

EPIPHYTIC LICHENS IN LATVIAN MANOR PARKS

Dace Stepanova*, Rolands Moisejevs, Māris Nitcis, Anna Mežaka

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Abstract

We present the results of lichenological research in 20 Latvian manor parks. In total 62 lichen taxa and one lichenicolous taxa (*Muellerella hospitans* Stizenb.) were identified on 18 tree taxa. In total, five lichen species were specially protected, eight were Woodland Key Habitat indicator species and two species were red-listed in Latvia.

Keywords: biodiversity, urban diversity, lichenized fungi.

*Corresponding author: Dace Stepanova. Daugavpils University, Institute of Life Sciences and Technology, Parādes Str. 1A, Daugavpils, LV-5401, Latvia, E-mail: dace.stepanova@biology.lv

Rolands Moisejevs, Māris Nitcis, Anna Mežaka. Institute of Life Sciences and Technology, Daugavpils University, Parādes Str. 1A, Daugavpils, LV-5401, Latvia

INTRODUCTION

Forest ecosystems contain up to half of total species richness of lichens and allied fungi known in Baltic region. The most species-rich groups of lichens in lowland forest ecosystems of hemiboreal vegetation region are epiphytic and epixylic lichens (Löhmus 2003, Gerra-Inohosa & Laiviņš 2016). Old urban parks may supply potential habitat as a shelter for various epiphytic lichens and promote their distribution in fragmented landscapes (Löhmus & Liira 2013).

Old urban parks represent important habitats for preserving considerable biodiversity in many regions, especially in Central Europe, where old-growth forests are rare, and the history of human colonization is very long (Gagarina et al. 2020). Old parks or landscape gardens around manor houses and castles are cultural heritage of nobles, but their value for biodiversity conservation is poorly acknowledged (Löhmus & Liira 2013).

In total 4806 dendrological plantings are registered in Latvia, including also manor parks (Laiviņš 2009). However, general knowledge about epiphytic lichens in manor parks and other dendrological plantations is still scarce (Piterāns & Kalvišķe 2002, Mežaka & Kirilova 2019).

In case of Latvia, only few targeted studies on lichens in manor parks previously were performed. Mežaka and Kirilova (2019), in their study about epiphytic bryophytes and lichens in Lūznava manor park reported 44 lichen species found on 91 host trees. The study on epiphytes in Dārznīca castle (Latvia) showed presence of 36 lichen species (Mežaka et al. 2008), but in Krimulda manor park (Latvia), during the epiphyte inventory, six Woodland Key Habitat (WKH) lichen indicator species were found (Strazdiņa et al. 2019).

The studies from other countries demonstrate the importance of manor parks for lichen diversity

preservation in rural and urban landscapes. For instance, 108 lichen species were reported from Mogilev region manor parks in Belarus (Yatsyna et al. 2018), 115 lichen species were reported from Central part of Minsk (Yatsyna 2014) and 158 lichen species were found in manor parks of Minsk (Yatsyna 2013). In total, 139 lichen species were reported from the former manors in the Smolensk Region in Russia, including one lichenicolous lichen and four non-lichenized calicioid fungi (Gagarina et al. 2020).

The studies about epiphytic lichen distribution in manor parks increase the understanding of manor park importance for epiphytic lichen distribution and long-term conservation at wider national scale. Therefore, the aim of the present study was to investigate the epiphytic lichen species in Latvian manor parks to increase general knowledge on lichen biota in these habitats.

MATERIALS AND METHODS

Study site characteristics

The climate in Latvia differs by region. The average annual temperature in Latvia is +6.4 °C. The warmest month is July, with an average temperature +17.4 °C, and the coolest month is February, with an average temperature -3.7 °C. The annual rainfall in Latvia is 692 mm. The highest average annual temperature of +6.5 °C and highest amount of annual rainfall 732 mm were recorded in Kurzeme (LVĢMC 2020).

The study was performed from May till August 2020, in 20 randomly selected manor parks (sites) located in four Latvian historical regions (five parks from each region): Latgale, Vidzeme, Zemgale and Kurzme (Fig. 1.). The area of studied manor parks varied from 23 to 38 ha, all studied parks were founded in late 18th to late 19th century (Tab. 1).

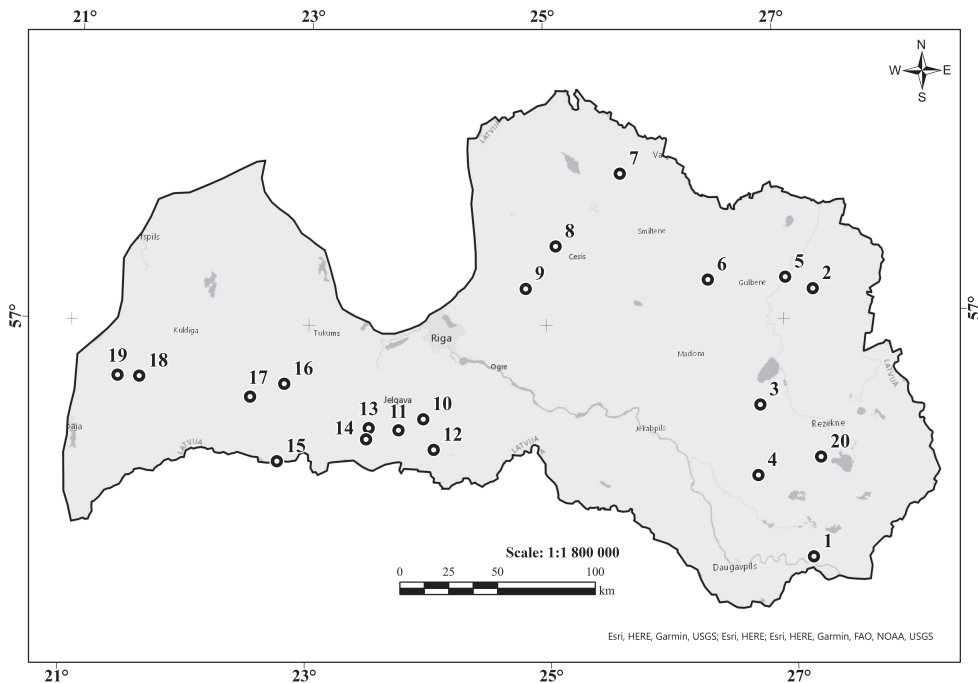


Figure 1. Studied manor parks: 1 – Krāslava manor park; 2 – Balvi manor park; 3 – Varakļāni manor park; 4 – Preiļi manor park; 5 – Litene manor park; 6 – Lizums manor park; 7 – Jercēnmuiža manor park; 8 – Ungurmuiža manor park; 9 – Krimulda manor park; 10 – Staļģene manor park; 11 – Lielvircava manor park; 12 – Mazmežotne manor park; 13 – Zaļenieki manor park; 14 – Apgunste manor park; 15 – Vadakste manor park; 16 – Smuku manor park; 17 – Kalnsētas manor park; 18 – Lažas-Padures manor park; 19 – Dzērves manor park; 20 – Lūznava manor park.

Table 1. Characteristics of the studied manor parks.

Name of the Park	Area, ha	Foundation time, century	Coordinates	Total number of lichen taxa	Number of specially protected lichen species	Number of WHK indicator species	Number of red-listed lichen species
Krāslava manor park	10.01	Mid-18th	55°54'02.5"N 27°09'44.3"E	34	3	5	1
Preiļi manor park	39.33	Mid-19th	56°17'06.0"N 26°44'05.3"E	23	0	2	0
Varakļāni manor park	30.09	Late 18th	56°36'31.7"N 26°46'27.1"E	35	3	6	0
Balvi manor park	7,53	Mid-18th	57°07'57.7"N 27°15'22.3"E	25	2	5	1
Litene manor park	9.29	Mid-18th	57°11'28.3"N 27°01'40.1"E	29	0	1	0
Lizums manor park	2.7	Mid-19th	57°11'31.2"N 26°22'20.3"E	25	2	2	1
Jercēnmuiža manor park	11.53	Late 19th	57°41'26.5"N 25°38'55.0"E	26	1	2	0
Ungurmuiža manor park	10.84	Early 18th	57°21'43.6"N 25°05'16.1"E	27	0	2	0
Krimulda manor park	2.06	Mid-19th	57°10'07.0"N 24°49'44.8"E	26	1	2	1
Stalģene manor park	2.37	Late 18th	56°34'18.1"N 23°57'45.0"E	26	1	3	1
Lielvircava manor park	1.27	Late 19th	56°31'15.2"N 23°45'23.4"E	28	1	3	0
Mazmežotne manor park	3.63	Mid-19th	56°25'51.6"N 24°02'57.1"E	27	2	4	0
Zaļenieki manor park	6.44	Late 18th	56°31'48.7"N 23°30'30.2"E	25	1	3	0
Apgunste manor park	3.69	Late 18th	56°28'41.9"N 23°29'14.3"E	26	1	4	1
Vadakste manor park	4.6	Early 19th	56°22'21.4"N 22°44'56.4"E	24	1	3	0
Smuku manor park	3.93	Late 16th	56°43'44.8"N 22°47'58.9"E	24	1	3	0
Kalnsētas manor park	6.47	Late 19th	56°40'01.9"N 22°30'57.2"E	25	2	5	0
Lažas-Padures manor park	4.76	Late 19th	56°44'57.1"N 21°35'04.6"E	23	1	3	0
Dzērves manor park	2.44	Early 19th	56°45'00.0"N 21°24'10.8"E	27	2	4	1
Lūznava manor park	21.06	Early 20th	56°21'26.6"N 27°15'34.6"E	24	1	4	0

The data about epiphytic lichens were collected from 400 trees. The species which were not identified in a field were collected and later determined in laboratory. In total 20 host trees were screened in site in randomly selected 20x20 m sample plot. In cases when the sample plot contained less than 20 trees, the nearest trees to the plot were screened. Epiphytic lichen species occurrence was evaluated up to the height of 2 m on each of the selected trees with a minimum diameter at breast height of 0.10 m.

Species identification

Spot-test reactions of thalli were checked with sodium hypochlorite solution (commercial bleach) (C) and/or 10% KOH solution (K) in field. Morphology of collected lichen specimens was examined under a dissecting microscope, anatomical structures were studied under a light microscope. At the laboratory, ethanol solution of *paraphenylenediamine* (PD), Lugol solution (I), commercial bleach) (C), 10% KOH solution (K) and 50% HNO₃ (N) were employed for additional spot tests and anatomical examinations.

The collected specimens are stored in the lichenological herbarium of the Daugavpils University (DAU).

RESULTS AND DISCUSSION

In total, 62 epiphytic lichen taxa and one lichenicolous species (*Muellerella hospitans* Stizenb. – on *Bacidia rubella*) were found on 18 tree taxa in the studied manor parks. From the identified lichen taxa, 32 were crustose, 19 – foliose, 7 – fruticose, 4 – squamulose and leprose (Fig. 2). In addition, lichens of the genus *Lepraria* have not been identified to species level, indicating potentially more species are present in study sites. The largest number of the epiphytic lichen taxa was found in Varakļāni manor park (35 taxa) and in Krāslava manor park (34 taxa). Five lichen species were red-listed and/or specially protected in Latvia – *Inoderma byssaceum*, *Chaenotheca phaeocephala*, *Parmelina tiliacea*, *Pleurosticta acetabulum* and *Sclerophora pallida* (Andrušaitis et al. 1996, Anonymous 2000). Eight WKH indicator species (*Acrocordia gemmata*, *Bacidia rubella*, *Chaenotheca brachypoda*, *Graphis scripta*, *Inoderma byssaceum*, *Parmelina tiliacea*, *Pleurosticta acetabulum*, *Sclerophora pallida*) were found (Ek et al. 2002).

The most common lichen species in studied sites was *Evernia prunastri* with 267 records. The most common specially protected lichen species were *Inoderma byssaceum* and *Parmelina tiliacea* with 26 records and *Sclerophora pallida* with 20 records. The most common WKH indicator spe-

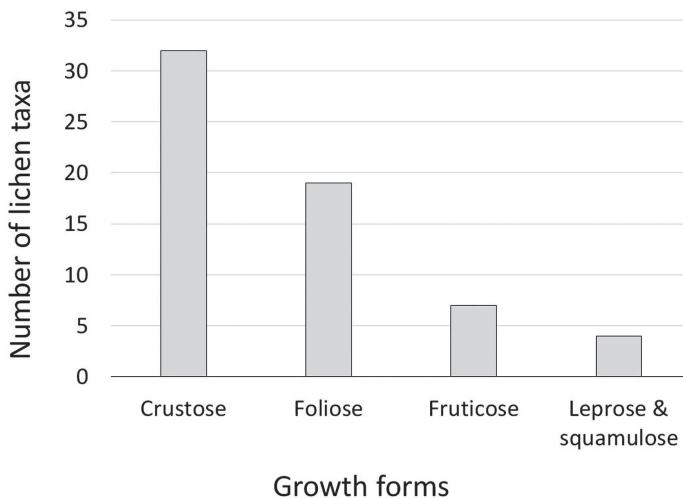


Figure 2. Total number of lichen taxa by growth forms.

cies were *Bacidia rubella* with 80 records and *Graphis scripta* with 79 records. The most common host tree taxa in studied sites were *Tilia cordata* and *Acer platanoides*.

Similar to this study, relatively high lichen species richness was recorded in Central part of Minsk (Yatsyna 2014), and manor park in Mogilev region in Belarus (Yatsyna et al. 2018). At the same time, in neighboring Russia, 166 lichen species were identified in manor parks of Pskov Region (Istomina & Likhacheva 2021), and 98 lichens found by Muchnik & Cherepenina (2020) in three museum-reserves in Moscow region. Similar to all above mentioned studies, the dominance of crustose lichens was observed in our study. Although, our study demonstrates the lowest number of the recorded lichen taxa among the mentioned park studies. The difference in species richness between previously mentioned studies and our study can be explained by different study methods, difference of environmental conditions among study sites, and relatively homogeneous tree stand structure conditions in our studied sites. However, 62 lichen taxa found in our study is almost 20% of the total number of known forest-dwelling lichen taxa in Latvia (Gerra-Inohosa & Laiviņš 2016). Moreover, the recorded number of lichen taxa in our study is the highest among the previous studies of lichens in urban parks in Latvia (Mežaka et al. 2008, Mežaka & Kirilova 2019, Strazdiņa et al. 2019).

Since the total richness of lichen taxa in studied manor parks was relatively high, and most of the studied parks were inhabited by rare and protected species, we recommend to perform lichen inventories in manor parks in cases when the management activities are planned in such areas, to avoid or minimize the potential negative impact of management activities on rare lichen species populations. In addition, the floristic studies with modern methods of lichen determination is recommended to increase general knowledge on manor park lichen biota. Also, the ecological studies on epiphytic and epixylic lichens in manor parks are suggested, including additional ecological studies with focus on the management intensity effect on lichen species richness.

List of lichen taxa

Protected species are marked with “!”, WHK indicator species are marked with “#”.

#*Acrocordia gemmata* (Ach.) A. Massal. – on *Acer platanoides*, *Fraxinus excelsior*, *Populus* sp., *Tilia cordata*, *Ulmus glabra* (3, 7, 8, 13, 14, 17, 19, 20)

Alyxoria varia (Pers.) Ertz & Tehler – on *Acer platanoides*, *Alnus glutinosa*, *Carpinus betulus*, *Fagus sylvatica*, *Fraxinus excelsior*, *Larix decidua*, *Populus* sp., *Quercus robur*, *Thuja occidentalis*, *Tilia cordata*, *Tilia platyphyllos*, *Tilia × vulgaris*, *Ulmus glabra*, *Ulmus leavis* (in all parks)

Anaptychia ciliaris (L.) Körb. ex A. Massal. – on *Acer platanoides*, *Alnus glutinosa*, *Betula pendula*, *Fraxinus excelsior*, *Populus* sp., *Quercus robur*, *Tilia cordata*, *Ulmus leavis* (4, 5, 6, 8, 10, 11, 12, 13, 14, 16, 17, 18, 19)

Anisomeridium bifforme (Borrer) R.C. Harris – on *Acer platanoides*, *Quercus robur*, *Tilia cordata*, *Ulmus glabra*, *Ulmus leavis* (1, 3)

Arthonia atra (Pers.) A. Schneid. – on *Acer platanoides*, *Alnus glutinosa*, *Carpinus betulus*, *Fagus sylvatica*, *Fraxinus excelsior*, *Larix decidua*, *Picea abies*, *Populus* sp., *Quercus robur*, *Thuja occidentalis*, *Tilia cordata*, *Ulmus glabra*, *Ulmus leavis* (in all parks)

#*Bacidia rubella* (Hoffm.) A. Massal. – on *Acer platanoides*, *Fraxinus excelsior*, *Populus* sp., *Tilia cordata*, *Ulmus glabra*, *Ulmus leavis* (1, 2, 3, 4, 5, 8, 9, 10, 11, 12, 14, 15, 16, 17, 18, 19, 20)

Bacidia subincompta (Nyl.) Arnold – on *Ulmus glabra*, *Ulmus leavis* (3)

Buellia griseovirens (Turner & Borrer ex Sm.) Almb. – on *Acer platanoides*, *Fraxinus excelsior*, *Populus* sp., *Tilia cordata*, *Ulmus glabra*, *Ulmus leavis* (1, 2, 3, 12, 19, 20)

Calicium viride Pers. – on *Acer platanoides*, *Fraxinus excelsior*, *Populus* sp., *Quercus robur*, *Tilia cordata*, *Ulmus leavis* (3, 8, 9, 11, 12, 20)

- Candelariella xanthostigma* (Pers. ex Ach.) Lettau – on *Acer platanoides*, *Fraxinus excelsior*, *Quercus robur*, *Tilia cordata*, *Ulmus glabra*, *Ulmus laevis* (2, 3, 17)
- # *Chaenotheca brachypoda* (Ach.) Tibell – on *Ulmus laevis* (3)
- Chaenotheca chrysocephala* (Ach.) Th. Fr. – on *Larix decidua* (7)
- Chaenotheca ferruginea* (Turner ex Sm.) Mig. – on *Larix decidua* (5, 7, 11)
- !# *Chaenotheca phaeocephala* (Turner) Th. Fr. – on *Quercus robur*, *Populus* sp., (3)
- Chaenotheca trichialis* (Ach.) Hellb. – on *Acer platanoides*, *Populus* sp., *Quercus robur*, *Tilia cordata*, *Tilia platyphyllos*, *Tilia* sp. (in all parks)
- Chrysothrix candelaris* (L.) J.R. Laundon – on *Acer platanoides*, *Fraxinus excelsior*, *Tilia cordata*, *Ulmus glabra* (15)
- Cladonia fimbriata* (L.) Fr. – on *Tilia cordata* (2)
- Diplotomma pharcidium* (Ach.) M. Choisy – on *Acer platanoides* (8)
- Evernia prunastri* (L.) Ach. – on *Acer platanoides*, *Betula pendula*, *Carpinus betulus*, *Fagus sylvatica*, *Fraxinus excelsior*, *Larix decidua*, *Populus* sp., *Quercus robur*, *Thuja occidentalis*, *Tilia cordata*, *Tilia platyphyllos*, *Tilia* × *vulgaris*, *Tilia* sp., *Ulmus laevis*, *Ulmus glabra* (in all parks)
- Fuscidea pusilla* Tønsberg – on *Acer platanoides*, *Tilia cordata* (1, 2, 13)
- Glaucomaria carpinea* (L.) S.Y. Kondr., Lökös & Farkas – on *Acer platanoides*, *Carpinus betulus*, *Tilia cordata* (12, 14, 20)
- # *Graphis scripta* (L.) Ach. – on *Acer platanoides*, *Carpinus betulus*, *Fraxinus excelsior*, *Populus* sp., *Tilia cordata*, *Tilia platyphyllos*, *Tilia* × *vulgaris*, *Ulmus glabra*, *Ulmus laevis* (1, 2, 3, 4, 10, 11, 12, 13, 14, 15, 16, 17, 18, 20)
- Hypocomyce scalaris* (Ach.) M. Choisy – on *Larix decidua*, *Quercus robur*, *Tilia cordata* (3, 5, 7, 18)
- Hypogymnia physodes* (L.) Nyl. – on *Alnus glutinosa*, *Larix decidua*, *Quercus robur*, *Tilia cordata*, *Tilia platyphyllos* (5, 6, 7, 8, 9, 16)
- Hypogymnia tubulosa* (Schaer.) Hav. – on *Tilia cordata*, *Quercus robur* (3, 5, 9)
- Imshaugia aleurites* (Ach.) S.L.F Mey – on *Larix decidua* (5)
- !# *Inoderma byssaceum* (Weigel) Gray – on *Populus* sp., *Quercus robur*, *Tilia cordata*, *Tilia* sp., *Ulmus glabra*, *Ulmus laevis* (2, 3, 6, 7, 12, 13, 17, 18, 20)
- Lecanora chlarotera* Nyl. – on *Acer platanoides*, *Fraxinus excelsior*, *Tilia cordata* (3, 8)
- Lecanora expallens* Ach. – on *Acer platanoides*, *Fraxinus excelsior*, *Quercus robur*, *Tilia cordata*, *Tilia* sp., (2, 5)
- Lecanora pulicaris* (Pers.) Ach. – on *Acer platanoides* (11)
- Lecidella elaeochroma* (Ach.) M. Choisy – on *Acer platanoides*, *Fraxinus excelsior*, *Populus* sp., *Thuja occidentalis*, *Tilia cordata* (8, 12)
- Lecidella euphorea* (Flörke) Kremp. – on *Acer platanoides*, *Carpinus betulus*, *Fraxinus excelsior*, *Populus* sp., *Ulmus glabra*, *Ulmus laevis* (3, 4, 11, 14)
- Lepra albescens* (Huds.) Hafellner – on *Acer platanoides*, *Fagus sylvatica*, *Fraxinus excelsior*, *Populus* sp., *Ulmus glabra*, *Ulmus laevis*, *Tilia cordata*, *Tilia platyphyllos*, *Ulmus glabra* (1, 2, 3, 8, 13, 14, 15, 16, 18)
- Lepra amara* (Ach.) Hafellner – on *Acer platanoides*, *Carpinus betulus*, *Fagus sylvatica*, *Fraxinus excelsior*, *Populus* sp., *Quercus robur*, *Tilia cordata*, *Tilia platyphyllos*, *Tilia* sp., *Ulmus glabra*, *Ulmus laevis* (1, 2, 4, 5, 6, 7, 8, 9, 10, 14, 15, 17, 18, 19, 20)
- Lepraria* sp. Ach. – on *Acer platanoides*, *Betula pendula*, *Fagus sylvatica*, *Fraxinus excelsior*, *Larix decidua*, *Populus* sp., *Quercus robur*, *Tilia cordata*, *Tilia platyphyllos*, *Tilia* × *vulgaris*, *Tilia* sp., *Ulmus glabra*, *Ulmus laevis* (in all parks)

- Melanohalea exasperatula* (Nyl.) O. Blanco, A. Crespo, Divakar, Essl., D. Hawksw. & Lumbsch – on *Acer platanoides*, *Acer pseudoplatanus*, *Alnus glutinosa*, *Betula pendula*, *Fagus sylvatica*, *Fraxinus excelsior*, *Larix decidua*, *Populus* sp., *Quercus robur*, *Thuja occidentalis*, *Tilia cordata*, *Tilia platyphyllos*, *Tilia* sp., *Ulmus glabra*, *Ulmus laevis* (in all parks)
- Opegrapha niveoatra* (Borrer) J.R. Laundon – on *Acer platanoides*, *Fraxinus excelsior*, *Ulmus glabra*, *Ulmus laevis* (3, 11)
- Parmelia sulcata* Taylor – on *Acer platanoides*, *Acer pseudoplatanus*, *Alnus glutinosa*, *Betula pendula*, *Carpinus betulus*, *Fagus sylvatica*, *Fraxinus excelsior*, *Larix decidua*, *Populus* sp., *Quercus robur*, *Thuja occidentalis*, *Tilia cordata*, *Tilia platyphyllos*, *Tilia* sp., *Ulmus glabra* (1, 2, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 19, 20)
- !# *Parmelina tiliacea* (Hoffm.) Hale – on *Acer platanoides*, *Fraxinus excelsior*, *Quercus robur*, *Tilia cordata*, *Ulmus glabra* (2, 6, 9)
- Parmeliopsis ambigua* (Wulfen) Nyl. – on *Larix decidua* (5)
- Peltigera canina* (L.) Willd. – on *Acer platanoides* (16)
- Phaeophyscia ciliata* (Hoffm.) Moberg – on *Quercus robur* (9)
- Phaeophyscia orbicularis* (Neck.) Moberg – on *Acer platanoides*, *Betula pendula*, *Fagus sylvatica*, *Fraxinus excelsior*, *Larix decidua*, *Populus* sp., *Quercus robur*, *Thuja occidentalis*, *Tilia cordata*, *Tilia platyphyllos*, *Tilia* sp., *Ulmus glabra* (2, 4, 5, 7, 8, 9, 11, 12, 13, 15, 16, 17, 18, 19, 20)
- Phlyctis argena* (Ach.) Flot. – on *Acer platanoides*, *Alnus glutinosa*, *Carpinus betulus*, *Fagus sylvatica*, *Fraxinus excelsior*, *Populus* sp., *Quercus robur*, *Thuja occidentalis*, *Tilia cordata*, *Tilia platyphyllos*, *Tilia* sp., *Ulmus glabra*, *Ulmus laevis* (1, 2, 3, 7, 10, 12, 13, 14, 15, 16, 18, 19, 20)
- Physcia adscendens* H. Olivier – on *Tilia cordata* (15)
- Physcia aipolia* (Ehrh. ex Humb.) Fűrnr. – on *Acer platanoides*, *Carpinus betulus*, *Fraxinus excelsior*, *Populus* sp., *Quercus robur*, *Tilia cordata* (4, 5, 14)
- Physcia tenella* (Scop.) DC. – on *Acer platanoides*, *Alnus glutinosa*, *Carpinus betulus*, *Populus* sp., *Tilia cordata*, *Tilia platyphyllos*, *Ulmus glabra*, *Ulmus laevis* (1, 6, 7, 10, 11, 13, 14, 15, 16, 17)
- Physconia detersa* (Nyl.) Poelt – on *Acer platanoides*, *Fraxinus excelsior*, *Quercus robur*, *Tilia cordata*, *Tilia platyphyllos*, *Tilia* sp. (2, 5, 6, 7, 17, 18)
- Physconia distorta* (With.) J.R. Laundon – on *Fraxinus excelsior*, *Tilia cordata*, *Tilia* sp. (2)
- Physconia enteroxantha* (Nyl.) Poelt – on *Acer platanoides*, *Carpinus betulus*, *Fraxinus excelsior*, *Picea abies*, *Populus* sp., *Thuja occidentalis*, *Tilia cordata*, *Tilia × vulgaris*, *Ulmus glabra*, *Ulmus laevis* (3, 9, 10, 11, 12, 19)
- Physconia grisea* (Lam.) Poelt – on *Acer platanoides*, *Tilia cordata*, *Tilia* sp., (2)
- Pleurosticta acetabulum* (Neck.) Elix & Lumbsch – on *Acer platanoides*, *Carpinus betulus*, *Populus* sp., *Tilia cordata* (4, 10, 14, 19)
- Pseudevernia furfuracea* (L.) Zopf – on *Acer platanoides*, *Quercus robur*, *Tilia cordata* (6, 9)
- Pseudoschismatomma rufescens* (Pers.) Ertz & Tehler – on *Acer platanoides*, *Carpinus betulus*, *Fagus sylvatica*, *Fraxinus excelsior*, *Populus* sp., *Quercus robur*, *Thuja occidentalis*, *Tilia cordata*, *Tilia platyphyllos*, *Tilia × vulgaris*, *Tilia* sp., *Ulmus glabra*, *Ulmus laevis* (1, 2, 3, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20)
- Pyrrhospora quernea* (Dicks.) Körb. – on *Acer platanoides*, *Tilia cordata*, *Tilia* sp., (2, 10)
- Ramalina farinacea* (L.) Ach. – on *Acer platanoides*, *Acer pseudoplatanus*, *Alnus glutinosa*, *Fagus sylvatica*, *Fraxinus excelsior*, *Larix decidua*, *Populus* sp., *Quercus robur*, *Tilia cordata*, *Tilia platyphyllos*, *Tilia* sp.,

Ulmus glabra, *Ulmus leavis* (2, 3, 4, 5, 6, 7, 8, 9, 10, 13, 15, 16, 19)

Ramalina fastigiata (Pers.) Ach. – on *Acer platanoides*, *Carpinus betulus*, *Tilia cordata*, *Fraxinus excelsior*, *Larix decidua*, *Populus* sp., *Quercus robur*, *Tilia* sp., *Ulmus glabra* (1, 2, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 15, 19)

Ramalina fraxinea (L.) Ach. – on *Acer platanoides*, *Alnus glutinosa*, *Fraxinus excelsior*, *Quercus robur*, *Thuja occidentalis*, *Tilia cordata*, *Tilia platyphyllos* (4, 5, 6, 7, 8, 9, 10, 11, 12, 16, 19)

!# *Sclerophora pallida* (Pers.) Y.J. Yao & Spooner – on *Fraxinus excelsior* (2, 3, 4, 11, 12, 15, 16, 17, 19)

Tephromela atra (Huds.) Hafellner – on *Acer platanoides*, *Fraxinus excelsior*, *Tilia cordata* (2)

Toniniopsis subincompta (Nyl.) Kistenich, Timdal, Bendiksby & S. Ekman – on *Ulmus glabra*, *Ulmus leavis* (3)

Violella fucata (Stirt.) T. Sprib.– on *Acer platanoides*, *Fagus sylvatica*, *Fraxinus excelsior*, *Larix decidua*, *Populus* sp., *Tilia cordata*, *Tilia platyphyllos*, *Tilia* sp., *Ulmus glabra*, *Ulmus leavis* (in all parks)

Xanthoria parietina (L.) Th. Fr. – on *Acer platanoides*, *Acer pseudoplatanus*, *Carpinus betulus*, *Fraxinus excelsior*, *Picea abies*, *Populus* sp., *Quercus robur*, *Thuja occidentalis*, *Tilia cordata*, *Tilia platyphyllos*, *Tilia* × *vulgaris*, *Ulmus glabra*, *Ulmus leavis* (1, 3, 4, 5, 6, 8, 9, 10, 11, 12, 13, 14, 16, 17, 19)

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