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 Mereschkowsky (1913), who reported Acolium sessile from Jaunugulbene (Vidzeme). Later, Diplochistes 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.
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.     | Acolum sessile (Pers.) Arnold. | Pertusaria sp. | K, V | Mereschkowskii 1913, Piterāns 1982, 2001, Ābolīga et al. 2015 |
| 2.     | Arthelia epiphytica Nyl. | Physcia aipolia | K | Motiejuānīte et al. 2016 |
| 3.     | Arthelia parietinaria Haellner & A.Fleischhacker | Xanthoria parietina | K | Motiejuānīte et al. 2016 (as Arthelia molendoi (Heufl. ex Fraenl.) R.Sant.) |
| 4.     | Arthopogon tenerensis R.Sant. & Tamsberg | Cladonia sp. | L | This paper |
| 5.     | Bachmanniomyces punctum (A. Massal.) Haellner & Pino-Bodas | Cladonia digitata, C. macilenta | K | Motiejuānīte et al. 2016 |
| 6.     | Biotopora usnearum Rāsāņen | Usnea subfloridana | V, K | Motiejuānīte et al. 2006, Ābolīga et al. 2015, DAU Herbarium |
| 7.     | Brianoppinsia cytopsora (Vouaux) Diederich et al. | Evernia prunastri, Melanelia subaurea | K, V | Czarnota and Kukwa 2010, Ābolīga et al. 2015, Motiejuānīte et al. 2016 |
| 8.     | Chaenothecopsis consociata (Nády) A.F.W.Schmidt | Chaenotheca chrysocephala | LV | Piterāns 1999 |
| 9.     | Chaenothecopsis epithallina Tibell | Chaenotheca trichialis | K | This paper |
| 10.    | Chaenothecopsis pusilla (A.Massal.) A.F.W.Schmidt | Chaenotheca sp. | LV | Piterāns 2001 |
| 11.    | Clypeococcus cetrariae Haellner & D.Hawksw. | Cetraria islandica | V | Motiejuānīte and Piterāns 1998 |
| 12.    | Clypeococcus hypocenomyces D.Hawksw. | Hypocenomyce scalaris | LV | Mošjejevs 2017 |
| 13.    | Corticifraga fucellii (Rehm) D.Hawksw. & R.Sant. | Peltigera neckeri | K | Motiejuānīte et al. 2016 |
| 14.    | Didymocyrtis epiphytica Ertz & Diederich | Xanthoria parietina | K | Motiejuānīte et al. 2016 |
| 15.    | Didymocyrtis pseudoverneae (Etyoo & Diederich) Ertz & Diederich | Pseudovernia furfuracea | V | Motiejuānīte and Grochowski 2014, Ābolīga et al. 2015 |
| 16.    | Didymocyrtis ramalinae (Roberge ex Desm.) Ertz, Diederich & Haellner | Ramalina fraxinea | LV | Motiejuānīte et al. 2016 |
| 17.    | Diplochistes muscorum (Scop.) A.F.W.Schmidt | Cladonia sp. | K, V | Malta 1926, Vimbba 1971, Piterāns 1982, 2001 |
| 18.    | Ellisembia lichenicola Heuchert & U.Braun | Ramalina fraxinea | K | Motiejuānīte et al. 2016 |
| 19.    | Epicladonia sandstedei (Zopf) D.Hawksw. | Cladonia coniocraea | K | Motiejuānīte et al. 2016 |
| 20.    | Erythricium aurantiacum (Lasch) D.Hawksw. & A.Henrici | Physcia ssp. | K | Motiejuānīte et al. 2016 |
| 21.    | Graphium aphthosae Alstrup & A.Henrici | Physcia spp. | K | Motiejuānīte et al. 2016 |
| 22.    | Heterocephalacria physciacearum (Diederich) Millanes & Wedin | Physcia spp. | K | Czarnota and Kukwa 2010, Ābolīga et al. 2015, Motiejuānīte et al. 2016 |
| 23.    | Homostegia piggottii (Berk. & Broome) P.Karst. | Parmelia submontana | K | Motiejuānīte et al. 2016 |
| 24.    | Illosporiopsis christiansenii (B.L.Brady & D.Hawksw.) D.Hawksw. | Physcia ssp., Xanthoria parietina | LV | Piterāns 2001, Czarnota and Kukwa 2010 |
| 25.    | Lichenochora obscuroides (Linds.) Triebel & Rambold | Phaeophyscia orbicularis | K | Motiejuānīte et al. 2016 |
| 26.    | Lichenochora weilii (Werner) Haellner & R. Sant. | Physconia enteroxantha | K | Motiejuānīte et al. 2016 |
| 27.    | Lichenocarpus erodes (M.S.Christ. & D.Hawksw. | Evernia prunastri, Hypogymnia physodes, Parmeliopsis ambigu, Ramalina fraxinea | LV | Motiejuānīte et al. 2006, Ābolīga et al. 2015, Motiejuānīte et al. 2016 |
| 28.    | Lichenocarpus lencanorae (Jaap) D.Hawksw. | Evernia prunastri | K | Motiejuānīte et al. 2016 |
| 29.    | Lichenocarpus pycnitàdeae (Oudem.) Petr. & Syd. | Cladonia chlorophaea | K | Motiejuānīte et al. 2016 |
| 30.    | Lichenocarpus usneae (Anzi) D.Hawksw. | Evernia prunastri | K | Motiejuānīte et al. 2016 |
| 31.    | Lichenocarpus xanthoriae M.S.Christ. D.Hawksw. | Xanthoria parietina | LV | Motiejuānīte et al. 2016 |
| 32.    | Lichenolipus lencanorae (Vouaux) D.Hawksw. | Caloplaca sp., Myrtolecis aff. hagenii | K, L | Motiejuānīte et al. 2016 |
| 33.    | Lichenosticta alcicornaria (Linds.) D.Hawksw. | Cladonia coniocraea, C. macilenta, C. ochrochloa | K, L | Czarnota and Kukwa 2010, Ābolīga et al. 2015, Motiejuānīte et al. 2016 |

(Continued)
Table 1. Continued

| S. No. | Species | Host(s) | Distribution | Reference(s) |
|-------|---------|---------|--------------|--------------|
| 34.   | Marchandiomycetes coralinus (Roberge) Diederich & D.Hawksw. | Physcia tenella | K | Motiejūnaitė et al. 2016 |
| 35.   | Monodictys epileprariae | Lepraria spp. | K | Czarnota and Kukwa 2010, Ābolīja et al. 2015, Motiejūnaitė et al. 2016 |
| 36.   | Muellerella hospitans | Bacidia rubella | L, V | Czarnota and Kukwa 2010, Ābolīja et al. 2015 |
| 37.   | Microcalicium disseminatum (Ach.) Vain. | Chaenotheca sp. | LV | Motiejūnaitė et al. 2016, DAU Herbarium |
| 38.   | Nectriopsis lecanodes (Ces.) Diederich & Schrebers | Peltigera canina, Peltigera rutilens | LV | Motiejūnaitė et al. 2006, Ābolīja et al. 2015, RIGG Herbarium |
| 39.   | Nectriopsis rubefaciens | Parmelia sulcata | LV | Motiejūnaitė et al. 2016 |
| 40.   | Plectocarpon lichenum (Sommerf.) D.Hawksw. | Lobaria pulmonaria | V | Strazdīga et al. 2017 |
| 41.   | Pronectria anisospora (Lowen) Lowen | Hypogymnia physodes | K, L, V | Motiejūnaitė et al. 2016 |
| 42.   | Pronectria lepidae (J. Steiner) Lowen | Physcia aipolia | K | Motiejūnaitė et al. 2016 |
| 43.   | Pronectria robergei (Mont. & Desm.) Lowen | Peltigera didactyla, P. extenuata | K, L | Motiejūnaitė et al. 2017, DAU Herbarium |
| 44.   | Pronectria xanthoriae Lowen & Diederich | Xanthoria parietina | LV | Motiejūnaitė et al. 2006, Ābolīja et al. 2015, Motiejūnaitė et al. 2016 |
| 45.   | Pyrenochea xanthoriae Diederich & Matzer | Xanthoria parietina | LV | Motiejūnaitė et al. 2016 |
| 46.   | Reconditella physoniarioum | Physconia distorta | K | Motiejūnaitė et al. 2016 |
| 47.   | Refractohilum intermedium Cl. Roux & Etayo | Pachyphiale fagica | K | Czarnota and Kukwa 2010, Ābolīja et al. 2015 |
| 48.   | Refractohilum peltigerae (Keissl.) D.Hawksw. | Peltigera spp. | K | Motiejūnaitė et al. 2016 |
| 49.   | Sphinctrina tubinata (Pers.) De Not. | Perturasia pertusa | K, V | Motiejūnaitė et al. 2016 |
| 50.   | Stigmidiun microspillum (Körb.) D.Hawksw. | Graphis scripta | K | Motiejūnaitė et al. 2016 |
| 51.   | Taeniolellia punctata M.S.Christ. & D.Hawksw. | Graphis scripta | K | Motiejūnaitė et al. 2016 |
| 52.   | Telogalla oceanic (Vouaux) N.K.Hoffm. & Hafellner | Xanthoria parietina | K | Motiejūnaitė et al. 2016 |
| 53.   | Thelecanorap epibolum var. epibulum Nyl. | Peltigera neckeri | K | Motiejūnaitė et al. 2016 |
| 54.   | Tremella candelariellae Diederich & Etayo | Candelariella sp. | LV | Czarnota and Kukwa 2010, Ābolīja et al. 2015 |
| 55.   | Tremella cetrariicola Diederich & Copins | Nepharopsis chlorophylla | K | Motiejūnaitė et al. 2006, Ābolīja et al. 2015 |
| 56.   | Tremella hypogymniae Diederich & M.S.Christ. | Hypogymnia physodes | K | Motiejūnaitė et al. 2014, Motiejūnaitė et al. 2016 |
| 57.   | Tremella hypogymniae | Hypogymnia physodes | K | Motiejūnaitė et al. 2016 |
| 58.   | Tremella hypogymniae | Hypogymnia physodes | K | Motiejūnaitė et al. 2016 |
| 59.   | Vouauxilichena lichenicola (Linds.) Petr. & Sydow | Lecanora chlarotera, L. pulicaris | K, V | Ābolīja et al. 2015, Motiejūnaitė et al. 2016 |
| 60.   | Vouauximycetes santessonii D.Hawksw. | Platismatia glauca | K, V | Motiejūnaitė et al. 2016 |
| 61.   | Xanthorica physciae (Kalchbr.) D.Hawksw. | Xanthoria parietina | K | Ābolīja et al. 2015, Motiejūnaitė et al. 2016 |

Results

New records for Latvia

#Arthropophis aeruginosa R.Sant. & Tønsberg

Distribution

Arthropophis 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., Uduņu 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
species ‘... is therefore easily recognized even when sterile’ (Santesson and Tönsberg 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., Udrišu 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*,
9 July 2018, leg. & det.: R. Moisejevs; (2) Kocēnu Co., Dīķu Dist., ca 200 m S of Rāķis Lake, 57°35ʹ34.1ʺN, 24°55ʹ6.2ʺE, 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

Chaealectothecopsis epithallina differs from the similar species Chaealectothecopsis 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 (Tønberg 2004, Harris and Lendemer 2010).

Material examined

Daugavpils Co., Skrudalienas Dist., Nature Park ‘Silene’, ca 500 m N of Ilgas manor house, 55°41ʹ54.5ʺN, 26°47ʹ34.5ʺE, 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°45ʹ41.60ʺN, 26°52ʹ58.08ʺE, 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 Xyloporina 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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References

Āboliņa, A., Piterāns, A. and Bambe, B. 2015. Lichens and bryophytes in Latvia. Checklist. Latvijas Valsts mezinātnes institūts ‘Silava’. – DAU AA Saule, in Latvian.

Āboliņa, A. and Vimba, E. 1959. Latvijas PSR Mežu ķērpju un sūnu noteicējs. – Latvijas valsts izdevniecība, in Latvian.

Alstrup, V., Kokourková, J., Kukwa, M. et al. 2009. The lichens and lichenicolous fungi of south Greenland. – Folia Cryptog. Estonica 46: 1–24.

Bendiksby, M. and Timdal, E. 2013. Molecular phylogenetics and taxonomy of Hypocenomyce sensu lato (Ascomycota: Lecanoromycetes): extreme polyphyly and morphological/ecological convergence. – Taxon 62: 940–956.

Czarnota, P. and Kukwa, M. 2010. New and noteworthy lichenized and lichenicolous fungi from Latvia. – Bot. Lithuan. 16: 21–27.

Eichler, M., Cezanne, R., Diederich, P. et al. 2010. New or interesting lichens and lichenicolous fungi from Belgium, Luxembourg and northern France. XIII. – Bull. Soc. Nat. Luxemb. 111: 33–46.

Esslinger, T. L. 2007. A cumulative checklist for the lichen-forming, lichenicolous and allied fungi of the continental United States and Canada. – North Dakota State Univ., Fargo.

Flakus, A., Ahiti, T., Kukwa, M. et al. 2008. New and interesting records of Cladonia and their lichenicolous fungi from the Andean cloud forest in Bolivia. – Ann. Bot. Fenn. 45: 448–454.

Hafellner, J., Petutschning, W., Tauer-Zeiner, C. et al. 2005. Über einige bemerkenswerte Flechtenfunde in Kärnten, hauptsächlich in den Gurktaler Alpen. – Carinthia II. 195: 423–440.

Hardman, A., Stone, D. and Selva, S. B. 2017. Calicioid lichens and fungi of the Gifford Pinchot and Okanagan-Wenatchee National Forests in Washington, U.S.A. – Opusc. Philolichenum 16: 1–14.
Orange, A., James, P. W. and White, F. J. 2001. Microchemical methods for the identification of lichens. – British Lichen Society, London.

Piterāns, A. 1982: Lishainiki Latvii. – Zinatne, in Russian.

Piterāns, A. 2001. Checklist of the lichens of Latvia. – Latvijas Vēsterrāts 3: 5–45.

Printzen, C. 1995. Die Flechtengattung Biatula in Europa. – Bibl. Lichenol. 60: 1–275.

Randlane, T., Saag, A. and Suija, A. 2016. Lichenized, lichenicolous and allied fungi of Estonia. Ver. December 31, 2016. <http://esamba.bo.bg.ut.ee/checklist/est/home.php>, accessed 29 July 2018.

Santesson, R. and Tönsberg, T. 1994. Arthrorhaphis aeruginosa and A. olivaceae, two new lichenicolous fungi. – Lichenologist 26: 295–299.

Šliwa, L. and Kukwa, M. 2008. Calicium pinastri (Lichenized Ascomycota), a lichen species new to Poland. – Pol. Bot. J. 53: 189–191.

Šliwa, L. and Kukwa, M. 2012. New distribution data for sterile crustose lichens in the Polish Tatra Mts and its surroundings. – Pol. Bot. J. 57: 259–278.

Smith, C. W., Aptroot, A., Coppins, B. J. et al. (eds). 2009. The Lichens of Great Britain and Ireland. – British Lichen Society.

Sohrabi, M. and Alstrup, V. 2007. Additions to the lichen mycota of Iran from East Azerbaijan Province. – Mycotaxon 100: 145–148.

Strazdiņa, L., Kluša, J., Leimanis, I. et al. 2017. New bryophyte and fungi records and rarities of Latvia in 2016. – Latvijas Vēsterrāts 26: 125–150, in Latvian.

Titov, A. 2000. Notes on calicoid lichens and fungi from the Gongga Mountains (Sichuan, China). – Lichenologist 32: 553–569.

Tibell, L. 1975. The Caliciales of boreal North America. Taxonomy, ecological and distributional comparisons with Europe, and ultrastructural investigations in some species. – Symb. Bot. Ups. 21: 1–128.

Tibell, L. 1999. Caliciales. – In: Nordic Lichen flora 1. Bohuslän ‘5, pp. 20–92.

Tönsberg, T. 2004. Additions to the lichen flora of Great Smoky Mountains National Park. – ATBI Q. 3: 6.

Turkyak, A. 2017. New or otherwise interesting records of lichens and lichenicolous fungi from Belarus. III. With an updated checklist of lichenicolous fungi. – Herzogia 30: 152–165.

Vimba E.1971. Materials of the 6th symposium of the Baltic republics on mycology and lichenology. – Zinatne, in Russian.

Vondrak, J., Palice, Z., Khodosovtsev, A. et al. 2010. Additions to the diversity of rare or overlooked lichens and lichenicolous fungi in Ukrainian Carpathians. – Chornomorskyi Bot Zhurnal 26: 3–6

Wirth, V., Hauck, M., von Brackel, W. et al. 2010. Checklist of lichens and lichenicolous fungi in Germany. Ver. #2: 19 January 2011. <www.gwgd.de/>mhauck>, accessed 29 July 2018.