from the area of the Aggtelek National Park (LŐKÖS 2009). Due to the huge number of taxonomic and nomenclatural changes of the last decade, most of these species names have been already changed (e.g. *Cetrelia cetrarioides* were revised as *Cetrelia monachorum* by FARKAS *et al.* (2021)). New occurrences of *Absconditella lignicola* and *Gyalecta fagicola* at Mt Szádvár have been published recently (FARKAS *et al.* 2022, 2023).

The Szalonna Karst surrounded by Bódvarákó, Martonyi, Perkupa, Szalonna, and Tornaszentandrás is a relatively small area. It is about 25 km^2, *ca* 1/8 of the territory of the Aggtelek National Park. Its highest place is Mt Hármas-hegy with

three peaks, i.e. Mt Nagy-hegy (501 m), Mt Szár-hegy (514 m) and Mt Csengő-tető (521 m). Most of the area is covered by deciduous forests (mainly beech, hornbeam, and oak). The bedrock, similarly to the main area of the Aggtelek National Park, is Middle Triassic limestone. Since it is covered by soil, you can find rocks in a considerable amount just in a few places. Mt Esztramos (320 m) is the biggest rocky range in the area, which had a quarry for a long period. The limestone mining was totally abandoned in 1996.

Fig. 1. The abandoned quarry at the top of Mt Esztramos.

Fig. 2. The yard of the abandoned quarry with large patches of cryptogamic organisms.

The lichen flora of the Szalonna Karst area – represented by only *ca* 100 specimens (80 species) – is rather unknown, comparing with other parts of the Aggtelek National Park. Former collections by F. Fóriss and L. Lőkös concentrate only on a few localities near Martonyi (Éger-völgy, Martonyi kolostorrom, Mész-völgy, Szár-hegy). The lichen flora of Mt Esztramos was studied in detail by A. Kiszelyné Vámosi, publishing 49 saxicolous and terricolous lichen species (Bakalárné Sütő *et al.* 1987). Unfortunately, the voucher specimens are not available. Some dubious records from that publication (e.g. *Eiglera flavida*, *Farnoldia jurana*, *Psora vallesiaca*, *Rhizocarpon umbilicatum*, *Xanthoparmelia somloensis*) were also planned to be checked.

Recent fieldworks were carried out in Mt Esztramos (Bódvarákó-Tornakápolna) and in Mt Szár-hegy (Martonyi-Szalonna) in 2023. The main aim of the latter fieldtrip in 2023 was to check some old occurrences of the protected lichen species *Cladonia magyarica* and to find lichenicolous fungi, that have not been treated before at all (Lőkös 2009, Révay and Gönczöl 2009, Vasas and Locsmándi 2009).

As a result of these recent field excursions, further records of lichen-forming and lichenicolous fungi are added to the flora of the Aggtelek National Park.

MATERIAL AND METHODS

Nomenclature and taxonomy of lichen-forming and lichenicolous fungi follow Index Fungorum (Index Fungorum Partnership 2021) and MycoBank (Robert *et al.* 2018). Coordinates of localities were recorded by a GPS device (Garmin Etrex Vista C) in WGS 84. Distribution maps were prepared by QGIS 3.28 (QGIS Development Team 2023) based on the Central European grid system of 5 km × 6 km units (Borhidi 1984, Niklfeld 1971).

A standard HPTLC thin layer chromatographic analysis (Arup *et al.* 1993, Molnár and Farkas 2011) was carried out to check the chemical substances of *Cladonia* and *Lepraria* specimens. Morphological-anatomical investigations and spot tests (Orange *et al.* 2010) were carried out by standard methods using an Olympus SZX-7 research stereomicroscope and an Olympus CX-41 microscope. Microphotographs were taken by a Canon EOS 1300D camera equipped by a Quickphoto 3.2 software.

All voucher specimens (64) are deposited in the lichen collection of the Hungarian Natural History Museum (BP).

RESULTS AND DISCUSSION

List of species
Lichen-forming fungi

Absconditella lignicola Vězda et Pišút – Hungary, Borsod-Abaúj-Zemplén County, Tornaszentandrás, Aggtelek National Park, Szalonna Karst, top of Mt Esztramos, abandoned quarry, on decaying wood (*Pinus sylvestris*). Lat.: 48.51723° N, Long.: 20.75647° E, Alt.: 265 m a.s.l. Coll.: Lőkös, L., Varga, N., 23.09.2023 [BP 97142]. – Hungary, Borsod-Abaúj-Zemplén County, Tornaszentandrás, Aggtelek National Park, Szalonna Karst, N side of Mt Esztramos, on decaying wood (*Pinus sylvestris*). Lat.: 48.519937° N, Long.: 20.749389° E, Alt.: 230 m a.s.l. Coll.: Lőkös, L., Varga, N., 23.09.2023 [BP 97143]. – Hungary, Borsod-Abaúj-Zemplén County, Aggtelek National Park, Szalonna Karst, Martonyi, SE side of Mt Hármas-hegy, on decaying wood (*Pinus sylvestris*). Lat.: 48.47912° N, Long.: 20.74491° E, Alt.: 360 m a.s.l. Coll.: Lőkös, L., Varga, N., 24.09.2023 [BP 97144]. – It has been recognised recently (Farkas and Lőkös 2021, Farkas *et al.* 2022), however, it is supposed to be common and widespread in the Aggtelek National Park on decaying wood (*Picea* and *Pinus*).

Acrocordia gemmata (Ach.) A. Massal. – Hungary, Borsod-Abaúj-Zemplén County, Tornaszentandrás, Aggtelek National Park, Szalonna Karst, N slope of Mt Esztramos, on bark (*Tilia* sp.) together with *Bacidia rubella*. Lat.: 48.519816° N, Long.: 20.750941° E, Alt.: 265 m a.s.l. Coll.: Lőkös, L., Varga, N., 23.09.2023 [BP 97114]. – It is known from the Aggtelek National Park on various trees with nutrient-rich bark. It was collected only once in the Szalonna Karst near Martonyi Kolostorrom from *Juglans* bark (Fóriss, F., 1928) (Lőkös 2009).

Agonimia globulifera M. Brand et Diederich – Hungary, Borsod-Abaúj-Zemplén County, Bódvarákó, Aggtelek National Park, Szalonna Karst, top of Mt Esztramos, abandoned quarry, on the thallus of *Peltigera rufescens* growing on calcareous soil. Lat.: 48.517751° N, Long.: 20.750280° E, Alt.: 308 m a.s.l. Coll.: Lőkös, L., Varga, N., 23.09.2023 [BP 97111]. – Almost the same locality, on calcareous soil. Lat.: 48.518148° N, Long.: 20.751789° E, Alt.: 306 m a.s.l. Coll.: Lőkös, L., Varga, N., 23.09.2023 [BP 97119]. – New to the Aggtelek National Park!

Alyxoria varia (Pers.) Ertz et Tehler – Hungary, Borsod-Abaúj-Zemplén County, Tornaszentandrás, Aggtelek National Park, Szalonna Karst, N slope of Mt Esztramos, on bark (*Tilia* sp.). Lat.: 48.519816° N, Long.: 20.750941° E, Alt.: 265 m a.s.l. Coll.: Lőkös, L., Varga, N., 23.09.2023 [BP 97115]. – It is rather common in the Aggtelek National Park, but three old records are known from the Szalonna Karst near Martonyi only (Lőkös 2009).

Bacidia rubella (Hoffm.) A. Massal. – Hungary, Borsod-Abaúj-Zemplén County, Tornaszentandrás, Aggtelek National Park, Szalonna Karst, N slope of Mt Esztramos, on bark (*Tilia* sp.). Lat.: 48.519816° N, Long.: 20.750941° E, Alt.: 265 m a.s.l. Coll.: Lőkös, L., Varga, N., 23.09.2023 [BP 97113]. – A common epiphytic lichen species in the Aggtelek National Park with three old records from the Szalonna Karst (Lőkös 2009). One of the latter was collected also at Mt Esztramos from *Fagus sylvatica* bark.

Calicium glaucellum Ach. – Hungary, Borsod-Abaúj-Zemplén County, Aggtelek National Park, Szalonna Karst, Szalonna, S side of Mt Hármas-hegy, on decorticated stump. Lat.: 48.478640° N, Long.: 20.742508° E, Alt.: 395 m a.s.l. Coll.: Lőkös, L., Varga, N., 24.09.2023 [BP 97109]. – It is known from several localities of the Aggtelek National Park (Lőkös 2009). New to the Szalonna Karst!

Catillaria nigroclavata (Nyl.) J. Steiner – Hungary, Borsod-Abaúj-Zemplén County, Tornaszentandrás, Aggtelek National Park, Szalonna Karst, top of Mt Esztramos, abandoned quarry, on bark (*Populus nigra*). Lat.: 48.518724° N, Long.: 20.751957° E, Alt.: 305 m a.s.l. Coll.: Lőkös, L., Varga, N., 23.09.2023 [BP 97129]. – This epiphytic lichen species is widespread in the country. It occurs predominantly on bark, but often overgrows other lichen thalli mostly on their decaying parts. Only two old occurrences were reported from the Aggtelek National Park (Lőkös 2009). New to the Szalonna Karst!

Chaenotheca xyloxena Nádv. – Hungary, Borsod-Abaúj-Zemplén County, Aggtelek National Park, Szalonna Karst, Szalonna, S side of Mt Hármas-hegy, on decorticated stump together with *Calicium glaucellum*. Lat.: 48.478640° N, Long.: 20.742508° E, Alt.: 395 m a.s.l. Coll.: Lőkös, L., Varga, N., 24.09.2023 [BP 97110]. – The first specimen was found at Lókosár near Aggtelek in 1991 (Lőkös 2009). The recent occurrence is the second record for the Aggtelek National Park, and first record to the Szalonna Karst.

Cladonia magyarica Vain. – Hungary, Borsod-Abaúj-Zemplén County, Bódvarákó, Aggtelek National Park, Szalonna Karst, top of Mt Esztramos, abandoned quarry, on calcareous soil. Coll.: Drozd, A., 13.06.2015 [BP 97130]. – Hungary, Borsod-Abaúj-Zemplén County, Bódvarákó, Aggtelek National Park, Szalonna Karst, top of Mt Esztramos, abandoned quarry, on calcareous soil. Lat.: 48.51580° N, Long.: 20.74976° E, Alt.: 295 m a.s.l. Coll.: Lőkös, L., Varga, N., 23.09.2023 [BP 97134]. – Hungary, Borsod-Abaúj-Zemplén County, Tornaszentandrás, Aggtelek National Park, Szalonna Karst, top of Mt Esztramos, abandoned quarry, on calcareous soil. Lat.: 48.51826° N, Long.: 20.75140° E, Alt.: 305 m a.s.l. Coll.: Lőkös, L., Varga, N., 23.09.2023 [BP 97131]. – Almost the same locality. Lat.: 48.51967° N, Long.: 20.75559° E, Alt.: 280 m a.s.l. Coll.: Lőkös, L., Varga, N., 23.09.2023 [BP 97132]. – Almost the same locality. Lat.: 48.51810° N, Long.: 20.75573° E, Alt.: 265 m a.s.l. Coll.: Lőkös, L., Varga, N., 23.09.2023 [BP

97133]. – Hungary, Borsod-Abaúj-Zemplén County, Aggtelek National Park, Szalonna Karst, Martonyi, Mt Hármas-hegy (Mt Szár-hegy), on calcareous soil. Lat.: 48.48009° N, Long.: 20.73888° E, Alt.: 500 m a.s.l. Coll.: Lőkös, L., Varga, N., 24.09.2023 [BP 97135]. – It is a protected lichen species in Hungary. Up to now, only old records (before 1985) have been known from the Aggtelek National Park (Lőkös 2009). It seems to be a pioneer species covering the bare calcareous soil in open habitats of the abandoned quarry in a considerable abundance together with a sparse higher plant vegetation (mostly weeds) (Fig. 3).

Fig. 3. Large patches of *Cladonia magyarica* thalli and other pioneer cryptogams and phanerogams.

Cladonia rei Schaer. – Hungary, Borsod-Abaúj-Zemplén County, Bódvarákó, Aggtelek National Park, Szalonna Karst, top of Mt Esztramos, abandoned quarry, on calcareous soil. Lat.: 48.51625° N, Long.: 20.75201° E, Alt.: 305 m a.s.l. Coll.: Lőkös, L., Varga, N., 23.09.2023 [BP 97136]. – It is the second record from the Aggtelek National Park (Lőkös 2009). Formerly collected *Cladonia subulata* specimens require taxonomic revision.

Coenogonium pineti (Ach.) Lücking et Lumbsch – Hungary, Borsod-Abaúj-Zemplén County, Tornaszentandrás, Aggtelek National Park, Szalonna Karst, top

of Mt Esztramos, abandoned quarry, on bark (*Pinus sylvestris*). Lat.: 48.51723° N, Long.: 20.75647° E, Alt.: 265 m a.s.l. Coll.: Lőkös, L., Varga, N., 23.09.2023 [BP 97145]. – It is the fourth record from the Aggtelek National Park (Lőkös 2009), new to the Szalonna Karst area!

Diploschistes muscorum (Scop.) R. Sant. – Hungary, Borsod-Abaúj-Zemplén County, Bódvarákó, Aggtelek National Park, Szalonna Karst, top of Mt Esztramos, abandoned quarry, on calcareous soil, overgrown on *Peltigera* sp. and *Cladonia* sp. Lat.: 48.517751° N, Long.: 20.750280° E, Alt.: 308 m a.s.l. Coll.: Lőkös, L., Varga, N., 23.09.2023 [BP 97116, BP 97117]. – Our recent record is a confirmation of the old literature data of A. Kiszelyné Vámosi (Bakalárné Sütő *et al.* 1987).

Evernia prunastri (L.) Ach. – Hungary, Borsod-Abaúj-Zemplén County, Bódvarákó, Aggtelek National Park, Szalonna Karst, top of Mt Esztramos, abandoned quarry, on bark (*Salix caprea*). Lat.: 48.51616° N, Long.: 20.74835° E, Alt.: 290 m a.s.l. Coll.: Lőkös, L., Varga, N., 23.09.2023 [BP 97146]. – It is widespread in the Aggtelek National Park) (Lőkös 2009), the second record from the Szalonna Karst area!

Hypogymnia farinacea Zopf – Hungary, Borsod-Abaúj-Zemplén County, Bódvarákó, Aggtelek National Park, Szalonna Karst, top of Mt Esztramos, abandoned quarry, on bark (*Salix caprea*). Lat.: 48.51616° N, Long.: 20.74835° E, Alt.: 290 m a.s.l. Coll.: Lőkös, L., Varga, N., 23.09.2023 [BP 97147]. – The third record from the Aggtelek National Park (Lőkös 2009), new to the Szalonna Karst area!

Hypogymnia tubulosa (Schaer.) Hav. – Hungary, Borsod-Abaúj-Zemplén County, Tornaszentandrás, Aggtelek National Park, Szalonna Karst, top of Mt Esztramos, abandoned quarry, on bark (*Salix caprea*). Lat.: 48.51886° N, Long.: 20.75198° E, Alt.: 300 m a.s.l. Coll.: Lőkös, L., Varga, N., 23.09.2023 [BP 97148]. – It is not rare in the Aggtelek National Park (Lőkös 2009), new to the Szalonna Karst area!

Lecanora compallens Herk et Aptroot – Hungary, Borsod-Abaúj-Zemplén County, Aggtelek National Park, Szalonna Karst, Szalonna, S side of Mt Hármashegy, on bark (*Quercus petraea*) together with *Lepraria incana*. Lat.: 48.47820° N, Long.: 20.73961° E, Alt.: 430 m a.s.l. Coll.: Lőkös, L., Varga, N., 24.09.2023 [BP 97149]. – It is new to the Szalonna Karst area and new to the Aggtelek National Park!

Lepraria incana (L.) Ach. – Hungary, Borsod-Abaúj-Zemplén County, Aggtelek National Park, Szalonna Karst, Szalonna, S side of Mt Hármas-hegy, on bark (*Quercus petraea*) together with *Lecanora compallens*. Lat.: 48.47820° N, Long.: 20.73961° E, Alt.: 430 m a.s.l. Coll.: Lőkös, L., Varga, N., 24.09.2023 [BP 97150]. – It is the fifth record from the Aggtelek National Park (Lőkös 2009).

Melanelixia glabratula (Nyl.) Sandler et Arup – Hungary, Borsod-Abaúj-Zemplén County, Aggtelek National Park, Szalonna Karst, Szalonna, S side of Mt Hármas-hegy, on bark (*Quercus petraea*). Lat.: 48.478640° N, Long.: 20.742508° E, Alt.: 395 m a.s.l. Coll.: Lőkös, L., Varga, N., 24.09.2023 [BP 97141]. – A common epiphytic lichen species, it is the second record from the Szalonna Karst.

Micarea denigrata (Fr.) Hedl. – Hungary, Borsod-Abaúj-Zemplén County, Tornaszentandrás, Aggtelek National Park, Szalonna Karst, top of Mt Esztramos, abandoned quarry, on decaying wood (*Pinus sylvestris*). Lat.: 48.51723° N, Long.: 20.75647° E, Alt.: 265 m a.s.l. Coll.: Lőkös, L., Varga, N., 23.09.2023 [BP 97166]. – It was reported from several places in the Aggtelek National Park from bark and from decaying wood (Lőkös 2009). However, it is new to the Szalonna Karst.

Parmelia sulcata Taylor – Hungary, Borsod-Abaúj-Zemplén County, Aggtelek National Park, Szalonna Karst, Martonyi, Mt Hármas-hegy (Mt Szárhegy), on bark (*Quercus* sp.). Lat.: 48.48009° N, Long.: 20.73888° E, Alt.: 500 m a.s.l. Coll.: Lőkös, L., Varga, N., 24.09.2023 [BP 97151]. – It occurs everywhere in the Aggtelek National Park (Lőkös 2009), the third record from the Szalonna Karst area!

Peltigera didactyla (With.) J. R. Laundon – Hungary, Borsod-Abaúj-Zemplén County, Bódvarákó, Aggtelek National Park, Szalonna Karst, top of Mt Esztramos, abandoned quarry, on calcareous soil. Lat.: 48.517751° N, Long.: 20.750280° E, Alt.: 308 m a.s.l. Coll.: Lőkös, L., Varga, N., 23.09.2023 [BP 97121]. – It is a recent confirmation of its old occurrence in the Szalonna Karst. It was recorded only from the Szalonna Karst within the Aggtelek National Park (Lőkös 2009).

Peltigera praetextata (Sommerf.) Zopf – Hungary, Borsod-Abaúj-Zemplén County, Tornaszentandrás, Aggtelek National Park, Szalonna Karst, N slope of Mt Esztramos, on calcareous rock near the opening of a cave. Lat.: 48.519816° N, Long.: 20.750941° E, Alt.: 265 m a.s.l. Coll.: Lőkös, L., Varga, N., 23.09.2023 [BP 97122]. – Although it is frequent everywhere in shaded, mossy habitats in the Aggtelek National Park, it was collected only once in the Szalonna Karst near Martonyi (Fóriss, F., 1928). It is the second record from the Szalonna Karst.

Peltigera rufescens (Weiss) Humb. – Hungary, Borsod-Abaúj-Zemplén County, Bódvarákó, Aggtelek National Park, Szalonna Karst, top of Mt Esztramos, abandoned quarry, on calcareous soil. Lat.: 48.517751° N, Long.: 20.750280° E, Alt.: 308 m a.s.l. Coll.: Lőkös, L., Varga, N., 23.09.2023 [BP 97123]. – A terricolous lichen species, common in open, sunny, xerothermic habitats. It is widespread in the Aggtelek National Park (Lőkös 2009), and the second record from the Szalonna Karst.

Fig. 4. Thalli of *Peltigera rufescens* cover large patches on the investigated area.

Phaeophyscia orbicularis (Neck.) Moberg – Hungary, Borsod-Abaúj-Zemplén County, Tornaszentandrás, Aggtelek National Park, Szalonna Karst, top of Mt Esztramos, abandoned quarry, on bark (*Populus nigra*). Lat.: 48.518724° N, Long.: 20.751957° E, Alt.: 305 m a.s.l. Coll.: Lőkös, L., Varga, N., 23.09.2023 [BP 97168]. – A nitrofrequent lichen species, widespread also in the Aggtelek National Park (Lőkös 2009). New to the Szalonna Karst!

Phlyctis argena (Ach.) Flot. – Hungary, Borsod-Abaúj-Zemplén County, Aggtelek National Park, Szalonna Karst, Martonyi, Mt Hármas-hegy (Mt Szárhegy), on bark (*Quercus* sp.). Lat.: 48.48070° N, Long.: 20.73709° E, Alt.: 515 m a.s.l. Coll.: Lőkös, L., Varga, N., 24.09.2023 [BP 97152]. – It is known from several localities of the Aggtelek National Park (Lőkös 2009), new to the Szalonna Karst area!

Physcia stellaris (L.) Nyl. – Hungary, Borsod-Abaúj-Zemplén County, Tornaszentandrás, Aggtelek National Park, Szalonna Karst, top of Mt Esztramos, abandoned quarry, on bark (*Salix caprea*). Lat.: 48.51886° N, Long.: 20.75198° E, Alt.: 300 m a.s.l. Coll.: Lőkös, L., Varga, N., 23.09.2023 [BP 97153]. – It is not rare in the Aggtelek National Park (Lőkös 2009), new to the Szalonna Karst area!

Physcia tenella (Scop.) DC. – Hungary, Borsod-Abaúj-Zemplén County, Tornaszentandrás, Aggtelek National Park, Szalonna Karst, top of Mt Esztramos, abandoned quarry, on bark (*Salix caprea*). Lat.: 48.51886° N, Long.: 20.75198° E, Alt.: 300 m a.s.l. Coll.: Lőkös, L., Varga, N., 23.09.2023 [BP 97154]. – The fourth record from the Aggtelek National Park (Lőkös 2009), new to the Szalonna Karst area!

Physciella nigricans (Flörke) S. Y. Kondr., Lőkös et Hur – Hungary, Borsod-Abaúj-Zemplén County, Tornaszentandrás, Aggtelek National Park, Szalonna Karst, top of Mt Esztramos, abandoned quarry, on bark (*Populus nigra*). Lat.:

48.518724° N, Long.: 20.751957° E, Alt.: 305 m a.s.l. Coll.: Lőkös, L., Varga, N., 23.09.2023 [BP 97169]. – Although it is a common lichen species in Hungary, only some recent occurrences were known from the Aggtelek National Park (Lőkös 2009). It is new to the Szalonna Karst!

Placidium squamulosum (Ach.) Breuss – Hungary, Borsod-Abaúj-Zemplén County, Tornaszentandrás, Aggtelek National Park, Szalonna Karst, top of Mt Esztramos, abandoned quarry, on calcareous soil. Lat.: 48.51886° N, Long.: 20.75198° E, Alt.: 300 m a.s.l. Coll.: Lőkös, L., Varga, N., 23.09.2023 [BP 97124]. – Only one occurrence was known in the Aggtelek National Park from Komjáti (Lőkös 2009). It is new to the Szalonna Karst area!

Placynthiella icmalea (Ach.) Coppins et P. James – Hungary, Borsod-Abaúj-Zemplén County, Tornaszentandrás, Aggtelek National Park, Szalonna Karst, top of Mt Esztramos, abandoned quarry, on decaying wood (*Pinus sylvestris*). Lat.: 48.51723° N, Long.: 20.75647° E, Alt.: 265 m a.s.l. Coll.: Lőkös, L., Varga, N., 23.09.2023 [BP 97155]. – Although it is frequent everywhere on decaying wood and on bark in the Aggtelek National Park (Lőkös 2009), it is the second record from the Szalonna Karst area!

Scytinium lichenoides (L.) Otálora, P. M. Jørg. et Wedin – Hungary, Borsod-Abaúj-Zemplén County, Tornaszentandrás, Aggtelek National Park, Szalonna Karst, top of Mt Esztramos, abandoned quarry, on calcareous soil. Lat.: 48.518724° N, Long.: 20.751957° E, Alt.: 305 m a.s.l. Coll.: Lőkös, L., Varga, N., 23.09.2023 [BP 97127]. – It occurs almost everywhere in the Aggtelek National Park, however, only two old records have been known from the Szalonna Karst area near Martonyi up to now (Lőkös 2009).

Scytinium pulvinatum (Hoffm.) Otálora, P. M. Jørg. et Wedin – Hungary, Borsod-Abaúj-Zemplén County, Tornaszentandrás, Aggtelek National Park, Szalonna Karst, top of Mt Esztramos, abandoned quarry, on calcareous soil. Lat.: 48.51886° N, Long.: 20.75198° E, Alt.: 300 m a.s.l. Coll.: Lőkös, L., Varga, N., 23.09.2023 [BP 97125]. – It was reported only once in the Aggtelek National Park (as *Leptogium gelatinosum*) from the Nagy-oldal at Jósvafő (Lőkös 2009), new to the Szalonna Karst area!

Thalloidima physaroides (Opiz) Opiz et Wedin – Hungary, Borsod-Abaúj-Zemplén County, Tornaszentandrás, Aggtelek National Park, Szalonna Karst, top of Mt Esztramos, abandoned quarry, on calcareous soil. Lat.: 48.518724° N, Long.: 20.751957° E, Alt.: 305 m a.s.l. Coll.: Lőkös, L., Varga, N., 23.09.2023 [BP 97128]. – New to the Aggtelek National Park! Old specimens published under the name *Toninia sedifolia* (Lőkös 2009) need further revisions.

Toniniopsis bagliettoana (A. Massal. et De Not.) Kistenich et Timdal – Hungary, Borsod-Abaúj-Zemplén County, Tornaszentandrás, Aggtelek National Park, Szalonna Karst, top of Mt Esztramos, abandoned quarry, on

the thallus of *Peltigera rufescens* and on bryophytes growing on calcareous soil. Lat.: 48.51886° N, Long.: 20.75198° E, Alt.: 300 m a.s.l. Coll.: Lőkös, L., Varga, N., 23.09.2023 [BP 97126]. – Almost the same locality. Lat.: 48.518148° N, Long.: 20.751789° E, Alt.: 306 m a.s.l. Coll.: Lőkös, L., Varga, N., 23.09.2023 [BP 97118]. – It occurs at several places in the Aggtelek National Park (Lőkös 2009), new to the Szalonna Karst area!

Trapeliopsis flexuosa (Fr.) Coppins et P. James – Hungary, Borsod-Abaúj-Zemplén County, Bódvarákó, Aggtelek National Park, Szalonna Karst, top of Mt Esztramos, abandoned quarry, on decaying wood (*Pinus sylvestris*). Lat.: 48.51920° N, Long.: 20.75345° E, Alt.: 300 m a.s.l. Coll.: Lőkös, L., Varga, N., 23.09.2023 [BP 97156]. – Probably it is more common on decaying wood, but it is the third record from the Aggtelek National Park (Lőkös 2009), new to the Szalonna Karst area!

Usnea sp. – Hungary, Borsod-Abaúj-Zemplén County, Bódvarákó, Aggtelek National Park, Szalonna Karst, top of Mt Esztramos, abandoned quarry, on bark (*Salix caprea*). Lat.: 48.51616° N, Long.: 20.74835° E, Alt.: 290 m a.s.l. Coll.: Lőkös, L., Varga, N., 23.09.2023 [BP 97157]. – Too young specimen for correct identification.

Verrucaria muralis Ach. – Hungary, Borsod-Abaúj-Zemplén County, Tornaszentandrás, Aggtelek National Park, Szalonna Karst, top of Mt Esztramos, abandoned quarry, on calcareous soil. Lat.: 48.518724° N, Long.: 20.751957° E, Alt.: 305 m a.s.l. Coll.: Lőkös, L., Varga, N., 23.09.2023 [BP 97112]. – Several records are known from the Aggtelek National Park (Lőkös 2009), but it is new to the Szalonna Karst!

Xanthoria parietina (L.) Th. Fr. – Hungary, Borsod-Abaúj-Zemplén County, Bódvarákó, Aggtelek National Park, Szalonna Karst, top of Mt Esztramos, abandoned quarry, on bark (*Populus tremula*). Lat.: 48.51920° N, Long.: 20.75345° E, Alt.: 300 m a.s.l. Coll.: Lőkös, L., Varga, N., 23.09.2023 [BP 97137]. – A common nitrofrequent lichen species, widespread also in the Aggtelek National Park (Lőkös 2009), however, it is the first record from the Szalonna Karst area!

Lichenicolous fungi

Athelia arachnoidea (Berk.) Jülich – Hungary, Borsod-Abaúj-Zemplén County, Aggtelek National Park, Szalonna Karst, Martonyi, Mt Hármas-hegy (Mt Szár-hegy), growing on thalli of *Phaeophyscia orbicularis*, *Physcia adscendens* and *Xanthoria parietina* on twigs of *Acer campestre*. Lat.: 48.479563° N, Long.: 20.732743° E, Alt.: 508 m a.s.l. Coll.: Lőkös, L., Varga, N., 24.09.2023 [BP 97140]. – This is a common basidiomycetous fungus widespread in Hungary (Varga *et al.* 2021). New to the Aggtelek National Park! Our specimen is sterile, but creamy-brownish sclerotia are visible.

Bryostigma parietinarium (Hafellner et Fleischhacker) S. Y. Kondr. et Hur – Hungary, Borsod-Abaúj-Zemplén County, Tornaszentandrás, Aggtelek National Park, Szalonna Karst, top of Mt Esztramos, abandoned quarry, on bark (*Populus nigra*), on apothecia and thalli of *Xanthoria parietina*. Lat.: 48.518724° N, Long.: 20.751957° E, Alt.: 305 m a.s.l. Coll.: Lőkös, L., Varga, N., 23.09.2023 [BP 97158]. – This species is not rare in Hungary (Varga *et al.* 2021), however, this is the first record from the Aggtelek National Park!

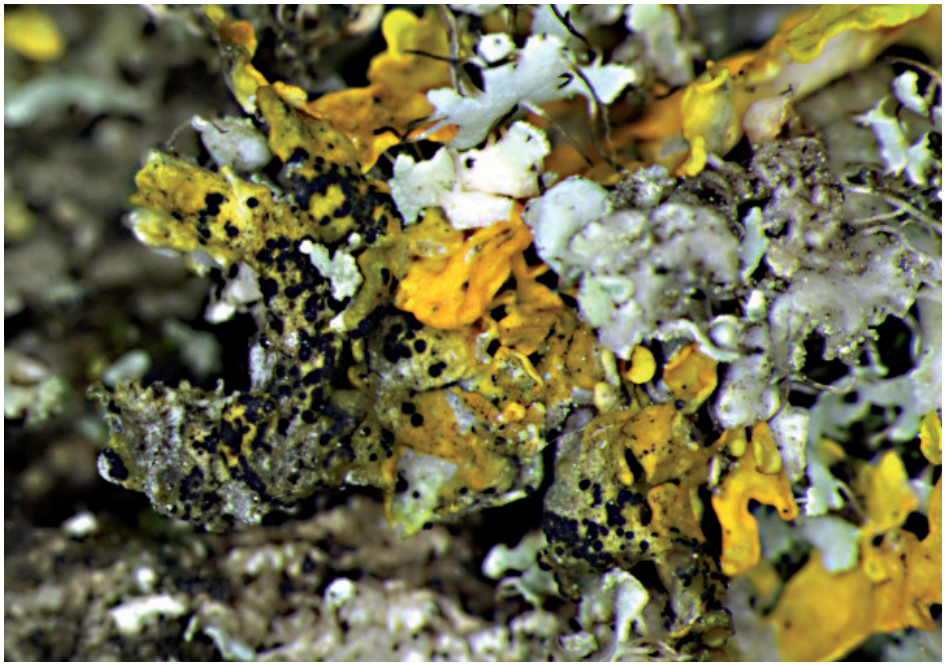

Fig. 5. Blackish arthonioid groups of apothecia of *Bryostigma parietinarium* on the thalli of *Xanthoria parietina*.

Bryostigma phaeophysciae (Grube et Matzer) S. Y. Kondr. et Hur – Hungary, Borsod-Abaúj-Zemplén County, Tornaszentandrás, Aggtelek National Park, Szalonna Karst, top of Mt Esztramos, abandoned quarry, on bark (*Populus nigra*). On *Phaeophyscia orbicularis* thalli together with *Lichenochora obscuroides*. Lat.: 48.518724° N, Long.: 20.751957° E, Alt.: 305 m a.s.l. Coll.: Lőkös, L., Varga, N., 23.09.2023 [BP 97159]. – This species is not rare in Hungary (Varga *et al.* 2021), however, this is the first record from the Aggtelek National Park! Well-developed arthonioid apothecia are abundant in our specimen.

Didymocyrtis slaptonensis (D. Hawksw.) Hafellner et Ertz – Hungary, Borsod-Abaúj-Zemplén County, Tornaszentandrás, Aggtelek National Park, Sza-

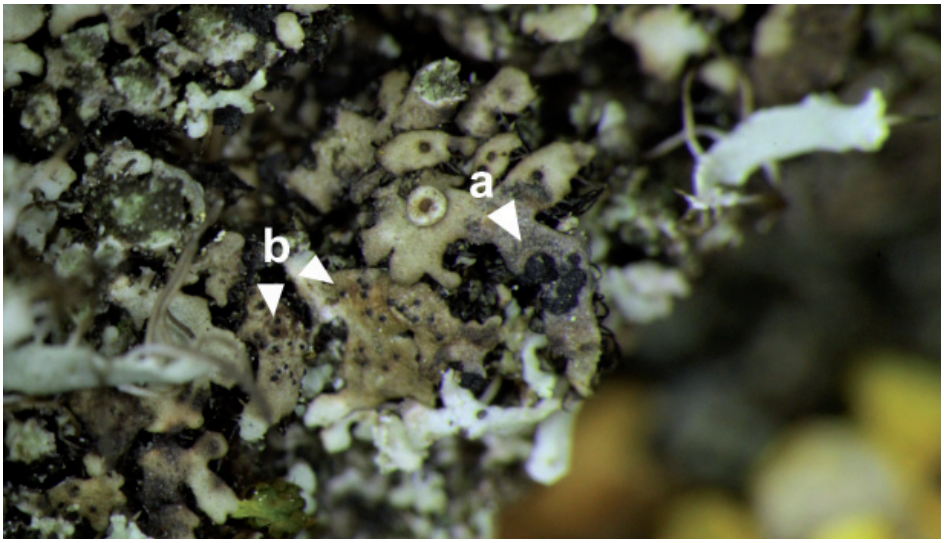

Fig. 6. Blackish arthonioid apothecia of *Bryostigma phaeophysciae* (a) and gall-forming perithecia in groups of *Lichenochora obscuroides* (b) on the thalli of *Phaeophyscia orbicularis*

lonna Karst, top of Mt Esztramos, abandoned quarry, on bark (*Populus nigra*). On apothecia and thalli of *Xanthoria parietina* together with *Pyrenochaeta xanthoriae*, *Xanthoriicola physciae.* Lat.: 48.51886° N, Long.: 20.75198° E, Alt.: 300 m a.s.l.

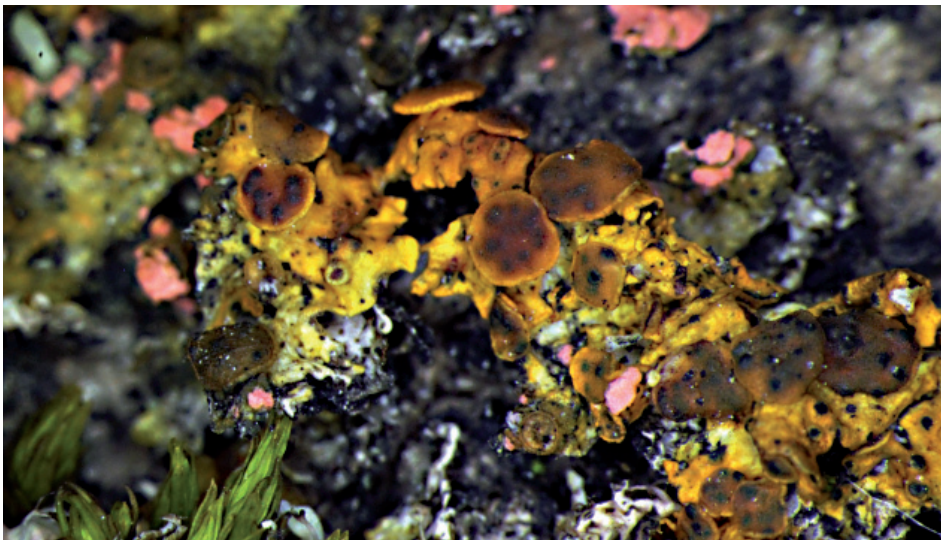

Fig. 7. Perithecia of *Didymocyrtis slaptonensis* on the thalli and on apothecia of *Xanthoria parietina* together with the pinkish sporodochia of *Illosporiopsis christiansenii.*

Coll.: Lőkös, L., Varga, N., 23.09.2023 [BP 97160]. – Although not as widespread as other xanthoriicolous fungi such as *Xanthoriicola physciae*, several occurrences are known from the country (Varga *et al.* 2021). This is the first record from the Aggtelek National Park!

Illosporiopsis christiansenii (B. L. Brady et D. Hawksw.) D. Hawksw. – Hungary, Borsod-Abaúj-Zemplén County, Tornaszentandrás, Aggtelek National Park, Szalonna Karst, top of Mt Esztramos, abandoned quarry, on bark (*Populus nigra*). On thalli of *Physcia adscendens*, *Xanthoria parietina* and mosses together with *Didymocyrtis slaptonensis*, *Pyrenochaeta xanthoriae*, *Xanthoriicola physciae*, *Zyzygomyces physciacearum*. Lat.: 48.51886° N, Long.: 20.75198° E, Alt.: 300 m a.s.l. Coll.: Lőkös, L., Varga, N., 23.09.2023 [BP 97161]. – It may be more common in Hungary, but poorly developed specimens might be overlooked (Varga *et al.* 2021). This is the first record from the Aggtelek National Park! The tiny pink sporodochia of this fungus are conspicuous, easy to recognise in the field. It overgrows various lichen thalli (e.g. *Physcia adscendens*, *Xanthoria parietina*), mosses, and occurs together with other lichenicolous fungi (*Didymocyrtis slaptonensis*, *Pyrenochaeta xanthoriae*, *Xanthoriicola physciae*, *Zyzygomyces physciacearum*).

Fig. 8. Black conidial mass of *Xanthoriicola physciae* together with the pink sporodochia of *Illosporiopsis christiansenii* on apothecia and a very damaged thalli *of Xanthoria parietina*.

Lichenochora obscuroides (Linds.) Triebel et Rambold – Hungary, Borsod-Abaúj-Zemplén County, Tornaszentandrás, Aggtelek National Park, Szalonna Karst, top of Mt Esztramos, abandoned quarry, on bark (*Populus nigra*), on thalli of *Phaeophyscia orbicularis*. Lat.: 48.518724° N, Long.: 20.751957° E, Alt.: 305 m a.s.l. Coll.: Lőkös, L., Varga, N., 23.09.2023 [BP 97162]. – Although its host is widespread in Hungary, we have just a few records of this fungus (Varga *et al.* 2021). This is the first record from the Aggtelek National Park!

Lichenoconium erodens M. S. Christ. et D. Hawksw. – Hungary, Borsod-Abaúj-Zemplén County, Bódvarákó, Aggtelek National Park, Szalonna Karst, top of Mt Esztramos, abandoned quarry, on bark (*Salix caprea*), on older part of the thalli of *Evernia prunastri* together with *Didymocyrtis* sp. Lat.: 48.51616° N, Long.: 20.74835° E, Alt.: 290 m a.s.l. Coll.: Lőkös, L., Varga, N., 23.09.2023 [BP 97171]. – Hungary, Borsod-Abaúj-Zemplén County, Aggtelek National Park, Szalonna Karst, Martonyi, Mt Hármas-hegy (Mt Szár-hegy), on bark (*Quercus* sp.), on thalli of *Parmelia sulcata*. Lat.: 48.48009° N, Long.: 20.73888° E, Alt.: 500 m a.s.l. Coll.: Lőkös, L., Varga, N., 24.09.2023 [BP 97172]. – Several occurrences are known from the country (Varga *et al.* 2021), but this is the first record from the Aggtelek National Park! It is interesting to note that two kinds of pycnidia of different sizes are present in a necrotic patch with a black margin on our specimen. The smaller one, *ca* 30–40 µm diam. was *Lichenoconium erodens* and the larger one *ca* 100–110 µm diam. was a *Didymocyrtis* (*Phoma*-like) species with only a few pycnidia.

Lichenodiplis lecanorae (Vouaux) Dyko et D. Hawksw. – Hungary, Borsod-Abaúj-Zemplén County, Bódvarákó, Aggtelek National Park, Szalonna Karst, top of Mt Esztramos, abandoned quarry, on bark (*Pinus sylvestris*), on apothecia of *Lecanora saligna*. Lat.: 48.51920° N, Long.: 20.75345° E, Alt.: 300 m a.s.l. Coll.: Lőkös, L., Varga, N., 23.09.2023 [BP 97167]. – It was only known from one locality in Hungary (Varga *et al.* 2021), this is the second published record to the country and the first from the Aggtelek National Park!

Pronectria robergei (Mont. et Desm.) Lowen – Hungary, Borsod-Abaúj-Zemplén County, Bódvarákó, Aggtelek National Park, Szalonna Karst, top of Mt Esztramos, abandoned quarry, on calcareous soil, on thalli of *Peltigera rufescens*. Lat.: 48.517751° N, Long.: 20.750280° E, Alt.: 308 m a.s.l. Coll.: Lőkös, L., Varga, N., 23.09.2023 [BP 97163]. – Almost the same locality. Lat.: 48.518148° N, Long.: 20.751789° E, Alt.: 306 m a.s.l. Coll.: Lőkös, L., Varga, N., 23.09.2023 [BP 97170]. – Only one old, dubious record of this species has been published (Varga *et al.* 2021). The first voucher specimens from Hungary represent the first records from the Aggtelek National Park! It was very abundant in the studied area, where the bare surface of the calcareous soil in the abandoned quarry was covered by pioneers as patches (*ca* 5 m^2 in diam.) of *Peltigera* and *Cladonia* thalli.

Pyrenochaeta xanthoriae Diederich – Hungary, Borsod-Abaúj-Zemplén County, Tornaszentandrás, Aggtelek National Park, Szalonna Karst, top of Mt Esztramos, abandoned quarry, on bark (*Populus nigra*), on apothecia and thalli of *Xanthoria parietina*. Lat.: 48.518724° N, Long.: 20.751957° E, Alt.: 305 m a.s.l. Coll.: Lőkös, L., Varga, N., 23.09.2023 [BP 97164]. See also the specimen [BP 97161] under *Illosporiopsis christiansenii*. – This species is not rare in Hungary (Varga *et al.* 2021), however, this is the first record from the Aggtelek National Park!

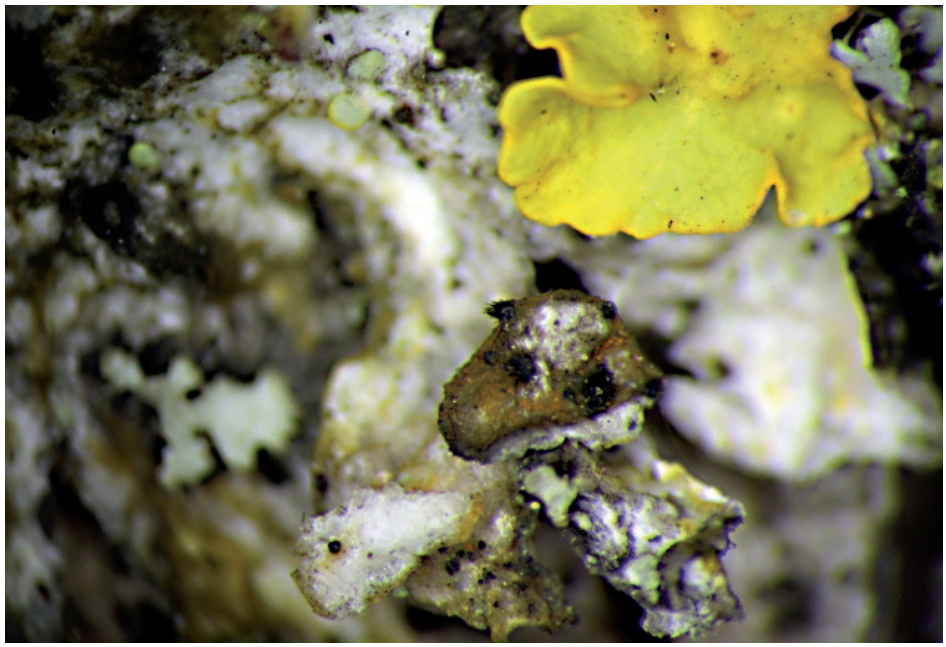

Fig. 9. *Pyrenochaeta xanthoriae* – dark brown, partially immersed pycnidia with setae near the ostiole on the very damaged apothecium of *Xanthoria parietina*.

Roselliniella cladoniae (Anzi) Matzer et Hafellner – Hungary, Borsod-Abaúj-Zemplén County, Tornaszentandrás, Aggtelek National Park, Szalonna Karst, top of Mt Esztramos, abandoned quarry, on calcareous soil, on thalli (basal squamules and scyphi) of *Cladonia magyarica*. Lat.: 48.51810° N, Long.: 20.75573° E, Alt.: 265 m a.s.l. Coll.: Lőkös, L., Varga, N., 23.09.2023 [BP 97138]. – It is known from the Kiskunság and the Balaton Upland (Varga *et al.* 2021), this is the third published and the first record from the Aggtelek National Park!

Xanthoriicola physciae (Kalchbr.) D. Hawksw. – Hungary, Borsod-Abaúj-Zemplén County, Tornaszentandrás, Aggtelek National Park, Szalonna Karst,

top of Mt Esztramos, abandoned quarry, on bark (*Populus nigra*), on thalli and apothecia of *Xanthoria parietina*. Lat.: 48.518724° N, Long.: 20.751957° E, Alt.: 305 m a.s.l. Coll.: Lőkös, L., Varga, N., 23.09.2023 [BP 97165]. – This is a common lichen parasite widespread in Hungary (Varga *et al.* 2021), but this is the first record from the Aggtelek National Park!

Zyzygomyces physciacearum (Diederich) Diederich, Millanes et Wedin – Hungary, Borsod-Abaúj-Zemplén County, Tornaszentandrás, Aggtelek National Park, Szalonna Karst, top of Mt Esztramos, abandoned quarry, on bark (*Populus nigra*), on apothecia and thalli of *Physcia adscendens*. Lat.: 48.51886° N, Long.: 20.75198° E, Alt.: 300 m a.s.l. Coll.: Lőkös, L., Varga, N., 23.09.2023 [BP 97120]. – Hungary, Borsod-Abaúj-Zemplén County, Aggtelek National Park, Szalonna Karst, Martonyi, Mt Hármas-hegy (Mt Szár-hegy), on twigs of *Acer campestre*, on *Physcia adscendens*. Lat.: 48.479563° N, Long.: 20.732743° E, Alt.: 508 m a.s.l. Coll.: Lőkös, L., Varga, N., 24.09.2023 [BP 97139]. – This gall-inducing basidiomycetous lichenicolous fungus is new to the Aggtelek National Park! This is the second published locality in the country (Varga *et al.* 2021).

Fig. 10. Brownish galls of *Zyzygomyces physciacearum* on the thalli and apothecia of *Physcia adscendens* at Mt Szár-hegy.

DISCUSSION

Altogether 308 lichen species were published from the Aggtelek National Park in 2009 (Lőkös 2009), and two more by Farkas *et al.* (2022, 2023) (*Absconditella lignicola*, *Gyalecta fagicola*) recently. Together with the three new records from the Szalonna Karst (*Agonimia globulifera*, *Lecanora compallens*, *Thalloidima physaroides*) the lichen flora of the Aggtelek National Park consists of 313 lichen species now. In addition to the lichen-forming fungi, 13 species of lichenicolous fungi were also recognised (*Athelia arachnoidea*, *Bryostigma parietinarium*, *Bryostigma phaeophysciae*, *Didymocyrtis slaptonensis*, *Illosporiopsis christiansenii*, *Lichenochora obscuroides*, *Lichenoconium erodens*, *Lichenodiplis lecanorae*, *Pronectria robergei*, *Pyrenochaeta xanthoriae*, *Roselliniella cladoniae*, *Xanthoriicola physciae*, *Zyzygomyces physciacearum*).

Cladonia magyarica was collected on limestone rocks among mosses in the Szalonna Karst at the top of Mt Szár-hegy (Martonyi) by Ferenc Fóriss on 5 August 1928. This locality was re-visited during our field trip and two small populations of *C. magyarica* (*ca* 0.1 m^2 each) were found in a small rocky grassland stand at the NE side of the top. So, the presence of *C. magyarica* has been confirmed in the Szalonna Karst after almost 100 years.

The considerable abundance of the protected *Cladonia magyarica* detected in the abandoned quarry of Mt Esztramos (Szalonna Karst) suggests that *C. magyarica* might be a pioneer in this area. The bare calcareous soil of this new locality in the abandoned quarry is covered by scattered, mosaic-like patches (*ca* 5 m^2 in diam.) of *Peltigera* and *Cladonia* thalli together with a rich lichenicolous community.

On the other hand, the dubious records from Mt Esztramos published by A. Kiszely Vámosi (e.g. *Eiglera flavida*, *Farnoldia jurana*, *Psora vallesiaca*, *Rhizocarpon umbilicatum*, *Xanthoparmelia somloensis*) could not be confirmed this time.

Lichenicolous fungi have not been studied in the Aggtelek National Park up to now (cf. Révay and Gönczöl 2009, Vasas and Locsmándi 2009). All species of the lichenicolous fungi are new to the Aggtelek National Park, including the common and widespread species *Athelia arachnoidea* and *Xanthoriicola physciae* (Varga *et al.* 2021), however, much more lichenicolous species are expected after a comprehensive study of the group.

* * *

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Összefoglaló: Az Aggteleki Nemzeti Park Szalonnai-karszt területén (Bódvarákó: Esztramos, Martonyi: Hármas-hegy, Szár-hegy) 2023-ban végzett lichenológiai vizsgálatok során 38 zuzmófaj és 13 zuzmóparazita mikrogombafaj 64 előfordulási adatát rögzítettük. Az *Agonimia globulifera*, *Lecanora compallens*, *Thalloidima physaroides*, valamint a 13 zuzmóparazita mikrogombafaj (*Athelia arachnoidea*, *Bryostigma parietinarium*, *Bryostigma phaeophysciae*, *Didymocyrtis slaptonensis*, *Illosporiopsis christiansenii*, *Lichenochora obscuroides*, *Lichenoconium erodens*, *Lichenodiplis lecanorae*, *Pronectria robergei*, *Pyrenochaeta xanthoriae*, *Roselliniella cladoniae*, *Xanthoriicola physciae*, *Zyzygomyces physciacearum*) új az Aggteleki Nemzeti Park flórájára.

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