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New records of lichens and lichenicolous fungi from Latvia, with a list of lichenicolous fungi reported from Latvia

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Four species of lichen-forming fungi (*Calicium pinastri*, *Chaenotheca laevigata*, *Lecania croatica* and *Pycnora praestabilis*) and two lichenicolous fungi (*Arthrorhaphis aeruginosa* and *Chaenothecopsis epithallina*) are reported as new for Latvia. The first comprehensive list of lichenicolous fungi in Latvia is also presented, including their hosts and distribution in Latvia (northern Europe).

Keywords: Baltic countries, distribution, lichenized fungi

Our knowledge of the lichens and allied fungi in Latvia (northern Europe) has been considerably advanced in recent years. Currently ca 640 taxa of lichenized fungi are recorded for Latvia (Āboliņa et al 2015, Moisejevs 2015, 2017, Motiejūnaitė et al. 2016, Moisejevs and Degtjarenko 2017), which is comparable to the 620 taxa known from the geographically similar territory of Lithuania (Motiejūnaitė 2017).

Lichenicolous fungi, on the other hand, have been understudied in Latvia. The first mention of lichenicolous species can be found in the paper by Mereschkowski (1913), who reported *Acolium sessile* from Jaunugulbene (Vidzeme). Later, *Diploschistes muscorum* was reported from the Gauja river valley and Riga city environs (Malta 1926, Vimba 1971). During the 13th International Symposium of Lichenologists and Mycologists of the Baltic States, two more species of lichenicolous fungi were reported (Motiejūnaitė and Piterāns 1998); a further four species were reported in the first annotated Latvian checklist of lichens (Piterāns 2001) and 16 more were added by Motiejūnaitė et al. (2006), Czarnota and Kukwa (2010) and Motiejūnaitė and Grochowski (2014). The second annotated checklist of lichens listed 15 lichenicolous taxa as supplementary data (Āboliņa et al. 2015). Further contribution was made by Motiejūnaitė et al. (2016), with 33 lichenicolous fungi reported for the first time from Latvia, complemented by the paper of Moisejevs (2017). Since a full and up-to-date list of lichenicolous fungi for Latvia is still lacking, a comprehensive list is provided here.

The current paper reports four new species of lichen-forming and two lichenicolous fungi new to Latvia, together with a list of lichenicolous fungi (61 taxa) known for Latvia, including their hosts and distribution data in the country (Table 1).

Material and methods

The material was determined by means of routine lichenological methods (Smith et al. 2009). Spot-tests were determined with 10% KOH (K), sodium hypochlorite (C), paraphenylenediamine in ethanol (Pd) and Lugol's solution (I), and secondary chemistry by thin layer chromatography (TLC) using solvent C (Orange et al. 2001). Specimens of the newly recorded species, according to the nomenclature of Wirth et al. (2010), are kept in the lichenological herbarium of University of Daugavpils (DAU).

The list of lichenicolous fungi presented below is a combination of published literature data and herbarium collections from DAU and the University of Latvia (RIG), together with those species reported in the current paper. Data on species distribution are derived from literature sources and herbarium collections (DAU and RIG). Regions of Latvia (Fig. 1) are abbreviated in the list as follows: K – Kurzeme (Kurland), V – Vidzeme, L – Latgale, R – Pieriga, Z – Zemgale, LV – all regions of Latvia; # = lichenicolous fungus.

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Table 1. The list of lichenicolous fungi known from Latvia, their distribution and hosts known in the country and the references that mention the species. For the abbreviations see Fig. 1.

S. No.	Species	Host(s)	Distribution	Reference(s)
1.	*Acolium sessile* (Pers.) Arnold.	*Pertusaria* sp.	K, V	Mereschkowski 1913, Piterāns 1982, 2001, Āboliņa et al. 2015
2.	*Arthonia epiphyscia* Nyl.	*Physcia aipolia*	K	Motiejūnaitė et al. 2016
3.	*Arthonia parietinaria* Hafellner & A.Fleischhacker	*Xanthoria parietina*	K	Motiejūnaitė et al. 2016 (as *Arthonia molendoi* (Heufl. ex Frauenf.) R.Sant.)
4.	*Arthrorhaphis aeruginosa* R.Sant. & Tønsberg	*Cladonia* sp.	L	This paper
5.	*Bachmanniomyces punctum* (A. Massal.) Diederich & Pino-Bodas	*Cladonia digitata*, *C. macilenta*	K	Motiejūnaitė et al. 2016
6.	*Biatoropsis usnearum* Räsänen	*Usnea subfloridana*	V, K	Motiejūnaitė et al. 2006, Āboliņa et al. 2015, DAU Herbarium
7.	*Briancoppinsia cytospora* (Vouaux) Diederich et al.	*Evernia prunastri*, *Melanelixia subaurifera*	K, V	Czarnota and Kukwa 2010, Āboliņa et al. 2015, Motiejūnaitė et al. 2016
8.	*Chaenothecopsis consociata* (Nádv.) A.F.W.Schmidt	*Chaenotheca chrysocephala*	LV	Piterāns 2001
9.	*Chaenothecopsis epithallina* Tibell	*Chanotheca trichialis*	K	This paper
10.	*Chaenothecopsis pusilla* (A.Massal.) A.F.W.Schmidt	*Chaenotheca* sp.	LV	Piterāns 2001
11.	*Clypeococcum cetrariae* Hafellner	*Cetraria islandica*	V	Motiejūnaitė and Piterāns 1998
12.	*Clypeococcum hypocenomycis* D.Hawksw.	*Hypocenomyce scalaris*	LV	Moisejevs 2017
13.	*Corticifraga fuckelii* (Rehm) D.Hawksw. & R.Sant.	*Peltigera neckeri*	K	Motiejūnaitė et al. 2016
14.	*Didymocyrtis epiphyscia* Ertz & Diederich	*Xanthoria parietina*	K	Motiejūnaitė et al. 2016
15.	*Didymocyrtis pseudeverniae* (Etayo & Diederich) Ertz & Diederich	*Pseudevernia furfuracea*	V	Motiejūnaitė and Grochowski 2014, Āboliņa et al. 2015
16.	*Didymocyrtis ramalinae* (Roberge ex Desm.) Ertz, Diederich & Hafellner	*Ramalina fraxinea*	LV	Motiejūnaitė et al. 2016
17.	*Diploschistes muscorum* (Scop.) R.Sant.	*Cladonia* sp.	K, V	Malta 1926, Vimba 1971, Piterāns 1982, 2001
18.	*Ellisembia lichenicola* Heuchert & U.Braun	*Ramalina fraxinea*	K	Motiejūnaitė et al. 2016
19.	*Epicladonia sandstedei* (Zopf) D.Hawksw.	*Cladonia coniocraea*	K	Motiejūnaitė et al. 2016
20.	*Erythricium aurantiacum* (Lasch) D.Hawksw. & A.Henrici	*Physcia* spp.	K	Motiejūnaitė et al. 2016
21.	*Graphium aphthosae* Alstrup & D. Hawksw.	*Peltigera neckeri*	K	Motiejūnaitė et al. 2016
22.	*Heterocephalacria physciacearum* (Diederich) Millanes & Wedin	*Physcia* spp.	K	Czarnota and Kukwa 2010, Āboliņa et al. 2015, Motiejūnaitė et al. 2016
23.	*Homostegia piggotii* (Berk. & Broome) P.Karst.	*Parmelia submontana*	K	Motiejūnaitė et al. 2016
24.	*Illosporiopsis christiansenii* (B.L.Brady & D.Hawksw.) D.Hawksw.	*Physcia* spp., *Xanthoria parietina*	LV	Piterāns 2001, Czarnota and Kukwa 2010
25.	*Lichenochora obscuroides* (Linds.) Triebel & Rambold	*Phaeophyscia orbicularis*	K	Motiejūnaitė et al. 2016
26.	*Lichenochora weillii* (Werner) Hafellner & R. Sant.	*Physconia enteroxantha*	K	Motiejūnaitė et al. 2016
27.	*Lichenoconium erodens* M.S.Christ. & D.Hawksw.	*Evernia prunastri*, *Hypogymnia physodes*, *Parmeliopsis ambigua*, *Ramalina fraxinea*	LV	Motiejūnaitė et al. 2006, Āboliņa et al. 2015, Motiejūnaitė et al. 2016
28.	*Lichenoconium lecanorae* (Jaap) D.Hawksw.	*Evernia prunastri*	K	Motiejūnaitė et al. 2016
29.	*Lichenoconium pyxidatae* (Oudem.) Petr. & Syd.	*Cladonia chlorophaea*	K	Motiejūnaitė et al. 2016
30.	*Lichenoconium usneae* (Anzi) D.Hawksw.	*Evernia prunastri*	K	Motiejūnaitė et al. 2016
31.	*Lichenoconium xanthoriae* M.S.Christ.	*Xanthoria parietina*	LV	Motiejūnaitė et al. 2016
32.	*Lichenodiplis lecanorae* (Vouaux) Dyko & D.Hawksw.	*Caloplaca* sp., *Myriolecis* aff. *hagenii*	K, L	Motiejūnaitė et al. 2016
33.	*Lichenosticta alcicornaria* (Linds.) D.Hawksw.	*Cladonia coniocraea*, *C. macilenta*, *C. ochrochlora*	K, L	Czarnota and Kukwa 2010, Āboliņa et al. 2015, Motiejūnaitė et al. 2016

(*Continued*)

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Table 1. Continued

S. No.	Species	Host(s)	Distribution	Reference(s)
34.	*Marchandiomyces corallinus* (Roberge) Diederich & D.Hawksw.	*Physcia tenella*	K	Motiejūnaitė et al. 2016
35.	*Monodictys epilepraria* Kukwa & Diederich	*Lepraria* spp.	K	Czarnota and Kukwa 2010, Āboliņa et al. 2015, Motiejūnaitė et al. 2016
36.	*Muellerella hospitans* Stizenb.	*Bacidia rubella*	L, V	Czarnota and Kukwa 2010, Āboliņa et al. 2015
37.	*Microcalicium disseminatum* (Ach.) Vain.	*Chaenotheca* sp.	LV	Moisejevs 2015, DAU Herbarium
38.	*Nectriopsis lecanodes* (Ces.) Diederich & Schroers	*Peltigera canina*, *Peltigera rufescens*	LV	Motiejūnaitė et al. 2006, Āboliņa et al. 2015, RIGG Herbarium
39.	*Nectriopsis rubefaciens* (Ellis & Everh.) M.S.Cole & D.Hawksw.	*Parmelia sulcata*	LV	Motiejūnaitė et al. 2016
40.	*Plectocarpon lichenum* (Sommerf.) D.Hawksw.	*Lobaria pulmonaria*	V	Strazdiņa et al. 2017
41.	*Pronectria anisospora* (Lowen) Lowen	*Hypogymnia physodes*	K, L, V	Motiejūnaitė et al. 2016
42.	*Pronectria leptaleae* (J.Steiner) Lowen	*Physcia aipolia*	K	Motiejūnaitė et al. 2016
43.	*Pronectria robergei* (Mont. & Desm.) Lowen	*Peltigera didactyla*, *P. extenuata*	K, L	Moisejevs 2017, DAU Herbarium
44.	*Pronectria xanthoriae* Lowen & Diederich	*Xanthoria parietina*	LV	Motiejūnaitė et al. 2006, Āboliņa et al. 2015, Motiejūnaitė et al. 2016
45.	*Pyrenochaeta xanthoriae* Diederich	*Xanthoria parietina*	LV	Motiejūnaitė et al. 2016
46.	*Reconditella physconiarum* Hafellner & Matzer	*Physconia distorta*	K	Motiejūnaitė et al. 2016
47.	*Refractohilum intermedium* Cl.Roux & Etayo	*Pachyphiale fagicola*	K	Czarnota and Kukwa 2010, Āboliņa et al. 2015
48.	*Refractohilum peltigerae* (Keissl.) D.Hawksw	*Peltigera* spp.	K	Motiejūnaitė et al. 2016
49.	*Sphinctrina turbinata* (Pers.) De Not.	*Pertusaria pertusa*	K,V	Motiejūnaitė et al. 2016
50.	*Stigmidium microspilum* (Körb.) D.Hawksw.	*Graphis scripta*	K	Motiejūnaitė et al. 2016
51.	*Taeniolella punctata* M.S.Christ. & D.Hawksw.	*Graphis scripta*	K	Motiejūnaitė et al. 2016
52.	*Telogalla olivieri* (Vouaux) Nik.Hoffm. & Hafellner	*Xanthoria parietina*	K	Motiejūnaitė et al. 2016
53.	*Thelocarpon epibolum* var. *epibolum* Nyl.	*Peltigera neckeri*	K	Motiejūnaitė et al. 2016
54.	*Tremella candelariellae* Diederich & Etayo	*Candelariella* sp.	LV	Czarnota and Kukwa 2010, Āboliņa et al. 2015
55.	*Tremella cetrariicola* Diederich & Coppins	*Nephromopsis chlorophylla*	K	Motiejūnaitė et al. 2006, Āboliņa et al. 2015
56.	*Tremella hypogymniae* Diederich & M.S.Christ.	*Hypogymnia physodes*	K	Motiejūnaitė and Grochowski 2014, Motiejūnaitė et al. 2016
57.	*Tremella lichenicola* Diederich	*Violella fucata*	K	Motiejūnaitė et al. 2016
58.	*Tremella phaeophysciae* Diederich & M.S.Christ.	*Phaeophyscia orbicularis*	K	Motiejūnaitė et al. 2016
59.	*Vouauxiella lichenicola* (Linds.) Petr. & Sydow	*Lecanora chlarotera*, *L. pulicaris*	K,V	Āboliņa et al. 2015, Motiejūnaitė et al. 2016
60.	*Vouauxiomyces santessonii* D.Hawksw.	*Platismatia glauca*	K,V	Motiejūnaitė et al. 2016
61.	*Xanthoriicola physciae* (Kalchbr.) D.Hawksw.	*Xanthoria parietina*	K	Czarnota and Kukwa 2010, Āboliņa et al. 2015, Motiejūnaitė et al. 2016

Results

New records for Latvia

#*Arthrorhaphis aeruginosa* R.Sant. & Tønsberg

Distribution

Arthrorhaphis aeruginosa is known from Europe (Wirth et al. 2010, Motiejūnaitė 2017, Tsurykau 2017), including Fennoscandia (Santesson and Tønsberg 1994, Nordin et al. 2011), and also from Greenland (Alstrup et al. 2009), North America (Esslinger 2007), South America (Flakus et al. 2008) and Asia (Sohrabi and Alstrup 2007).

Material examined

Krāslavas Co., Ūdrīšu Dist., Nature Park 'Daugavas loki', Tartaka Forest, ca 350 m W of Tartaks village, 55°53′6.9″N, 26°59′18.1″E, 150 m a.s.l., on side of old forest road in boreal forest with *Pinus sylvestris* and *Picea abies*, on primary thallus of *Cladonia* sp., 25 May 2018, leg. & det.: R.Moisejevs (DAU600000910).

Notes

The collected specimen was sterile, but it was recognized by the characteristic colour of the infected host thallus. Only *A. aeruginosa* is known to turn the infected lichen an aeruginose colour and, as stated in the protologue of the

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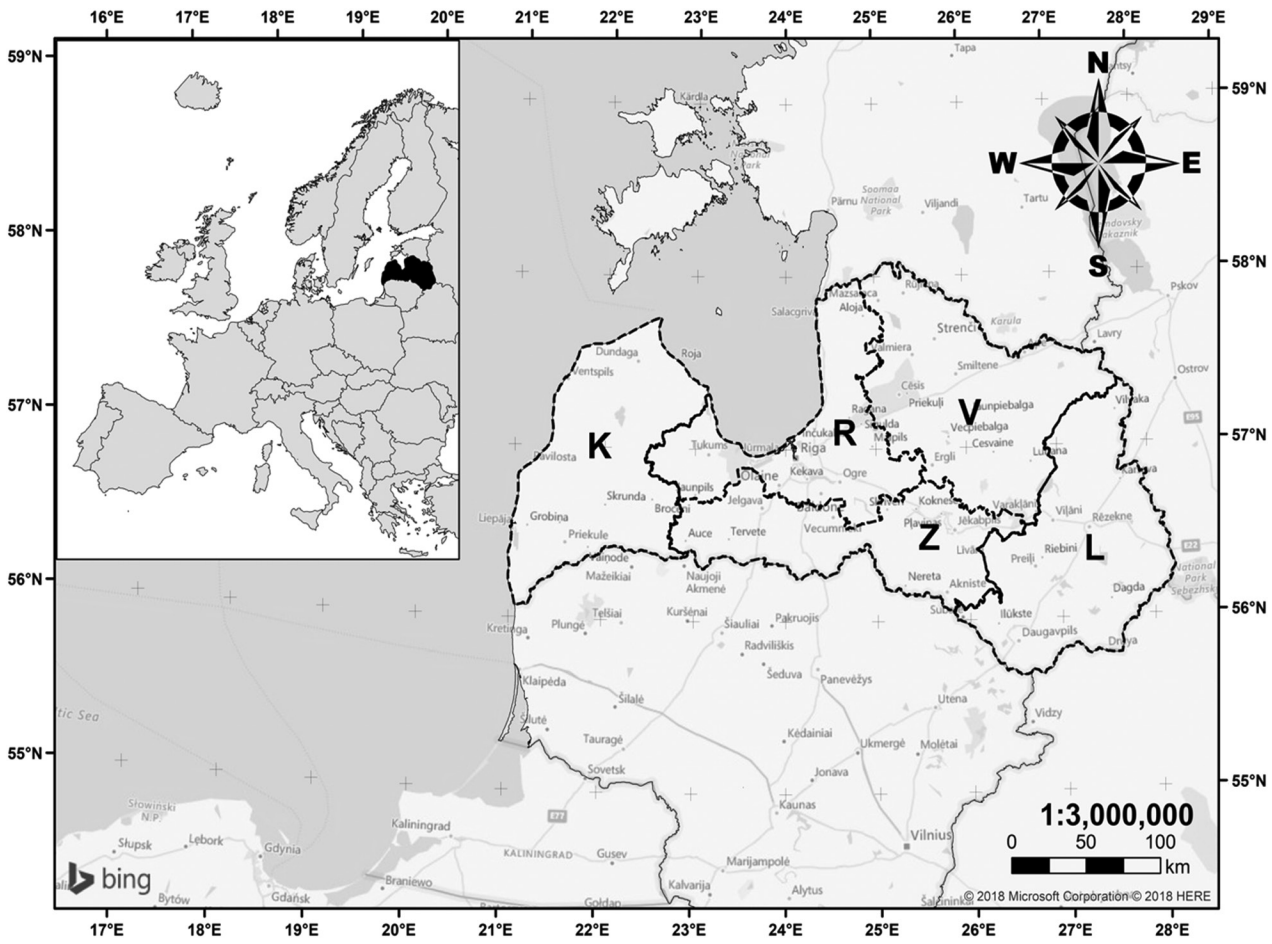


Figure 1. Regions of Latvia: K – Kurzeme (Curland), V – Vidzeme, L – Latgale, R – Pieriga, Z – Zemgale.

species '... is therefore easily recognized even when sterile' (Santesson and Tønsberg 1994).

Calicium pinastri Tibell

Distribution

Calicium pinastri is known from Europe (Tibell 1999, Śliwa and Kukwa 2008, Istomina and Likhacheva 2010, Wirth et al. 2010, Nordin et al. 2011) and North America (Hardman et al. 2017).

Material examined

Krāslava Co., Ūdrīšu Dist., Nature Park 'Daugavas loki', Tartaka forest, ca 500 m SW of Tartaks village, 55°53′7.6″N, 26°59′30.8″E, 130 m a.s.l., old-growth dry boreal forest, on bark of *P. sylvestris*, 20 June 2018, leg. & det.: R.Moisejevs (DAU600000911).

Notes

The lichen was found growing close to *Calicium parvum*, a species that resembles *C. pinastri*, but has clavate asci, while *C. pinastri* has cylindrical asci when mature.

Chaenotheca laevigata Nádv.

Distribution

Chaenotheca laevigata is a rare lichen with a wide distribution in Northern Hemisphere, being known from Europe (Wirth et al. 2010, Nordin et al. 2011), Asia (Titov 2000) and North America (Hardman et al. 2017).

Material examined

Ventspils Co., Usmas Dist., Nature Reserve 'Moricsala', ca 400 m NE of guest house, 57°11′28.6″N, 22°8′12.0″E, 25 m a.s.l., in a humid old-growth deciduous forest with *Picea abies*, on the bark of *P. abies*, 9 July 2018, leg. & det.: R.Moisejevs (DAU600000917).

Notes

Chaenotheca laevigata can be confused with *Chaenotheca chlorella*, from which it differs by its immersed thallus, ellipsoid to short cylindrical ascospores and longer ascomata.

#*Chaenothecopsis epithallina* Tibell

Distribution

Chaenothecopsis epithallina is distributed in central Europe, Fennoscandia (Tibell 1975, Wirth et al. 2010, Nordin et al. 2011, Tsurykau 2017) and North America (Hardman et al. 2017).

Material examined

(1) Ventspils Co., Usmas Dist., Nature Reserve 'Moricsala', ca 400 m NE of guesthouse, 57°11′33.5″N, 22°8′12.3″E, 25 m a.s.l., in an old-growth deciduous forest, on thallus of *Chaenotheca trichialis* growing on the bark of *Quercus robur*,

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9 July 2018, leg. & det.: R.Moisejevs; (2) Kocēnu Co., Dīķļu Dist., ca 200 m S of Rāķis Lake, 57°35′34.1″N, 24°55′6.2″E, 120 m a.s.l., in a deciduous forest, on thallus of *C. trichialis* growing on the bark of old *Q. robur*, 23 March 2018, leg.: M. Kalniņš, det.: R.Moisejevs (DAU600000912).

Notes
Chaenothecopsis epithallina differs from the similar species *Chaenothecopsis nigra* by its association with *C. trichialis*, darker ascospores with less contrasting septum and dark green hypothecium.

Lecania croatica (Zahlbr.) Kotlov

Distribution
Lecania croatica is known from Europe (Printzen 1995, Mrak et al. 2004, Hafellner et al. 2005, Eichler et al. 2010, Vondrák et al. 2010, Kukwa et al. 2012, Motiejūnaitė 2017, Tsurykau 2017) and North America (Tønsberg 2004, Harris and Lendemer 2010).

Material examined
Daugavpils Co., Skrudalienas Dist., Nature Park 'Silene', ca 500 m N of Ilgas manor house, 55°41′54.5″N, 26°47′34.5″E, m a.s.l., in a deciduous forest with *Tilia cordata*, *Populus tremula* and *P. abies*, on the bark of *T. cordata*, 27 May 2018, leg. & det.: R.Moisejevs (DAU600000913).

Notes
The collected sterile specimen was checked using TLC, but no secondary compounds were found. The species was distinguished from species with a similar morphology and chemistry following the same characters as employed by Motiejūnaitė et al. (2012) and Tsurykau (2017).

Pycnora praestabilis (Nyl.) Hafellner

Distribution
Pycnora praestabilis is known in North America (Hodkinson 2009), Europe (Śliwa and Kukwa 2012, Randlane et al. 2016, Motiejūnaitė 2017), including Fennoscandia (Bendiksby and Timdal 2013).

Material examined
Daugavpils Co., Skrudalienas Dist., ca 3.5 km E of Silene town, 55°45′41.60″N, 26°52′58.08″E, 130 m a.s.l., in periphery of raised bog, on dry wood (snag) of *P. sylvestris*, 20 July 2017, leg. & det.: R.Moisejevs (DAU600000918).

Notes
From similar species of *Pycnora* and several morphologically similar species from *Xylopsora* genus, *P. praestabilis* differs in its lack of soredia, normally abundant pycnidia up to 0.3 mm diam., typical spot test reactions and presence of alectorialic acid.

Discussion

According to our data, 61 species of lichenicolous fungi have been recorded from Latvia. *Acolium inquinans* mentioned by Āboliņa and Vimba (1959), who described it as 'a parasitic lichen, growing on thalli of other lichens', has been excluded since it is a lichenized species that lacks a lichenicolous habit (Tibell 1999). Specimen on which the record was based is lacking, therefore it is impossible to check its identity. Furthermore, Piterāns (1982) did not mention *A. inquinans* in his list of Latvian lichens and Āboliņa et al. (2015) described the species as an epiphytic lichen; therefore, it can be assumed that the aforementioned report was based on misidentification. Specimens of *Biatoropsis usnearum* reported by Motiejūnaitė et al. (2006) (both on *Usnea subfloridana*) are housed in the herbaria of the Institute of Botany, Nature Research Centre (BILAS) and University of Tartu (TU); the BILAS specimen and DAU specimens were checked in accordance with the description of *B. usnearum* (s. str.) given by Millanes et al. (2016), so it is assumed that only one species of *Biatoropsis* is known from Latvia.

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