

Additions to the flora of lichenicolous fungi of Sweden

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15 lichenicolous fungi are reported as new to Sweden: *Abrothallus halei*, *A. puntilloi*, *Arthonia japewiae*, *A. parietinaria*, *Buelliella lecanorae*, *Lecidella parasitica*, *Opegrapha lamyi*, *O. pertusariicola*, *Parmeliocida pandemica*, *Rosellinula frustulosae*, *Sclerococcum microsporum*, *Stigmidium acetabuli*, *S. hageniae*, *S. humidum* and *Xenonectriella physciacearum*. Eight of these are also new to Fennoscandia.

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Introduction

Currently 418 species of lichenicolous fungi are included in the Swedish checklist (Westberg et al. 2021). Numerous species remain to be found and during the past years efforts have been made to search for species that have not yet been documented from Sweden. In this paper, we report 15 lichenicolous fungi that are new to Sweden, mainly as a result of field work but also from searching collections in the lichen herbarium in UPS for lichenicolous fungi. Eight of these species are also new to Fennoscandia.

Material and Methods

Specimens were studied using a dissecting microscope. Anatomical features were examined on hand-cut apothecial sections and squash preparations mounted in water using a compound microscope. Measurements of ascospore dimensions and other anatomical features were made in water. Coordinates are expressed in degrees and decimals in WGS 84.

The Species

***Abrothallus halei* Pérez-Ort., Suija, D.Hawksw. & R.Sant.**

Fig. 1A

New to Sweden. *Abrothallus halei* was so far known only from Norway and North America (Suija et al. 2011). *Abrothallus* comprises more than 40 lichenicolous species (Diederich et al. 2018). On *Lobaria* spp. several species of *Abrothallus* are known, but most of these have 1-septate ascospores,

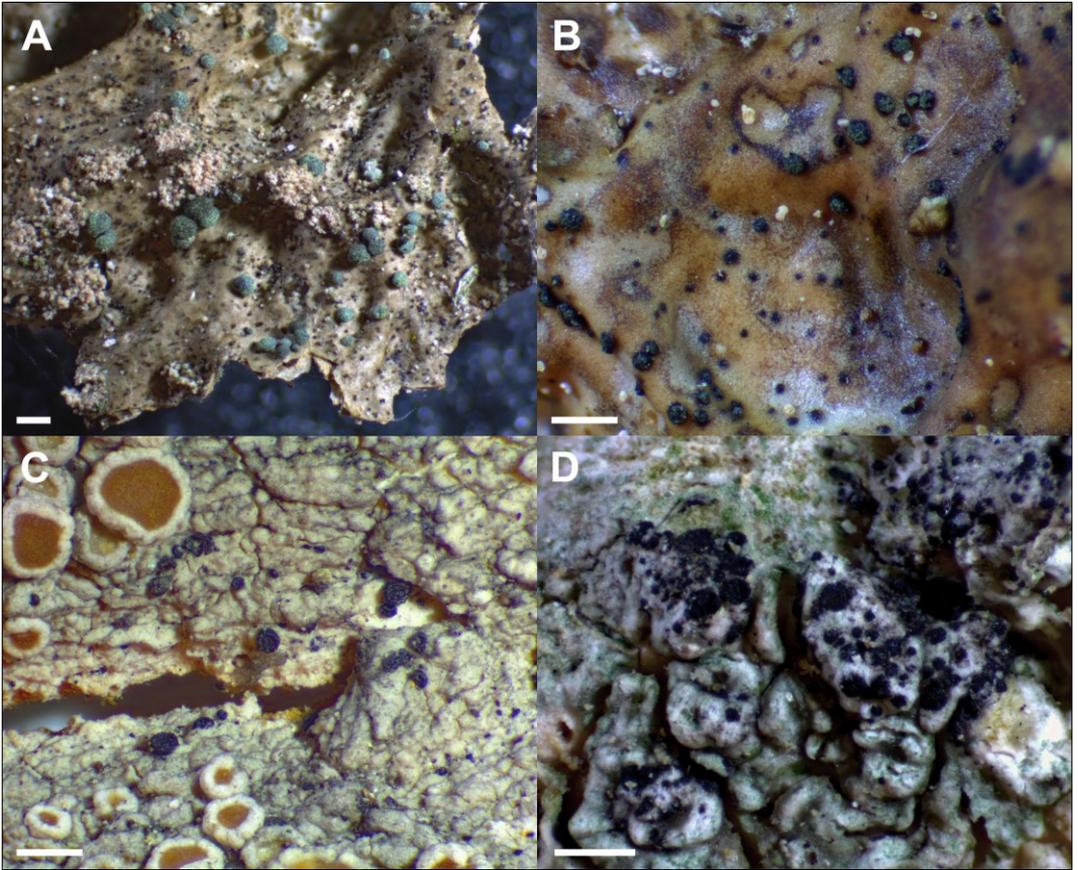


Figure 1. A. *Abrothallus halei*, Sweden, Hälsingland, 16 June 2022, Vicente & Hammarström (UPS F-1050413). B. *Abrothallus puntilloi*, Sweden, Jämtland, 28 July 2022, Isaksson (UPS F-1050781). C. *Buelliella lecanorae*, Sweden, Uppland, 10 May 1953, Du Rietz (UPS F-1041398). D. *Opegrapha lamyi*, Sweden, Gotland, 9 Aug. 2022, Vicente (UPS L-1057472). Scale bars = 0.5 mm.

with the exception of *A. halei*. *A. halei* has distinctive 3-septate ascospores, which break in the middle to form part-spores. The spore characters together with the host choice (*Lobaria*) make *A. halei* characteristic and easily recognized under the microscope. The ascospores size in our sample matches the description made by Suija et al. (2011). In our sample, the apothecia are associated with an anamorph with similar appearance and conidia as described for *Abrothallus (Phoma) lobariae* (Zhurbenko & Braun 2013).

Abrothallus halei was found growing on *Lobaria pulmonaria* on two *Salix caprea* trees in a patch of old mixed taiga forest. The host thalli were necrotic and apparently dying, which, however, was probably due to shadowing from closely growing *Picea abies* and did not represent damages induced by *A. halei*.

Specimens examined: Sweden. Hälsingland: Voxna par., NW of Edsbyn, S shore of Övre Ärtasen, N of Rättjärnsberget, 61.43104°N 15.55208°E, on *L. pulmonaria* on snag of *S. caprea* in oldgrowth forest with *Picea*, *Pinus*, *Betula* and *Salix*, 16 June 2022, R. Vicente & O. Hammarström (UPS F-1050412, F-1050413).

Abrothallus puntilloi* Brackel*Fig. 1B**

New to Fennoscandia. Compared to *Abrothallus halei* (see above), *A. puntilloi* has 1-septate ascospores (3-septate in *A. halei*) that fall apart at the septum, and smaller apothecia (100–210 µm diam. in *A. puntilloi* vs 200–500 µm diam. in *A. halei*) and is thus easy to distinguish from that species (Brackel & Puntillo 2016). The species is apparently known only from Italy (Brackel & Puntillo 2016). In our sample, the apothecia are associated with an anamorph with a similar appearance and similar conidia as described for *Abrothallus (Phoma) lobariae* (Zhurbenko & Braun 2013). This latter species was combined into *Abrothallus* by Diederich et al. (2018), but as far as we know the teleomorph has not been described in *A. lobariae*. Brackel & Puntillo (2016) briefly described the anamorph of *A. puntilloi* but distinguishing characters towards *A. lobariae* are not clear to us. In the Nordic countries, *A. lobariae* has been reported from Norway (as *Phoma* cf. *lobariae*, Alstrup et al. 2008) but the identity of that specimen is doubtful as it grew on *Nephroma expallidum*.

Specimen examined: Sweden. Jämtland: Frostviken par., Storvallbäcken, 500 m NW of Blåsjöatern, 64.85033°N 14.07242°E, on *L. pulmonaria*, 28 July 2022, R. Isaksson (UPS F-1050781).

***Arthonia japewiae* Grube & Holien**

New to Sweden. This species was described from Norway and has been reported from a few other localities in that country (Grube & Matzer 1997, Frisch et al. 2020). Its known hosts are *Japewia subaurifera* and *J. tornoënsis*. In the two Swedish localities it grows on *J. tornoënsis* on twigs of *Picea abies*. *Arthonia japewiae* has 1-septate ascospores that are at first hyaline, becoming brown and finely warted when mature (Grube & Matzer 1997). Mature spores were not found in the two Swedish collections however.

Specimens examined: Sweden. Lule lappmark: Jokkmokk par., 45.7 km ESE of the village Jokkmokk and 17.2 km NE of the village Vuollerim, 66.55203°N 20.84521°E, elev. 309 m, old-growth *P. abies* stand surrounded by commercially managed forest and a dirt road in N, E and S, on *J. tornoënsis* on *P. abies* branch (tree diameter 33 cm) in old-growth *P. abies* stand (tree 9 (of 23) in plot MK3, a circular plot with a radius of 17.8 m=1000 m²), 27 Aug. 2018, G. Thor 40401 (UPS L-1057812); *Norrbotnen:* Tärendö par., 19.2 km NW of the village Tärendö and 1.5 km S of dirt road, 67.24162°N 22.25132°E, elev. 225 m, old-growth forest stand surrounded by commercially managed forest, on *J. tornoënsis* on *P. abies* branch (tree diameter 27 cm) in old-growth *P. abies* stand (tree 2 (of 9) in plot Tä3, a circular plot with a radius of 17.8 m=1000 m²), 23 Aug. 2018, G. Thor 38768 (UPS L-1057811).

***Arthonia parietinaria* Hafellner & Fleischhacker**

New to Sweden. Fleischhacker et al. (2016) mentioned a specimen from Sweden used in their phylogenetic analysis but did not cite any material or an accession number in Genbank. Gene sequence 11Se17 in Figure 6 in Fleischhacker et al. (2016) represent specimen A. Frisch 11/Se17 (see below, A. Frisch pers. comm.). Here we report that species from several provinces in Sweden. In the Nordic countries *Arthonia parietinaria* has earlier been reported from Denmark and Norway, and is known from Europe, western Asia and northwestern Africa (Canary Islands) (Fleischhacker et al. 2016). For a description, see Fleischhacker et al. (2016) and Cannon et al. (2020). *A. parietinaria* can be confused with *A. molendoi* and *A. epiphyscia*. It differs from *A. molendoi* and *A. epiphyscia* in causing larger infection spots and also by the higher mean numbers of ascomata (10–)20–30(–50) per infection spot versus 1–5(–10) in *A. molendoi* and (1–)5–10 in *A. epiphyscia*

(Fleischhacker et al. 2016). *A. parietinaria* can also be distinguished from *A. molendoi* by the less intense colouration (mat black) of the ascomata (pure black in *A. molendoi*).

Specimens examined: Sweden. Dalarna: Sundborn parish, SW of the small lake Blixbotjärn, forest edge to farmland, 60.62703°N 15.83569°E, on *X. parietina* thallus on *Populus tremula* twigs from tree crown, 11 Sept. 2017, P. Johansson (UPS L-1057790); *Närke:* Glanshammar par., Glanshammar, 300 m NE of the church, 59.32118°N 15.40583°E, on *X. parietina* on a branch of *Fraxinus excelsior*, 23 April 2017, M. Westberg (UPS L-926901); *Skåne:* Fjälkestad par., Råbelöv, i allén N om slottet, på *X. parietina*, 21 May 1948, R. Santesson 4874B (UPS L-519634); *Uppland:* Uppsala par., Universitetsparken, 59.85867°N 17.63094°E, on *X. parietina* thallus on dead, small branches of *F. excelsior*, 30 March 2017, J.C. Zamora (UPS L-804479); Vänge par., Fiby Nature Reserve, at the parking lot just south of the reserve, 59.8816°N 17.35442°E, on *X. parietina* on fallen *P. tremula*, 7 April 2017, M. Westberg (UPS L-92424); *Värmland:* Säffle par., by church, in the churchyard c. 65 m south of the church, 59.1122°N 12.93855°E, on *X. parietina* on a branch of *Ulmus* lying on the ground, 22 April 2018, M. Westberg (UPS L-904017); *Östergötland:* Västra Tollstad par., Ödeshög, Alvastra Kloster, 58.29694°N 14.65917°E, on *X. parietina* on side-face of a standing stone (the northern one of the two stones ENE of the church ruin), 21 April 2011, A. Frisch 11/Se17 (hb Frisch, GenBank acc. no. OQ028693); *ibid.*, 58.2967°N 14.6583°E. alt. 100 m, 21 April 2011, G. Thor 26243 (UPS L-1058153).

***Buelliella lecanorae* Suija & Alstrup**

Fig. 1C

New to Fennoscandia. This species was first described from Estonia (Suija & Alstrup 2004) and later reported from several European countries, Germany, Italy, Russia and Ukraine (Brackel 2009, 2011, Kondratyuk et al. 2014, Urbanavichus et al. 2021). It has also been reported from Bolivia in the southern hemisphere (Flakus & Kukwa 2012). *Buelliella lecanorae* is a commensalistic species with small black apothecia growing on various epiphytic *Lecanora* species (for a detailed description see Suija & Alstrup 2004). The Swedish specimen was found while studying Einar Du Rietz' unidentified collections in herbarium UPS.

Specimen examined: Sweden. Uppland: Almunge par., Harparbol lund, på *Lecanora* på ung lönn, 10 May 1953, G. E. Du Rietz (UPS F-1041398).

***Lecidella parasitica* Sanderson**

New to Fennoscandia. This species was recently described and reported from several localities in England in the revision of the British Lichen Flora (Cannon et al. 2022). It is a lichenicolous fungus forming black apothecia immersed in the thallus of *Pyrrhospora querneae*. A search in the herbarium in UPS of all Nordic specimens of *P. querneae* resulted in four specimens of *Lecidella parasitica* from three provinces in southeast Sweden.

Specimens examined: Sweden. Gotland: Östergarn par., Grogarnsberget, on wooden fence, 29 July 1932, G. Degelius (UPS L-785979); *Östergötland:* Furingstad par., Lilla Skärby, 26 June 1904, P.A. Issén (UPS L-786048); [without locality and date], in junipero, Petré (UPS L-786049); *Uppland:* Gottröra par., Strybro, on *Juniperus*, 16 June 1922, A.H. Magnusson 6603 (UPS L-786060).

***Opegrapha lamyi* (O.J.Rich. ex Nyl.) Triebel**

Fig. 1D

New to Sweden. *Opegrapha lamyi* is a parasite on species of the *Lecanora subfusca* group. The species usually forms clusters of apothecia on the thallus of the host. Sometimes single apothecia are found scattered, but in well developed specimens they tend to occur in clusters of four or more. The aggregated apothecia grow on gall-like swellings of the host thallus, sometimes arranged in circular clusters, perhaps due to growing on old host apothecia. The apothecia are mostly round, with a distinct rim with visible furrows, rarely lirelliform. The ascospores are 3-septate, with a

distinct perispore, becoming warty in old spores. Our samples match the descriptions made in Stepanchikova et al. (2010) and Ertz et al. (2021). The species has earlier been reported from Europe and the Azores (Stepanchikova et al. 2010) and from North America (Ertz et al. 2021).

Opegrapha lamyi was found during extensive surveys of lichens in deciduous forests and pastures on Gotland. The two specimens examined both parasitized *Lecanora* cf. *argentata* on old trees of *Fraxinus excelsior*. *O. lamyi* was observed at four different sites in the southern and southeastern part of Gotland. In Fennoscandia it was earlier known only from Finland (Westberg et al. 2021).

Specimens examined: Sweden. Gotland: Grötlingbo par., S of Viges, 57.10882°N 18.38196°E, on old *F. excelsior* in wooded pasture, lichenicolous on *Lecanora* cf. *argentata*, 12 Aug. 2022, R. Vicente (UPS L-1047332); *ibid.*, c. 500 m N of Hallinge, 57.11510°N 18.36705°E, on old *F. excelsior* in deciduous forest, lichenicolous on *Lecanora* cf. *argentata*, 9 Aug. 2022, R. Vicente (UPS L-1057472).

***Opegrapha pertusariicola* Coppins & P.James**

Fig. 2A

New to Sweden. This species was recently reported for the first time from Fennoscandia from Norway (Frisch et al. 2020). In Sweden *Opegrapha pertusariicola* was found on three old *Corylus avellana* bushes in a patch of deciduous forest on southeast Gotland. This parasitic *Opegrapha* has small, simple, lirellate to branched apothecia. The thallus of the host, *Pertusaria leioplaca*, had very few apothecia and was necrotic around the apothecia of *O. pertusariicola*. According to Cannon et al. (2021) it is rarely also growing on *Pertusaria pertusa*. The 5–6-septate ascospores and the host choice characterise this species. It has been reported from Europe and Africa (the Canary Islands) (Hafellner 1995).

Specimen examined: Sweden. Gotland: Öja par., NE of Burgsvik, Ockesänget, 57.04120°N 18.30136°E, on *P. leioplaca* on *Corylus* in a grove, 17 Aug. 2022, R. Vicente & O. Hammarström (UPS L-1047382).

***Parmeliicida pandemica* Diederich, F.Berger, Etayo & Lawrey**

New to Fennoscandia. *Parmeliicida pandemica* is a lichenicolous basidiomycete, described as late as August 2022 in the first volume of the Flora of Lichenicolous Fungi (Diederich et al. 2022a). It was reported from Austria, France and Spain and infects corticolous parmelioid lichens, mostly *Parmelia saxatilis* and *P. sulcata*, but also *Cetrelia olivetorum* and *Menegazzia terebrata*. The host is rapidly killed and turns reddish brown. For a full description and photographs, see Diederich et al. (2022b).

Specimen examined: Sweden. Ångermanland: Vibyggerå par., SW of Värns, Valabergen, below the S-facing precipice facing Ullångersfjärden, 63.02051°N 18.38753°E, on *P. saxatilis* on *Sorbus aucuparia*, 16 Sept. 2022, M. Westberg (UPS F-1049803).

***Rosellinula frustulosae* (Vouaux) R.Sant.**

Fig. 2B

New to Sweden. *Rosellinula frustulosae* is a parasite on *Lecanora argopholis* and *L. frustulosa*, originally described from Crimea, Ukraine and has also been reported from Austria, Norway, Russia, Spain and Turkey in Europe, Greenland in North America, India, Iran, Mongolia and Kyrgyzstan in Asia, and Bolivia in South America (Alstrup 1981, Flakus & Kukwa 2012, Hafellner 1985, Halıcı et al. 2007, Nadyeina & Halıcı 2011, Sohrabi & Alstrup 2007, Zhurbenko 2013). The black, up to 0.3 mm wide perithecia grow immersed in the thallus of the host, *L. frustulosa* in the Swedish

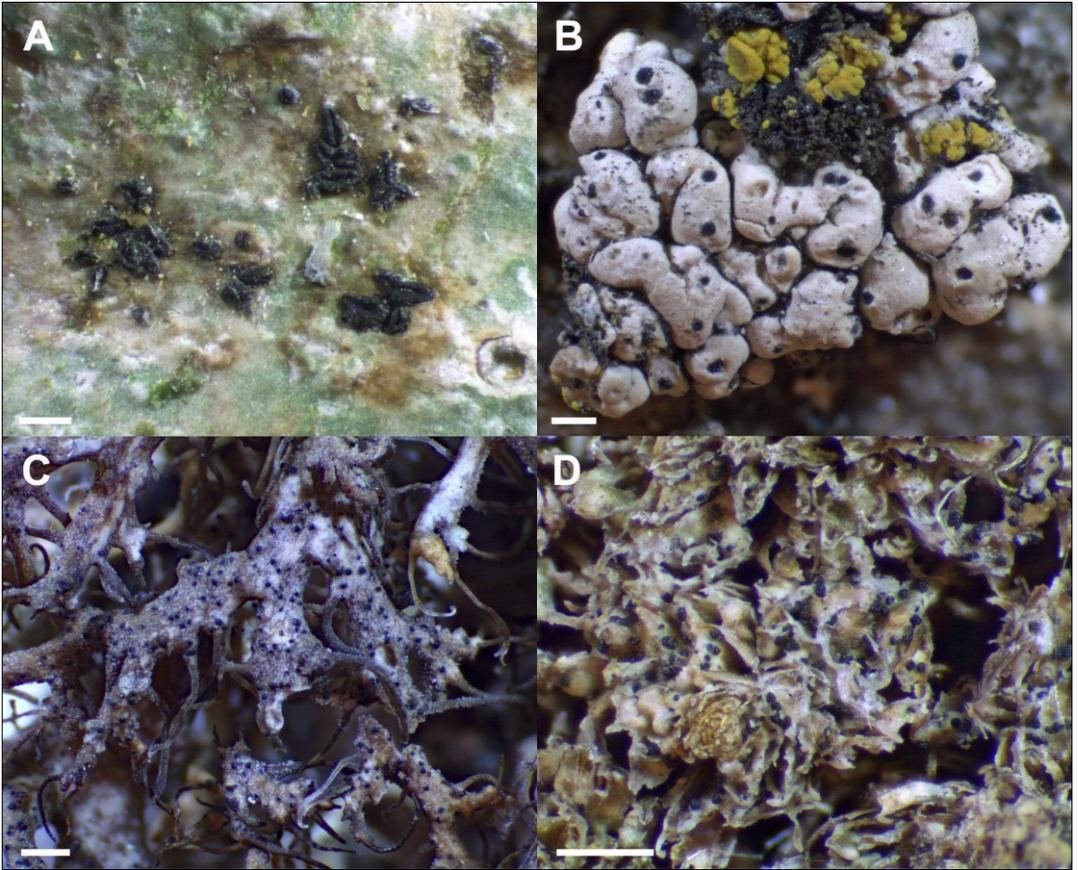


Figure 2. A. *Opegrapha pertusariicola*, 17 Aug. 2022, Vicente & Hammarström (UPS L-1047382). B. *Rosellinula frustulosae*, Sweden, Åsele lappmark, 23 July 1926, Degelius (UPS L-091219). C. *Stigidium hageniae*, Sweden, Uppland, 4 July 2021, Vicente (UPS F-1015375). D. *Stigidium humidum*, Sweden, Öland, 31 Oct. 2021, Isaksson (F-1037905). Scale bars = 0.5 mm.

specimen. The asci have numerous brown, smooth-walled, subglobose to broadly ellipsoid ascospores, measuring $6.5\text{--}8 \times 5\text{--}6 \mu\text{m}$ in the investigated specimen.

Specimen examined: Sweden. Åsele lappmark: Vilhelmina par., Klimpberget, elev. 600 m, 23 July 1926, G. Degelius (UPS L-091219, filed under *L. frustulosa*).

***Sclerococcum microsporum* (Etayo) Ertz & Diederich**

New to Sweden. *Sclerococcum microsporum* was described from a single collection from Spain, where it grew on the thallus of *Catinaria atropurpurea* (Etayo 1991). It is characterized by comparatively small, $4\text{--}5(-7) \times 2\text{--}3 \mu\text{m}$, 1-septate, brown ascospores, 40–80 per ascus (Etayo 1991). Another multispore species of the genus is *S. pertusariicola*, but this species has larger and up to 3-septate ascospores (Etayo 1991, Ihlen & Holien 2004). *S. microsporum* has also been reported growing on *Pachyphiale carneola* (Etayo 2010) and in Fennoscandia (Norway) on *Megalaria*

pulverea (Holien 2001, Frisch et al. 2020). The Swedish specimen mainly grew on the thallus of *Coenogonium pineti*, but also partly on an unidentified member of the *Micarea prasina* group. Whether *S. microsporum* is a saprophyte overgrowing various lichens, a lichenicolous fungus with a wide host spectrum, or represents several host-specific species, deserves further study.

Specimen examined: Sweden. Uppland: Järlåsa par., W end of Lake Tarmlången, S shore, about 200 m WNW of the N top of Mt. Uvberget, 59.97466°N 17.07130°E, on bark of *Alnus glutinosa*, 8 April 2020, M. Svensson 3726 (UPS F-1057542).

***Stigmatidium acetabuli* Calat. & Triebel**

New to Fennoscandia. This species was first described from Spain and France (Calatayud & Triebel 2001) and later reported from Italy (Brackel 2008). *Stigmatidium acetabuli* grows on *Pleurosticta acetabulum*, and the small perithecia are largely immersed in the apothecia of the host. The asci contain 8 hyaline ascospores that turn golden yellow as they age; they are 1-septate, constricted at the septum and with a narrower lower cell. For a full description, see Calatayud & Triebel (2001).

Specimen examined: Sweden. Västergötland: Skörstorp par., Skörstorp church, in the cemetery, 58.12547°N 13.73178°E, on *Fraxinus excelsior* and *Ulmus glabra*, 5 May 2022, R. Isaksson (UPS F-1045965).

***Stigmatidium hageniae* (Rehm) Hafellner**

Fig. 2C

New to Fennoscandia. This parasite on the thallus of *Anaptychia ciliaris* has been reported from several European countries: Germany, Greece, Great Britain, Ireland, Italy and Spain (Brackel & Berger 2019, Brackel & Döbbeler 2020, Hawksworth 1994, Winter 1872). The ascospores in our specimen are poorly developed but measure c. 11–12.5 × 3.5–4 µm, which agrees well with Brackel & Döbbeler (2020) and Winter (1872).

Specimen examined: Sweden. Uppland: Värmdö par., the small island Kalkkobben just south of Munkö, 59.228466°N 18.713582°E, on *A. ciliaris* on limestone, 4 July 2021, R. Vicente (UPS F-1015375).

***Stigmatidium humidum* Pérez-Ort., Halici & K.Knudsen**

Fig. 2D

New to Fennoscandia. This species grows on *Thelenella muscorum*. It was first described from Spain and Turkey (Pérez-Ortega et al. 2010) and later reported from North America (USA) (Haldeman 2021). *Stigmatidium humidum* has black perithecia, 75–140 µm wide, growing immersed to sessile on the host thallus. The ascospores are 1-septate, hyaline and halonate with a smooth surface, 12–18 × 3.5–6.5 µm, with the upper cell wider and shorter than the lower. For a full description and spore photos, see Pérez-Ortega et al. (2010).

Specimen examined: Sweden. Öland: Böda par., Neptuni alvar, 1 km SW of Hälludden, 57.35046°N 17.04221°E, on *T. muscorum* on dead bryophyte, 31 Oct. 2021, R. Isaksson (UPS F-1037905).

***Xenonectriella physciacearum* F.Berger, E.Zimm. & Brackel**

New to Fennoscandia. This species was recently described from central Europe (Berger et al. 2020) where it grows on several Physciaceae hosts. Berger et al. (2020) noted that old reports regarding *Xenonectriella* cf. *leptaleae* on *Physconia distorta* probably belong to *X. physciacearum*. *Xenonectriella physciacearum* has dark red to brown, solitarily arranged perithecia, growing immersed in the host thallus. The ascospores are consistently 1-septate, constricted at the septum, hyaline when young but turning pinkish orange to pale brown when mature, with one big oil droplet

per cell and the spore surface is ornamented with tubercles. Spores in our sample measured (9–)10–15(–18) × 5–7.5 µm. For a full description and spore photos, see Berger et al. (2020).

Xenonectriella physciacearum was collected in an urban park with mostly young trees of *Acer pseudoplatanus* and was growing on white necrotic patches on the thalli of *Phaeophyscia orbicularis*. *P. orbicularis* is abundant in this area and other lichenicolous species also found on the same tree were *Taeniolella phaeophysciae* and *Arthonia phaeophysciae*.

Specimen examined: **Sweden.** Skåne: Malmö par., Sorgenfrivägen, SE of St. Pauli kyrkogård, 55.59440°N 13.03100°E, on *P. orbicularis* on young *A. pseudoplatanus* in park edge, 23 Nov. 2022, R. Vicente (LD2056375).

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References

- Alstrup, V., Grube, M., Motiejūnaitė, J., Nordin, A. & Zhurbenko, M. 2008. Lichenicolous fungi from the Skibotn area, Troms, Norway. *Graphis Scripta* **20**: 1–8.
- Berger, F., Zimmermann, E. & Brackel, W. v. 2020. Species of *Pronectria* (Bionectriaceae) and *Xenonectriella* (Nectriaceae) growing on foliose Physciaceae, with a key of the Central European species. *Herzogia* **33**: 473–493.
- Brackel, W. v. 2008. *Zwackhiomyces echinulatus* sp. nov. and other lichenicolous fungi from Sicily, Italy. *Herzogia* **21**: 181–198.
- Brackel, W. v. 2009. Weitere Funde von flechtenbewohnenden Pilzen in Bayern. Beitrag zu einer Checkliste IV. *Berichte der Bayerischen Botanischen Gesellschaft* **79**: 5–55.
- Brackel, W. v. 2011. Lichenicolous fungi and lichens from Puglia and Basilicata (southern Italy). *Herzogia* **24**: 65–101.
- Brackel, W. v. & Berger, F. 2019. Lichenicolous fungi from Sardinia (Italy): new records and a first synopsis. *Herzogia* **32**: 444–471.
- Brackel, W. v. & Döbbeler, P. 2020. An addition to the knowledge of lichenicolous fungi of Greece with a key to the lichenicolous fungi on *Collema* s.l. *Folia Cryptogamica Estonica* **57**: 147–152.
- Brackel, W. v. & Puntillo, D. 2016. New records of lichenicolous fungi from Calabria (southern Italy), including a first checklist. *Herzogia* **29**: 277–306.
- Calatayud, V. & Triebel, D. 2001. *Stigmatidium acetabuli* (Dothideales s. l.), a new lichenicolous fungus on *Pleurosticta acetabulum*. *Bibliotheca Lichenologica* **78**: 27–33.
- Cannon, P., Coppins, B., Ertz, D., Fletcher, A., Pentecost, A. & Simkin, J. 2021. *Arthoniales*: Opegraphaceae, including the genera *Llimonaea*, *Opegrapha*, *Paralecanographa* and *Sparria*. *Revisions of British and Irish Lichens* **13**: 1–19.
- Cannon, P., Ertz, D., Frisch, A., Aptroot, A., Chambers, S., Coppins, B., Sanderson, N., Simkin, J. & Wolseley, P. 2020. *Arthoniales*: Arthoniaceae, including the genera *Arthonia*, *Arthothelium*, *Briancoppinsia*, *Bryostigma*, *Coniocarpon*, *Diarthonis*, *Inoderma*, *Naevia*, *Pachnolepta*, *Reichlingia*, *Snippocia*, *Sporodophoron*, *Synarthonia* and *Tylophoron*. *Revisions of British and Irish Lichens* **1**: 3–48.
- Cannon, P., Maliček, J., Ivanovich, C., Printzen, C., Aptroot, A., Coppins, B., Sanderson, N., Simkin, J. & Yahr, R. 2022. Lecanorales: Lecanoraceae, including the genera *Ameliella*, *Bryonora*, *Carbonea*, *Claurouxia*, *Clauzadeana*, *Glaucomaria*, *Japewia*, *Japewiella*, *Lecanora*, *Lecidella*, *Miriquidica*, *Myriolecis*,

- Palicella*, *Protoparmeliopsis*, *Pyrrhospora* and *Traponora*. *Revisions of British and Irish Lichens* **25**: 1–83.
- Diederich, P., Lawrey, J.D. & Ertz, D. 2018. The 2018 classification and checklist of lichenicolous fungi, with 2000 non-lichenized, obligately lichenicolous taxa. *The Bryologist* **121**: 340–425.
- Diederich, P., Millanes, A.M., Wedin, M. & Lawrey, J.D. 2022a. *Flora of Lichenicolous Fungi*, Vol. 1 Basidiomycota. National Museum of Natural History, Luxembourg, 351 pp.
- Diederich, P., Sikaroodi, M. & Lawrey, J.D. 2022b. Class Agaricomycetes, order Cantharellales. In: Diederich et al. (eds), *Flora of Lichenicolous Fungi*, Vol. 1, Basidiomycota. National Museum of Natural History, Luxembourg: 51–69.
- Etayo, J. 1991. *Dactylospora microspora* spec. nov., nuevo hongo liquenícola de la flora española. *Candollea* **46**: 391–393.
- Etayo, J. 2010. Líquenes y hongos liquenícolas de Aragón. *Guineana* **16**: 1–501.
- Ertz, D., Driscoll, K.E. & Clayden, S.R. 2021. Two new lichenicolous species of *Opegrapha* (Arthoniales) from Canada. *The Bryologist* **124**: 39–51.
- Flakus, A. & Kukwa, M. 2012. New records of lichenicolous fungi from Bolivia. *Opuscula Philolichenum* **11**: 36–48.
- Fleischhacker, A., Grube, M., Frisch, A., Obermayer, W. & Hafellner, J. 2016. *Arthonia parietinaria* – a common but frequently misunderstood lichenicolous fungus on species of the *Xanthoria parietina*-group. *Fungal Biology* **120**: 1341–1353.
- Frisch, A., Klepsland, J., Palice, Z., Bendiksbj, M., Tønsberg, T. & Holien, H. 2020. New and noteworthy lichens and lichenicolous fungi from Norway. *Graphis Scripta* **32**: 1–47.
- Grube, M. & Matzer, M. 1997. Taxonomic concepts of lichenicolous *Arthonia* species. In: Türk, R. & Zorer, R. (eds), Progress and Problems in Lichenology in the Nineties. *Bibliotheca Lichenologica* **68**: 1–17.
- Hafellner, J. 1985. Studien über lichenicole Pilze und Flechten III. Die Gattung *Roselliniella* Vainio emend. Haf. (Ascomycotina, Dothideales). *Herzogia* **7**: 145–162.
- Hafellner, J. 1995. Bemerkenswerte Funde von Flechten und lichenicolen Pilzen auf makaronesischen Inseln II. Einige bisher übersehene arthoniale Arten. *Herzogia* **11**: 133–142.
- Haldeman, M. 2021. New and interesting records of lichens, lichenicolous fungi and other Ascomycota from Northwestern USA IV. *Evansia* **38**: 149–158.
- Halıcı, M.G., Aksoy, A. & Kocakaya, M. 2007. Some lichens from Gaziantep, Kahramanmaraş, Kırşehir and Yozgat provinces (Turkey). *Turkish Journal of Botany* **31**: 161–170.
- Hawksworth, D.L. 1994. Notes on British lichenicolous fungi: VII. *Lichenologist* **26**: 337–347.
- Holien, H. 2001. Additions to the Norwegian flora of lichens and lichenicolous fungi II – with some further distributional notes on Norwegian Caliciales. *Graphis Scripta* **12**: 51–58.
- Ihlen, P.G. & Holien, H. 2004. Two new species of *Dactylospora* (Dactylosporaceae, Lecanorales), with a key to the known species in Scandinavia. *The Bryologist* **107**: 357–362.
- Kondratyuk, S., Lőkös, L. & Hur, J.-S. 2014. New lichen-forming and lichenicolous fungi from Ukraine. *Acta Botanica Hungarica* **56**: 361–368.
- Nadyeina, O. & Halıcı, M.G. 2011. New lichenicolous fungi records for Kyrgyzstan, Uzbekistan, and Ukraine. *Mycotaxon* **118**: 131–136.
- Pérez-Ortega, S., Halıcı, M.G., Knudsen, K. & Candan, M. 2010. A new species of *Stigmidium* sensu stricto on *Thelenella muscorum*. *Lichenologist* **42**: 397–403.
- Sohrabi, M. & Alstrup, A. 2007. Additions to the lichen mycota of Iran from East Azerbaijan Province. *Mycotaxon* **100**: 145–148.
- Stepanchikova, I.S., Kukwa, M., Kuznetsova, E.S., Motiejūnaitė, J. & Himelbrant, D.E. 2010. New records of lichens and allied fungi from the Leningrad Region, Russia. *Folia Cryptogamica Estonica* **47**: 77–84.
- Suija, A. & Alstrup, V. 2004. *Buelliella lecanorae*, a new lichenicolous fungus. *Lichenologist* **36**: 203–206.
- Suija, A., Pérez-Ortega, S. & Hawksworth, D.L. 2011. *Abrothallus halei* (Ascomycota, *incertae sedis*), a new lichenicolous fungus on *Lobaria* species in Europe and North America. *Lichenologist* **43**: 51–55.
- Urbanavichus, G.P., Urbanavichene, I.N., Vondrák, J. & Ismailov, A.B. 2021. Epiphytic lichen biota of Prielbrusie National Park (Northern Caucasus, Russia). *Nature Conservation Research* **6**: 77–94.

- Westberg, M., Moberg, R., Myrdal, M., Nordin, A. & Ekman, S. 2021. *Santesson's Checklist of Fennoscandian Lichen-Forming and Lichenicolous Fungi*. Uppsala University, Museum of Evolution (with updates on: www.evolutionsmuseet.uu.se/databaser/santesson.html).
- Winter, G. 1872. Diagnosen und Notizen zu Rehm's Ascomyceten. *Flora* **55**: 508–511, 523–527, 542–544.
- Zhurbenko, M.P. 2013. A first list of lichenicolous fungi from India. *Mycobiota* **3**: 19–34.
- Zhurbenko, M.P. & Braun, U. 2013. *Ameroconium cladoniae* gen. et sp. nov. and *Phoma psoromatis* sp. nov., new anamorphic lichenicolous fungi from the Holarctic. *Lichenologist* **45**: 583–591.