Folia Cryptog. Estonica, Fasc. 60: 129–136 (2023)
https://doi.org/10.12697/fce.2023.60.12

Lichenicolous fungi of southern Scandinavia with particular reference to those associated with *Xanthoria calcicola* s. lat.

Serhii Y. Kondratyuk[1&2], Ave Suija[3], Ingvar Kärnefelt[4] & Arne Thell[4]

[1]M. H. Kholodny Institute of Botany, Tereshchenkivska str. 2, 01004 Kyiv, Ukraine
E-mail: ksya_net@ukr.net
[2]Molecular Cell Biology Unit, Lund University, Sölvegatan 35, 22362 Lund, Sweden
[3]Institute of Ecology and Earth Sciences, University of Tartu, Liivi street 2, 50409 Tartu, Estonia
E-mail: ave.suija@ut.ee
[4] Biological Museum, Lund University Box 117, SE-22100 Lund, Sweden
E-mails: ingvar.karnefelt@biol.lu.se, arne.thell@biol.lu.se

Abstract: Lichenicolous fungi associated with *Xanthoria calcicola* s. lat. are studied in southernmost Scandinavia, i.e., Skåne, the southernmost province in Sweden and southern Denmark. Two species, *Didymocyrtis slaptoensis* and *Pyrenochaeta xanthoriae,* are reported as new for the Nordic countries, whereas three species, *Didymocyrtis* cf. *consimilis, Erythricium aurantiacum,* and *Illosporiopsis christiansenii* are recorded for the first time from Skåne. New localities for rare lichenicolous fungi from southern Scandinavia and southernmost Denmark are also listed. Notes on the taxonomy and ecology of *Telogalla olivieri* and *Pyrenochaeta xanthoriae* are provided.

Keywords: *Didymocyrtis*, lichenicolous fungi, new species, *Pyrenochaeta*, *Telogalla*, *Xanthoria*, Sweden, Denmark

INTRODUCTION

Xanthoria (Teloschistaceae) is a genus of lichenized fungi with a worldwide distribution. Before the molecular era, this genus included c. 50 species (Kärnefelt, 1989), but today only 13 species remain in *Xanthoria* in the strict sense (Kondratyuk et al., 2022a). In the recent years knowledge of lichenicolous fungi associated with *Xanthoria* has increased considerably, and currently there are more than 40 lichenicolous species associated with *Xanthoria* s. lat. (Diederich et al., 2018; Tsurykau & Etayo, 2017; Suija et al., 2021).

When new material of the genus *Xanthoria* was collected in southernmost Scandinavia for a taxonomic revision, focus was shifted to the large number of different lichenicolous fungi inhabiting many of the thalli identified as *Xanthoria calcicola* s. lat., presently including three taxa, i.e., *X. calcicola* Oxner, *X. ectaneoides* (Nyl.) Zahlbr. and *X. aureola* (Ach.) Erichsen, which are nested in the *Xanthoria* s. str. clade (Kondratyuk et al., 2022a). Herewith, the first observations of the lichenicolous fungi associated with saxicolous specimens of *Xanthoria calcicola* s. lat. in southernmost Scandinavia, and during the field studies, several rare species and species with a poorly known distribution were identified.

MATERIAL & METHODS

All lichenicolous fungi associated with *Xanthoria calcicola* s. lat. were listed and studied at 37 localities in southernmost Scandinavia (Fig. 1, Table 1). All localities are open habitats (cemeteries, churchyards, etc.) potentially suitable for epilithic *X. calcicola* s. lat. A frequency study of the commonest species, *Telogalla olivieri*, was performed (Tables 1–2). The specimens were studied and determined microscopically at the unit of Molecular Cell Biology, Department of Biology, Lund University. A key to lichenicolous fungi growing on *Xanthoria* s. str. has earlier been presented by Tsurykau & Etayo (2017), but also keys of lichenicolous fungi growing on other genera were used (Hafellner et al., 2008; Etayo & Berger, 2009; Halici et al., 2009; Etayo et al., 2013; Berger et al., 2015; Khodosovtsev & Darmostuk, 2016). Local checklists of lichenicolous fungi were also consulted (Hafellner et al., 2008; Sparrius et al., 2016; Darmostuk & Khodosovtsev, 2017; Varga et al. 2021).

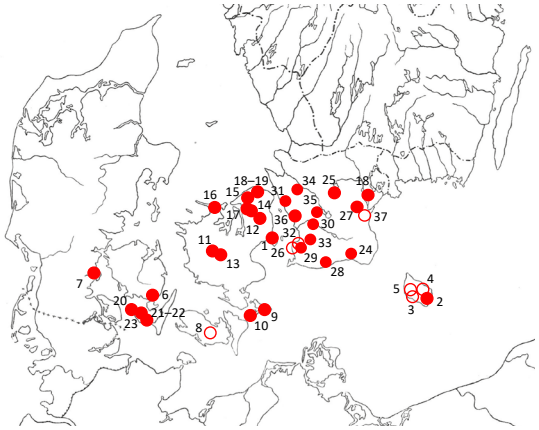

Fig. 1. Investigated sites with *Xanthoria calcicola* s. lat., most of them with lichenicolous fungi (filled circles) in southern Scandinavia.

RESULTS & DISCUSSION

The largest number of lichen specimens were collected at seven plots in Denmark (numbers 2, 12, 15, 19, 20, 21, 23), and four in Sweden (numbers 24, 27, 34, 37) (Table 1). No lichenicolous fungi were found at seven of the 37 investigated sites. Among the records, *Telogalla olivieri* was the commonest lichenicolous fungus found at 28 sites, and at 13 sites, it was the single lichenicolous fungus recorded. The number of species of lichenicolous fungi found per site varied between one and nine (Table 1).

Within this study, eleven species of lichenicolouos fungi were found associated with epilithic *Xanthoria* in southern Scandinavia (Table 2). Two species, *Didymocyrtis slaptoensis* and *Pyrenochaeta xanthoriae* were recorded for the first time in the Nordic countries, and three species, *Didymocyrtis* cf. *consimilis, Erythricium aurantiacum* and *Illosporiopsis christiansenii* were reported for the first time from the province Skåne, southernmost Sweden.

Three species, i.e., *Athelia arachnoidea*, *Pyrenochaeta xanthoriae* and *Telogalla olivieri* were the most abundant, often killing the host thalli (Table 2). However, *Athelia arachnoidea* and *Pyrenochaeta xanthoriae* were registered at four and three sites respectively. *Didymocyrtis* cf. *consimilis*, *Phoma* sp. and *Tremella caloplacae* were registered at a single locality each (Table 2). *Telogalla olivieri* is the commonest species in southern Scandinavia; found on 301 of 1185 studied specimens of epilithic lichens of the genus *Xanthoria*, although it was not the target of the collection (Table 1).

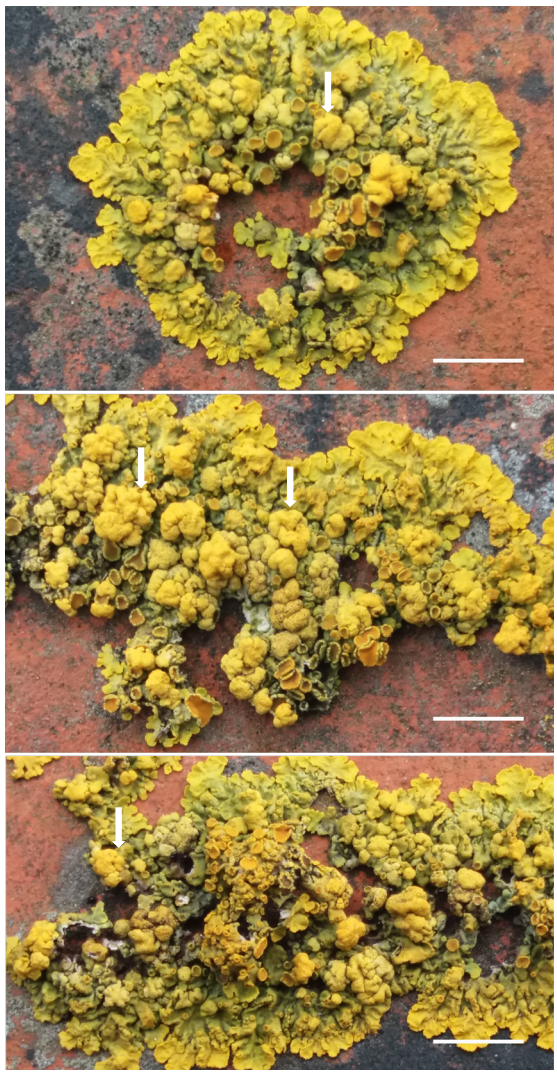

Fig. 2. *Telogalla olivieri* on *Xanthoria* aff. *ectaneoides*, Søborg church, 16.04.2023, lichenicolous fungus infecting especially central portion of host thallus (field photos). Scale 1 cm.

Pyrenochaeta xanthoriae and *Telogalla olivieri* cause a similar destroying effect on the host lichen *Xanthoria* aff. *ectaneoides*. When the parasite is abundant in central parts, most of the lichen may be destroyed (Figs. 2–4). Lichen thalli may appear as incomplete circles

Table 1. List of localities of investigated epilithic communities of *Xanthoria calcicola* s. lat. The number of specimens collected and infected by lichenicolous fungi are indicated.

No	Locality	Date	Position	Number of specimens collected	Number of specimens with *Telogalla olivieri*	Other lichenicolous fungi (Table 2)
1	DENMARK. Amager. Tårnby par., the church, on tiles of cemetery wall.	13.08.2023	55.6280°N 12.6028°E	35	1	8, 11
2	Bornholm. Nexø par. On stone fence in the town.	28.10.2022	55.0629°N 15.1250°E	56	13	2, 5
3	Nylars par., the church. On stone fence.	28.10.2022	55.0724°N 14.8100°E	11	-	-
4	Østerlars par., the church. On stone fence.	29.10.2022	55.1648°N 14.9656°E	2	-	-
5	Nyker par., the church. On stone fence.	29.10.2022	55.1396°N 14.7595°E	11	-	-
6	Fyn: Svendborg Landevej, on concrete.	28.05.2023	55.1860°N 10.7330°E	44	11	-
7	Jutland: Haderslev, the old church. On tiles of cemetery wall.	1.07.2023	55.2501°N 9.4891°E	33	5	4, 10
8	Lolland. Bursø par., Naturskolen. On granitic rocks.	11.10.2022	54.7567°N 11.4893°E	5	-	-
9	Møn. Borre par., the church. On tiles of cemetery wall.	22.09.2022	54.9959°N 12.4432°E	6	2	-
10	Fanefjord par., the church. On tiles of cemetery wall.	11.10.2022	54.9013°N 12.1511°E	23	4	-
11	Zealand. Bjernede par., the church. On tiles of cemetery wall.	26.05.2023	55.462°N 11.625°E	22	3	-
12	Farum par., the church. On tiles of cemetery wall.	4.02.2023	55.8070°N 12.3573°E	54	12	1, 6, 11
13	Fjenneslev par., the church. On tiles of cemetery wall.	26.05.2023	55.4336°N 11.6875°E	22	8	-
14	Gørløse par., the church. On tiles of cemetery wall.	3.12.2022	55.8853°N 12.1991°E	22	-	3
15	Helsinge par., the church. On tiles of cemetery wall.	26.03.2023	56.0208°N 12.1969°E	170	15	1, 2, 4, 5, 7, 8, 10, 11
16	Højby par., the church. On tiles of cemetery wall.	25.06.2023	55.9128°N 11.5996°E	15	4	-
17	Slangerup par. SE edge of Lystrup forest. On tile roof.	3.12.2022	55.8536°N 12.1968°E	4	-	4
18	Søborg par., castle ruins, on modern brick inclusions.	16.04.2023	56.0906°N 12.3097°E	45	31	8
19	Søborg par., the church. On tiles of cemetery wall.	16.04.2023	56.0861°N 12.5120°E	70	37	8
20	Ærø. Søby par. church. On tiles of cemetery wall.	26.05.2023	54.9386°N 10.2568°E	55	38	-
21	Marstal par., the church in town. On tiles of cemetery wall.	26.05.2023	54.8550°N 10.5170°E	59	22	8
22	Marstal par., Ommel church, on tile roof.	27.05.2023	54.8646°N 10.4891°E	17	3	2, 8
23	Ærøskøbing par., the church. On tiles of cemetery wall.	26.05.2023	54.8879°N 10.4122°E	71	43	8
24	SWEDEN. Skåne. Bromma par., the church. On stone fence.	28.09.2022	55.4707°N 13.8001°E	34	6	-
25	Brönnestad par., Hovdala castle. On granitic rocks.	26.08.2022	56.1040°N 13.7138°E	10	2	-
26	Bunkeflo par., Lernacken, on granitic rocks.	12.07.2022	55.5541°N 12.9191°E	13	-	-
27	Everöd par., the church. On tiles of cemetery wall.	4.03.2023	55.9018°N 14.0730°E	64	3	1, 2, 5, 6, 8, 11,
28	Gislöv par., Gislövsläge, on coastal granitic wall.	6.09.2022	55.3567°N 13.2369°E	20	3	10
29	Husie par., the former LV4 military area. On cement.	27.08.2022	55.5773°N 13.0840°E	6	5	7

No	Locality	Date	Position	Number of specimens collected	Number of specimens with *Telogalla olivieri*	Other lichenicolous fungi (Table 2)
30	Igelösa par., the church. On tiles of cemetery wall.	11.05.2023	55.7631°N 13.2744°E	16	1	-
31	Kvistofta par., Rydebäck, on granitic rocks.	12.08.2022	55.9655°N 12.7722°E	6	1	-
32	Malmö, Västra Hamnen, on granitic rocks.	16.08.2022	55.6133°N 12.9813°E	14	-	-
33	Mölleberga par., the church. On tiles of cemetery wall.	11.05.2023	55.6085°N 13.1770°E	14	1	-
34	Norra Vram par., the church. On tiles of cemetary wall.	12.11.2022	56.0870°N 12.9734°E	15	5	2
35	Stehag par., Stehag, Rapsvägen 3, on tile roof.	30.06.2022–25.07.2023	55.9009°N 13.3948°E	45	5	2, 5, 11
36	Tofta par., the church. On tiles of cemetery wall.	2.04.2023	56.8669°N 12.9262°E	75	18	1, 2, 5, 6, 8, 11
37	Vittskövle par., the castle, on stone bridge.	26.07.2022	55.8549°N 14.1336°E	2	-	-

Table 2. Lichenicolous fungi associated with epilithic *Xanthoria calcicola* s. lat. species in southern Scandinavia, their distribution and frequency. Frequency: 1 – presence only as single ascoma or conidioma, 2 – rather common, 3 – abundant.

	Species	Localities (Table 1)	Frequency
1	*Athelia arachnoides* (Berk.) Jülich	12, 15, 27, 37	3
2	*Bryostigma parietinarium* (Hafellner & A.Fleischhacker) S.Y.Kondr. & Hur	2, 15, 22, 27, 34, 37	2
3	*Didymocyrtis cf, consimilis* Vain.	14	1
4	*Didymocyrtis slaptoensis* (D.Hawksw.) Hafellner & Ertz	7, 15, 17	1
5	*Erythricium aurantiacum* (Lasch) D.Hawksw. & A.Henrici	2, 15, 27, 34, 37	2
6	*Illosporiopsis christiansenii* (B.L.Brady & D.Hawksw.) D.Hawksw.	12, 27, 37	1
7	*Phoma* sp.	15, 29	1
8	*Pyrenochaeta xanthoriae* Diederich	1, 15, 18, 19, 21–23, 27, 37	3
9	*Telogalla olivieri* (Vouaux) Nik. Hoffm. & Hafellner	1–2, 6–7, 9–13, 15–16, 18–25, 27–31, 33–34, 36–37	3
10	*Tremella caloplacae* (Zahlbr.) Diederich	7, 15, 28	1
11	*Xanthoriicola physciae* (Kalchbr.) D.Hawksw.	1, 12, 15, 27, 34, 37	2

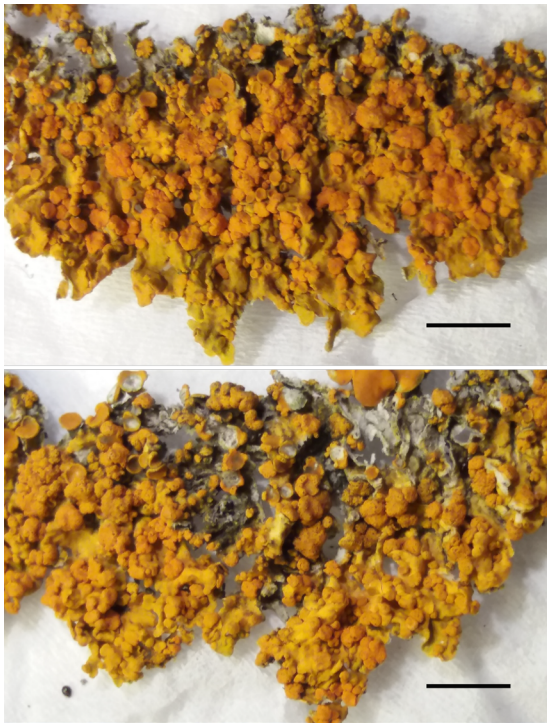

Fig. 3. *Telogalla olivieri* on *Xanthoria* aff. *ectaneoides*, Nexø, 28.10.2022, lichenicolous fungus infecting the whole host thallus. Scale 1 cm.

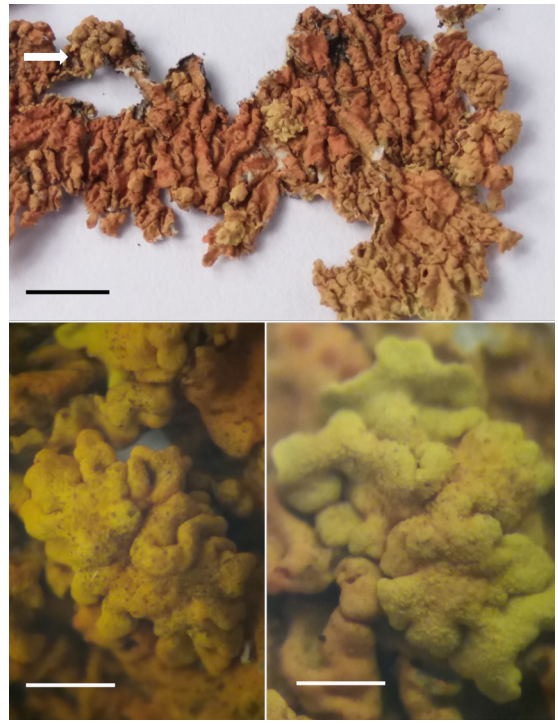

Fig. 4. *Telogalla olivieri* on *Xanthoria* aff. *ectaneoides*, Fanefjord, 11.10.2022, general view of host thallus fragment (upper, scale 1 cm) and enlarged galls (lower, scale 1 mm).

with healthy peripheral zones but destroyed centres. Such thalli remind of the Euroasian species *Kudratoviella anularis* (Clauzade & Poelt) S.Y.Kondr., L.Lőkös, I.Kärnefelt & A.Thell (Kondratyuk et al., 2022b). In addition, moss mites were frequently found in lichens damaged or killed by *Telogalla olivieri*. Gall formations of the host probably offer additional protection for moss mites. In the autumn and winter of 2022 most lichen thalli of *Xanthoria calcicola* s. lat. were almost completely eaten by moss mites at several localities.

Notes on the lichenicolous fungi found on *Xanthoria calcicola* s. lat. in southern Scandinavia

Athelia arachnoidea (Berk.) Jülich
New localities within Skåne and Denmark are found for this rather common, occasionally lichenicolous fungus known for its broad spectrum of lichen hosts. The species was particularly abundant at four localities (2, 15, 27 and 37, Table 1) where most of the hosts were killed.

Bryostigma parietinarium (Hafellner & A. Fleischhacker) S.Y. Kondr. & Hur
New localities in Skåne and Denmark are reported for this rather common lichenicolous fungus. It was earlier known from Denmark (Alstrup, 1993; Fleischhacker et al., 2016), and from a single locality in Skåne (Westberg et al., 2023). It is found not only on saxicolous hosts but is also common on epiphytic *Xanthoria* specimens. *Bryostigma parietinarium* was very frequent at four localities (1, 15, 27 and 37, Table 1) where the hosts were killed.

There are four species of Arthoniaceae inhabiting the genus *Xanthoria*, of which *Bryostigma parietinarium* growing on *Xanthoria parietina* and *B. molendoi* growing on the *Rusavskia elegans* and *Calogaya saxicola* groups are the commonest (Fleischhacker et al. 2016). The main differences between these two species are

the colour of ascomata, pigmentation of the ascomatal section and the number of ascomata per infection spot (Fig. 5). The characters of our investigated specimens fit the description of *B. parietinarium* compared to *B. molendoi* even if the former is commoner on epiphytic species.

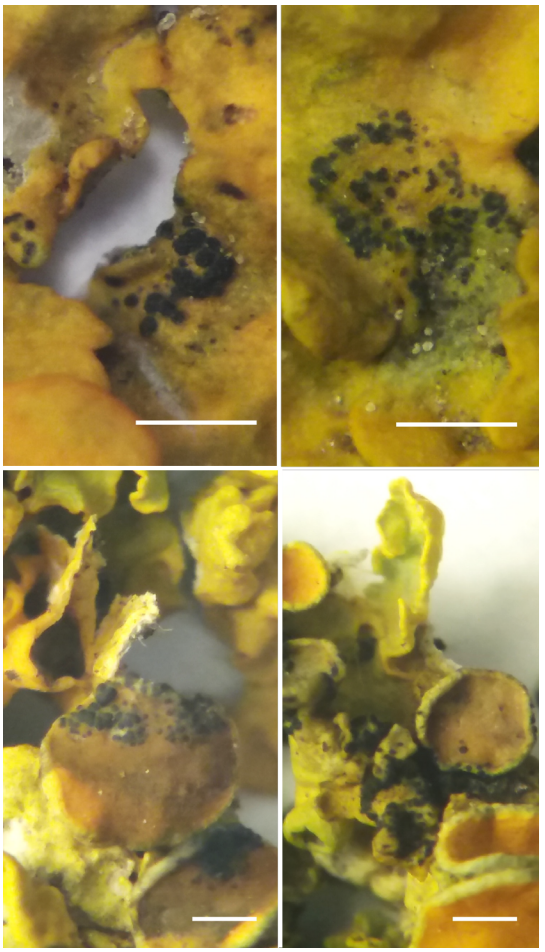

Fig. 5. *Bryostigma parietinarium* on *Xanthoria* aff. *ectaneoides*, Ommel, 27.05.2023 (the upper row), Tofta, 2.04.2023 (the lower row). Scale 2 mm.

DIDYMOCYRTIS SLAPTONENSIS (D. Hawksw.) Hafellner & Ertz
New to the Nordic countries. The specimen has *Phoma*-like conidiomata with rather long ellipsoid conidia measuring 5–7 x 2–3 µm.

DIDYMOCYRTIS CF. CONSIMILIS
This taxon is reported as new to Skåne. It was earlier known only from the northernmost province of Sweden, Torne Lappmark (Westberg et al., 2021). *Didymocyrtis* cf. *consimilis* is usually collected along with the *Caloplaca cerina* group, however, specimens with almost identical ITS sequences and similar spore size are growing on rather distantly related hosts (Ertz et al., 2015), explaining the use of the name cf. *consimilis* for this *Phoma*-like fungus which is characterized by almost spherical conidia, 3–5 µm diam.

ERYTHRICIUM AURANTIACUM (Lasch) D. Hawksw. & A. Henrici
This species is here reported as new to Skåne, earlier known from the Swedish provinces Östergötland, Södermanland, and Uppland (Westberg et al., 2021) and from Denmark (Motiejûnaitë & Grochowski, 2014).

ILLOSPORIOPSIS CHRISTIANSENII (B.L. Brady & D. Hawksw.) D. Hawksw.
This species is here reported as new to Skåne, earlier known from the Swedish provinces Småland, Öland, Östergötland, Södermanland, Uppland, Jämtland and Norrbotten (Kärnefelt et al. 2014; Westberg et al., 2021), and from Bornholm, Denmark (Wieczorek et al., 2017).

PYRENOCHAETA XANTHORIAE Diederich
The species is new to Nordic countries. This parasitic fungus proved to be very common in Helsinge (Zealand) and Marstal (Ærø) in Denmark. At the latter locality, *P. xanthoriae* was even more frequent than *Telogalla olivieri*. In general, *Pyrenochaeta xanthoriae* is rather rare on epilithic thalli of *Xanthoria calcicola* s. lat. compared with epiphytic specimens of *X. parietina* s. lat. in southernmost Scandinavia. *Pyrenochaeta xanthoriae* is rather rare on the thalli investigated within this study, usually present as a single ascoma or conidioma among other lichenicolous fungi, e.g., *Xanthoriicola physciae, Telogalla olivieri* and *Bryostigma parietinarium*.

TELOGALLA OLIVIERI (Vouaux) Nik. Hoffm. & Hafellner
The lichenicolous genus *Telogalla*, characterized by inducing irregular galls with immersed perithecia and conidiomata, includes two species; *Telogalla olivieri* and *T. cajasensis* Etayo, inhabiting *Xanthoria parietina* s. lat. and the genus *Leptogium* respectively (Hoffman & Hafellner, 2000; Etayo, 2017). No molecular data are hitherto available for these two lichenicolous fungi in public DNA databases.

XANTHORIICOLA PHYSCIAE (Kalchbr.) D. Hawksw. New localities within Skåne and Denmark are reported for this rather common hyphomycetous lichenicolous fungus that inhabits fruiting bodies of *Xanthoria* (Motiejûnaitë & Grochowski, 2014). *Xanthoriicola physciae* was particularly abundant, killing the hosts at six localities, i.e., 3, 12, 15, 27, 31 and 37 (Table 1).

CONCLUSIONS

Eleven species of lichenicolous fungi were found on thalli of *Xanthoria calcicola* s. lat. in southern Scandinavia. Two of them, *Didymocyrtis slaptoensis* and *Pyrenochaeta xanthoriae*, are new for the Nordic region, while three are new for the province of Skåne. This study is a first contribution to a better knowledge of diversity and distribution for this still overlooked group of organisms.

ACKNOWLEDGEMENTS

This study is dedicated to Associate Professor Tiina Randlane, Tartu University, on the occasion of her birthday. Tiina has been a valued colleague and dear friend of ours for more than three decades.

SK is grateful to Dr J. K. Abbott, Head of the Department of Biology, and to Prof. Mats Hansson, Head of the Molecular Cell Biology Unit at Lund University for generous support, and to Drs Arne Thell and Nataliya Thell, Lund University, for all help in connection with the evacuation of the family from Ukraine. Thanks are due to Elisabeth Gauger Nilsson, Lars Fredriksson, David Stuart and Shakhira Zakhrabekova at the Molecular Cell Biology Unit of Lund University for assistance, and to Christoffer Fägerström, Biological Museum of Lund University, for identifying moss mites living on/in lichens of the genus *Xanthoria*. Prof. Mark R. D. Seaward, University of Bradford, is warmly thanked for a thorough revision of the text.

This work was supported by a grant from the Ove Almborn Foundation, Lund University, for AT, the Wenner-Gren Stiftelserna (Wenner-Gren Foundations, Sweden) for SK, and by an Estonian Research Council grant (PRG1170) for AS.

REFENRENCES

Alstrup, V. 1993. News on lichens and lichenicolous fungi from the Nordic countries. *Graphis Scripta* 5(2): 96–104.

Berger, F., Braun, U. & Heuchert, B. 2015. *Gonatophragmium lichenophilum* sp. nov. – a new lichenicolous hyphomycete from Austria. *Mycobiota* 5: 7–13.

Darmostuk, V. V. & Khodosovtsev, A. Y. 2017. Lichenicolous fungi of Ukraine: an annotated checklist. *Studies in Fungi* 2(1): 138–156.

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(3): 340–425. https://doi.org/10.1639/0007-2745-121.3.340

Ertz, D., Diederich, P., Lawrey, J. D., Berger, F., Freebury, C. E., Coppins, B., Gardiennet, A. & Hafellner, J. 2015. Phylogenetic insights resolve Dacampiaceae (Pleosporales) as polyphyletic: *Didymocyrtis* (Pleosporales, Phaeosphaeriaceae) with *Phoma*-like anamorphs resurrected and segregated from *Polycoccum* (Trypetheliales, Polycoccaceae fam. nov.). *Fungal Diversity* 74: 53–89. https://doi.org/10.1007/s13225-015-0345-6

Etayo, J. & Berger, F. 2009. About a fast developing community of lichenicolous deuteromycetes decaying *Xanthoria parietina*. *Österreichische Zeitschrift für Pilzkunde* 18: 111–115.

Etayo, J. 2017. Lichenicolous fungi of Ecuador [Hongos liquenícolas de Ecuador]. *Opera Lilloana* 50: 1–535

Etayo, J., Flakus, A., Kukwa, M. & Rodriguez-Flakus, P. 2013. *Lichenochora tertia* (Phyllachorales): the third species of the genus growing on *Xanthoria elegans*. *Mycotaxon* 123: 9–13.

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(11): 1341–1353. https://doi.org/10.1016/j.funbio.2016.06.009

Hafellner, J., Herzog, G. & Mayrhofer, H. 2008. Zur Diversität von lichenisierten und lichenicolen Pilzen in den Ennstaler Alpen (Österreich: Steiermark, Oberösterreich). *Mitteilungen der Naturwissenschaftlichen Vereines für Steiermark* 137: 131–204.

Halıcı, M. G., Knudsen, K., Candan, M. & Türk, A. 2009. A new species of *Polycoccum* (Dothideales, Dacampiaceae) from Turkey. *Nova Hedwigia* 89(3–4): 431–436.

Hoffmann, N. & Hafellner, J. 2000. Eine Revision der lichenicolen Arten der Sammelgattungen *Guignardia* und *Physalospora* (Ascomycotina). *Bibliotheca Lichenologica* 77. 181 pp.

Khodosovtsev, A. Y. & Darmostuk, V. V. 2016. *Pleospora xanthoriae* sp. nov. (Pleosporaceae, Pleosporales), a new lichenicolous fungus on *Xanthoria parietina* from Ukraine, with a key to the known

lichenicolous species of *Dacampia* and *Pleospora*. *Opuscula Philolichenum* 15: 6–10.

Kondratyuk, S. Y., Popova, L. P., Kondratiuk, A. S. & Lőkös, L. 2022a. The first enumeration of members of the Teloschistaceae (lichen-forming Ascomycetes) status of which confirmed by three gene phylogeny. *Studia Botanica Hungarica* 53(2): 137–234.

Kondratyuk, S. Y., Persson, P.-E., Hansson, M., Lőkös, L., Kondratiuk, A. S., Fayyaz, I., Kouser, R., Afshan, N. S., Niazi, A. R., Zulfiqar, R., Khalid, A. N., Kärnefelt, I., Farkas, E., Hur, J.-S. & Thell, A. 2022b. Contributions to molecular phylogeny of lichens 4. New names in the Teloschistaceae. *Acta Botanica Hungarica* 64(3–4): 313–336. https://doi.org/10.1556/034.64.2022.3-4.7

Kärnefelt, I. 1989. Morphology and phylogeny in the Teloschistales. *Cryptogamic Botany* 1: 147–203.

Kärnefelt, I., Arup, U., Arvidsson, L., Bendiksby, M., J., Båtvik, I., Feuerer, T., Galloway, D. J., Haugan R., Klepsland, J. T., Kukwa, M., Larsson, U., Launis, A., Millanes, A. M., Prieto, M., Pykälä, J., Seaward, M. R. D., Thell, A., Timdal, E, Tsurykau, A., Wall, S. & Westberg, M. 2014. Lichens from the Vadstena Monastery churchyard – the burial place of Erik Acharius. *Graphis Scripta* 26(1–2): 34–39.

Motiejûnaitë, J. & Grochowski, P. 2014. Miscellaneous new records of lichens and lichenicolous fungi. *Herzogia* 27(1): 193–198. https://doi.org/10.13158/heia.27.1.2014.193

Sparrius, L. B., van der Kolk, H., Aptroot, A., van der Pluijm, A. & van Dort, K. W. 2016. Nieuwe vindplaatsen van zeldzame korstmossen en lichenparasieten in de periode 2012 t/m medio 2016. *Buxbaumiella* 107: 15–37.

Suija, A., Delhoume, A., Poumarat, S. & Diederich, P. 2021. *Didymocyrtis microxanthoriae* (Phaeosphaeriaceae, Dothideomycetes), a new lichenicolous fungus from France. *Bulletin de la Société des naturalistes luxembourgeois* 123: 129–136.

Tsurykau, A. & Etayo, J. 2017. *Capronia suijae* (Herpotrichiellaceae, Eurotiomycetes), a new fungus on *Xanthoria parietina* from Belarus, with a key to the lichenicolous species growing on *Xanthoria* s. str. *The Lichenologist* 49(1): 1–12.

Varga, N., Lőkös, L. & Farkas, E. 2021. Annotated Checklist of the Lichenicolous Fungi of Hungary. *Diversity* 13: 557. https://doi.org/10.3390/d13110557

Westberg, M., Hammarström, O., Isaksson, R., Johansson, P., Thor, G., Vicente, R. & Svensson, M. 2023. Additions to the flora of lichenicolous fungi of Sweden. *Graphis Scripta* 35(2): 4–13. https://nhm2.uio.no/botanisk/lav/Graphis/35_2/GS_35_4.pd

Westberg, M., Moberg, R., Myrdal, M., Nordin A. & Ekman, S. 2021. Santesson's Checklist of Fennoskandian Lichen-Forming and Lichenicolous Fungi. Uppsala University: Museum of Evolution. 933 p.

Wieczorek, A., Łysko, A., Popiela, A. & Śliwa, L. 2017 Additions to the flora of lichenized and lichenicolous fungi of Bornholm (Denmark) [Ergänzungen zur Flora der lichenisierten und lichenicolen Pilze von Bornholm (Dänemark)]. *Herzogia* 30(1): 304–308. https://doi.org/10.13158/heia.30.1.2017.304