

New and remarkable records of lichenicolous fungi from Ternopil Oblast (Ukraine)

VALERIY V. DARMOSTUK¹, OLHA YE. SIRA²

¹Kherson State University, 27 Universytetska Str., Kherson, UA-73000, Ukraine; valeriidarmostuk@gmail.com

²V.N. Karazin Kharkiv National University, 4 Svobody Sq., Kharkiv, UA-61022, Ukraine

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Recent records of lichenicolous fungi from Ternopil Oblast are provided. Twenty-nine species are reported as new to the region in the present study. Three of them, *Didymocyrtis foliaceiphila*, *Stagonospora exasperatulae* and *Tremella everniae*, are new to Ukraine. *Cladosporium licheniphilum*, *Henfellra muriformis*, *Illosporiosis christiansenii*, *Laetisaria lichenicola*, *Licheniconium pyxidatae* and *Refractohilum intermedium* are new to the forest-steppe zone of Ukraine. *Punctelia subrudecta* is a new host species for *Didymocyrtis foliaceiphila*. Notes on the currently known distribution of selected species in other Ukrainian regions are provided.

Key words: biodiversity, distribution, forest-steppe zone, *Didymocyrtis*, *Henfellra*, *Stagonospora*.

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Článek přináší přehled aktuálních nálezů lichenikolních hub z Ternopilské oblasti. Během současného výzkumu bylo zjištěno celkem 29 druhů, které z této oblasti dosud nebyly známy; mezi nimi *Didymocyrtis foliaceiphila*, *Stagonospora exasperatulae* a *Tremella everniae* jsou novými druhy pro Ukrajinu. *Cladosporium licheniphilum*, *Henfellra muriformis*, *Illosporiosis christiansenii*, *Laetisaria lichenicola*, *Licheniconium pyxidatae* a *Refractohilum intermedium* byly zaznamenány jako nové druhy v lesostepní zóně Ukrajiny. *Punctelia subrudecta* je novým hostitelským druhem pro *Didymocyrtis foliaceiphila*. U vybraných druhů jsou připojeny poznámky o jejich známém rozšíření v jiných oblastech země.

INTRODUCTION

Lichenicolous fungi are a highly specialised group of organisms which live exclusively on lichens. Most commonly they are host-specific parasites, but they can also be broad-spectrum pathogens, saprotrophs or commensals (Diederich et al. 2018). The history of research into lichenicolous fungi in Ukraine started in

Western Ukraine with a few floristic surveys (Hawksworth 1992, Kondratyuk & Khodosovtsev 1997, Kondratyuk & Kolomiyets 1997). Currently, the interest in the study of lichenicolous fungi is growing again. However, it is concentrated in only a few regions in Southern and Western Ukraine as well in the Carpathian Mts. (Khodosovtsev & Darmostuk 2017b, Darmostuk et al. 2018, Gromakova 2018).

A study of the diversity of lichenicolous fungi on the local scale is one of the main ways to explore regional diversity (Hafellner 2018). Only 19 species of lichenicolous fungi were known from Ternopil Oblast before our recent research. Such a small number indicates a low level of mycofloristic knowledge in the Ternopil Oblast, since some other Ukrainian regions have recorded more than 50 species (Darmostuk & Khodosovtsev 2017). Therefore, the Ternopil Oblast remains one of the “white spots” in the diversity of lichenicolous fungi. The aim of this paper is to contribute to the local knowledge of lichenicolous fungi; twenty-nine species are reported as new to the region in the present study.

MATERIAL AND METHODS

Surveyed sites. Lichenicolous fungi were collected during field trips in January and August 2019 to Berezhans'kyi district (Ternopil Oblast, Ukraine). Field surveys were carried out at the following sites (coordinates of the centre of the area are provided for each site):

1. Town of Berezhany, 49°26'42.1" N, 24°54'58.6" E, 23 January 2019;
2. Village of Rai, “Arboretum Rai” protected area, 49°25'43.9" N, 24°54'07.5" E, 22 January 2019;
3. Village of Posukhiv, 49°24'45.6" N, 24°58'00.7" E, 13 January 2019;
4. Near village of Posukhiv, Mt. Lysonia, 49°25'10.3" N, 24°58'57.5" E, 19 January 2019;
5. Village of Lisnyky, Monastyrok Reserve Landmark, 49°26'37.0" N, 24°52'12.3" E, 9 August 2019.

Morphological study and identification. The specimens were examined by standard microscope techniques using LOMO microscopes MBS-1 and MICROMED-2. Microscopical examination was done in water, 10% KOH, and Lugol's iodine solution, directly or after pretreatment with KOH, or Brilliant Cresyl Blue. The measurements were made in water with an accuracy of 0.5 μm for conidia and conidiogenous cells (the different number of measurements for *Stagonospora exasperatulae* is due to the limited number of cells available for measuring in the studied material). The sizes are given as (min.) x –SD – x +SD (max.), where x is the average and SD is the standard deviation. The photographs were taken with a Levenhuk C510 NG camera.

The species were identified using different keys for particular genera of lichenicolous fungi (e.g. Diederich 1996, Ertz et al. 2015, Hawksworth et al. 2016, Darmostuk 2019). All examined specimens were collected and identified by V. Darmostuk and O. Sira and deposited in the lichenological herbarium of Kherson State University (KHER) and the personal herbarium of the first author (herb. VD). Some specimens of the most common species (*Arthonia apotheciorum*, *Athelia arachnoidea*, *Laetisaria lichenicola*, *Lichenocodium erodens* and *Marchandiomyces corallinus*) were not deposited in the herbarium. Species new to Ukraine are indicated by an asterisk.

RESULTS AND DISCUSSION

LIST OF SPECIES

Abrothallus bertianus de Not.

Specimen examined: Site 2, on *Melanelixia glabrata* on *Carpinus* (herb. VD 101).

In the forest-steppe zone, this species was only reported from the Lviv Oblast (Pirogov & Shovhan 2015).

Arthonia apotheciorum (A. Massal.) Almq. s.l.

Specimens examined: Site 3, on *Myriolecis albescens* and *M. semipallida* on concrete.

Arthonia apotheciorum s.l. (incl. *Arthonia galactinaria*) is a widespread species in Ukraine infecting calcicolous species of the *Myriolecis dispersa* complex (Darmostuk & Khodosovtsev 2017).

Arthonia phaeophysciae Grube & Matzer

Specimen examined: Site 1, on *Phaeophyscia orbicularis* on *Pyrus* (KHER 12547).

This species was known from a few localities in Ukraine (Darmostuk & Khodosovtsev 2017, Kapets & Kondratyuk 2019).

Athelia arachnoidea (Berk.) Jülich

Specimen examined: Site 3, on *Physcia adscendens* on *Malus*.

It is a widespread species in Ukraine.

Cladosporium licheniphilum Heuchert & U. Braun

Specimen examined: Site 1, on *Xanthoria parietina* on *Prunus* (KHER 12517).

Previously it was reported from Southern Ukraine (Khodosovtsev & Darmostuk 2016, Khodosovtsev et al. 2017a, Khodosovtsev et al. 2018, 2019).

Clypeococcum hypocenomycis D. Hawksw.

Specimens examined: Site 2, on *Hypocenomyce scalaris* on *Pinus* and *Larix* bark (KHER 12556).

It is a common species in the Ukrainian forest and forest-steppe zone (Darmostuk & Khodosovtsev 2017).

* ***Didymocyrtis foliaceiphila*** (Diederich, Kocourk. & Etayo) Ertz & Diederich
Specimen examined: Site 2, on *Punctelia subrudecta* on *Salix* (KHER 12571).

This species is common in Europe and can be distinguished from other 2-guttulate *Didymocyrtis* species by its very narrowly ellipsoid conidia (5.2)5.6–7.4(7.6) × (2.0)2.4–2.6(3.2) μm (n = 30), length/width ratio (2.0)2.3–3.0(3.4). The specimen examined fits well to the concept of *D. foliaceiphila* by morphological features. It was described on *Cladonia* spp., but also reported on *Parmelia* species (Ertz et al. 2015). *Punctelia subrudecta* is a new host species.

Erythricium aurantiacum (Lasch) D. Hawksw. & A. Henrici

Specimens examined: Site 3, on *Xanthoria parietina* on *Salix*. – Site 4, on *Physcia stellaris* on *Pyrus* (KHER 12537).

Henfellra muriformis Halıcı, D. Hawksw., Z. Kocakaya & Kocakaya

Fig. 1 A, B, C

Specimen examined: Site 3, on apothecia of *Lecania cyrtella* on *Armeniaca* bark (KHER 12529).

This species was known from Turkey and Southern Ukraine (Hawksworth et al. 2016, Darmostuk et al. 2018) on *Candelariella antennaria* and *Myriolecis hagenii*, respectively. Another lichenicolous fungus, *Dacampia cyrtellae*, was described as a holomorph from *Lecania cyrtella* (originally as *Dacampia lecaniae*; Brackel 2010). Its anamorph with muriform hyaline conidia (see protologue and Fig. 4C in the cited study) is very similar to *H. muriformis*. More samples and studies including molecular data are needed to elucidate possible identity of both fungi.

Illosporiopsis christiansenii (B.L. Brady & D. Hawksw.) D. Hawksw.

Specimens examined: Site 2, on *Physcia stellaris* on *Carpinus* (herb. VD 088). – Site 4, on *Physcia tenella* on *Pyrus* (KHER 12562).

Intralichen baccisporus D. Hawksw. & M.S. Cole

Specimen examined: Site 3, on *Calogaya decipiens* on concrete (herb. VD 032).

Intralichen christiansenii (D. Hawksw.) D. Hawksw. & M.S. Cole

Specimens examined: Site 1, on *Myriolecis hagenii* on wood (KHER 12544). – Site 3, on *Candelariella aurella* on concrete (herb. VD 017).

Laetisaria lichenicola Diederich, Lawrey & Van den Broeck

Specimen examined: Site 4, on *Physcia tenella* on *Pyrus*.

This species was reported in Ukraine only from Kherson Oblast (Khodosovtsev & Darmostuk 2017a, Khodosovtsev et al. 2017b). It is new to the forest-steppe zone of Ukraine.

Lichenochora obscuroides (Linds.) Triebel & Rambold

Specimens examined: Both specimens on thallus of *Phaeophyscia orbicularis*. Site 1, on *Populus* (KHER 12553). – Site 2, on *Salix* (KHER 12559).

It is a common species in the forest and forest-steppe zones (Kapets et al. 2015, Kapets & Kondratyuk 2019).

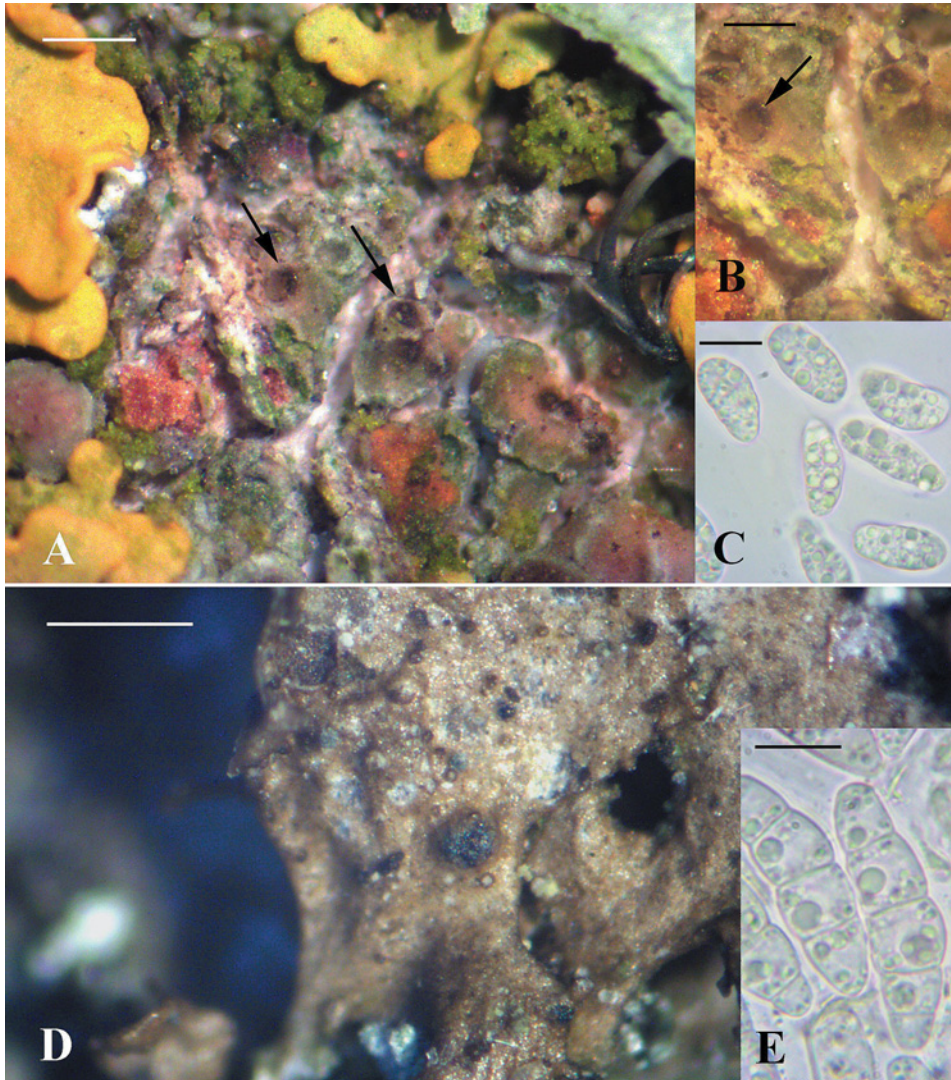


Fig. 1. *Henfellra muriformis* (KHER 12529): **A, B** – conidiomata on apothecia of *Lecania cyrtella* (arrows); **C** – conidia. *Stagonospora exasperatulae* (KHER 12558): **D** – conidiomata on thallus of *Melanohalea exasperatula*; **E** – conidia. Scale bars: **A, D** – 500 μm , **B** – 300 μm , **C, E** – 10 μm . Photos V. Darmostuk.

Lichenochora weillii (Werner) Hafellner & R. Sant.

Specimen examined: Site 1, on *Physconia grisea* on *Acer* (KHER 12528).

Lichenochora weillii was previously only known in the forest-steppe zone only from Kharkiv Oblast (Gromakova 2018).

Lichenonium erodens M.S. Christ. & D. Hawksw.

Specimen examined: Site 2, on *Hypogymnia physodes* on *Carpinus*.

Lichenonium lecanorae (Jaap) D. Hawksw.

Specimen examined: Site 4, on *Lecanora symmicta* on *Pyrus* (KHER 12535).

Lichenonium pyxidatae (Oudem.) Petr. & Syd.

Specimen examined: Site 3, on podecia of *Cladonia* sp. (herb. VD 007).

Recently, this fungus was also reported from a thallus of *Cladonia foliacea* in Southern Ukraine (Khodosovtsev 2011, Darmostuk 2019).

Marchandiomyces corallinus (Roberge) Diederich & D. Hawksw.

Specimens examined: Site 3, on *Phaeophyscia orbicularis* and *P. stellaris* on *Salix*.

Monodictys epilepraria Kukwa & Diederich

Specimen examined: Site 5, on *Lepraria* sp. on limestone (herb. VD 079).

The species was only reported from Zhytomyr Oblast and Zakarpattia Oblast (Darmostuk & Khodosovtsev 2017).

Pyrenochaeta xanthoriae Diederich

Specimens examined: All specimens on *Xanthoria parietina*. Site 1, on *Prunus* (KHER 12550). – Site 2, on *Salix* (KHER 12539). – Site 3, on *Populus* (herb. VD 096, 109).

Refractohilum intermedium Cl. Roux & Etayo

Specimen examined: Site 2, on *Pachyphiale carneola* on *Fraxinus* (herb. VD 105).

This inconspicuous fungus was previously reported from Crimea, Kherson Oblast and Sumy Oblast (Khodosovtsev & Darmostuk 2017b).

* ***Stagonospora exasperatulae*** Brackel Fig. 1 D, E

Specimen examined: Site 2, on *Melanohalea exasperatula* on *Salix* (KHER 12558).

Our specimen is characterised by black semi-immersed globous conidiomata up to 160 µm diam., spherical to ampule-shaped, hyaline, smooth, holoblastic conidiogenous cells (7.6)8.0–12.8(14.4) × (6.0)6.6–8.8(10.4) µm (n = 15) and hyaline ellipsoid, straight to slightly curved 1–3-septate conidia, constricted at the septa, (25.4)30.4–34.0(36.6) × (7.4)8.2–9.8(10.6) µm (n = 25), and fits well to the protologue (Brackel 2009). So far, it was only known from Germany (Brackel 2009, Zimmermann & Berger 2018).

Telogalla olivieri (Vouaux) Nik. Hoffm. & Hafellner

Specimens examined: Site 2, on *Xanthoria parietina* (herb. VD 082, 089).

This lichenicolous fungus was known from Ivano-Frankivsk Oblast (Navrotskaya et al. 1996) and erroneously reported from Kherson Oblast (Kondratyuk 1999). This record is the second one for Ukraine.

* ***Tremella everniae*** Diederich

Specimen examined: Site 2, on *Evernia prunastri* on *Salix* (KHER 12565).

This species is known from Canada, China (Diederich 1996), Italy (Brackel & Puntillo 2016), Russia (Zhurbenko 2012) and the USA (Diederich 2003, GBIF 2017).

***Taeniolella phaeophysciae* D. Hawksw.**

Specimen examined: Site 1, on *Phaeophyscia orbicularis* on *Acer* (KHER 12536).

***Taeniolella punctata* M.S. Christ. & D. Hawksw.**

Specimen examined: Site 5, on *Graphis scripta* on *Fagus* bark (herb. VD 033).

***Vouauxiella lichenicola* (Linds.) Petr. & Syd.**

Specimen examined: Site 2, on *Lecanora argentata* on *Salix* (KHER 12551).

***Xenonectriella leptaleae* (J. Steiner) Rossman & Lowen**

Specimen examined: Site 1, on *Physconia grisea* on *Carpinus* (KHER 12527).

SUMMARY

Including 29 species presented in this study, the total number of currently known lichenicolous fungi in Ternopil Oblast has increased to 48 species. *Didymocyrtis foliaceiphila*, *Stagonospora exasperatulae* and *Tremella everniae* are reported from Ukraine for the first time. *Cladosporium licheniphilum*, *Henfellra muriformis*, *Illosporiopsis christiansenii*, *Laetisaria lichenicola*, *Lichenocodium pyxidatae* and *Refractohilum intermedium* are new to the forest-steppe zone of Ukraine.

The species *Athelia arachnoidea*, *Erythrimum aurantiacum*, *Illosporiopsis christiansenii*, *Lichenocodium erodens* and *Lichenocodium lecanorae* are widespread in Ukraine and were frequently observed at the localities of the study area. Most species are common lichenicolous fungi in the forest and forest-steppe zones of Ukraine and occur mainly on corticolous lichens. These are *Abrothallus bertianus*, *Arthonia phaeophysciae*, *Clypeococcum hypocenomyces*, *Lichenochora weilii* and *Taeniolella punctata*. *Laetisaria lichenicola* and *Xenonectriella leptaleae* are probably also common species in Ukraine, but we need more data to verify this hypothesis.

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