Pak. J. Bot., 48(2): 813-830, 2016.

THE LICHENS IN THE AGRICULTURAL LANDSCAPE OF PODLASIE, NORTH EAST POLAND

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Abstract

This paper carries information for diagnosis lichenobiota in the agricultural landscape of Poland NE. The research led to a better understanding of the problem of occurrence of lichens in the agricultural landscape. The functional groups of lichens, which were used to characterize lichen biota taking into account the morphological forms, frequency of occurrence and habitat requirements were determined. The basis for the specification of the more interesting taxa in the study area was to analyze the species composition of lichens in relation to the data on their previous records in rural areas, the degree of recognition in Poland NE and conservation status and threats in the country.

Key words: Lichens, Distributions, Agricultural landscape, Poland.

Introduction

Agricultural landscape is one of the types of cultural landscapes resulting from anthropogenic activities (Szczęsny, 1971). In Poland, according to official data from 2011 (Anon., 2011) farmland occupied 60.3% of the total area of the country. Arable land (44.5%) prevailed within it; meadows, pastures and orchards covered respectively 7.3%, 5.2% and 0.9% of the total area of the country. Vertical shape of the surface of Poland determined the concentration of arable land in Middle Poland Lowlands. In contrast, the least of it can be found in the wooded lake districts and in the mountains. Meadows and pastures in Poland are distributed more or less evenly, although a larger share of them is marked in the eastern part of the country - in Mazury, Podlasie, Polesie and Carpathian mountains.

Lichens in the agricultural landscape: Polish literature is clearly characterised by a lack of cross-cutting studies on the occurrence of lichens in the agricultural landscape. Interesting information in this regard comes only from rural north-west (Lipnicki, 1990), north (Szymczyk & Zalewska, 2008) and central (Zarabska, 2011) part of the country. The degree of diversity of lichens was demonstrated at the level of 174 taxa in the Choszczno Lake District (Lipnicki, 1990), 96 species in the selected passage of Warmia Plains (Szymczyk & Zalewska, 2008) and 175 taxa in the agricultural landscape of Sandr Nowotomyski (Zarabska, 2011). Among the habitats most commonly occupied by lichens in the agricultural landscape of these mesoregions were plantings of roadside trees and artificial substrates. In both statements there appeared lichens typical of open habitats , including those interesting ones due to the rarity of their quotations from the region and the country, conservation status and the degree of danger in Poland (Lipnicki, 1990; Szymczyk & Zalewska, 2008; Zarabska, 2011).

Limited information about lichens present in the agricultural landscape has highlighted the need to try to characterize lichen biota occurring in rural areas of Podlasie. Implementation plans were undertaken to serve the following objectives: 1 determination of the species composition of lichens, 2 distinction of species particularly associated with areas covered by agricultural use and valuable in the Podlasie region in relation to the rarity of their listing on the area of NE Poland and/or conservation status and the degree of risk in the country, 3 determination of the degree of diversity of lichen species in communities characterized by different levels of anthropogenic transformation, including those mainly caused by agricultural activities, 4 characterization of the functional groups of lichens typical of rural areas.

Study area: Location and topography of the region of Podlasie is extremely beneficial for agriculture because of the small undulation and lowland character of the land. The region is located in the north-eastern part of the country, in the area of Podlasie Lowland, Suwałki Lakeland and Mazowsze Lowland. It borders on Masovian Voivodeship to the west, Warmian-Masurian Voivodeship to the northwest, Lublin Voivodeship to the south, the Belarusian Voblasts of Grodno and Brest to the east, the Lithuanian Counties of Alytus and Marijampolė to the northeast, and the Kaliningrad Oblast of Russia to the north (Fig. 1). Its capital is Białystok. Białystok is, and has been for centuries, the main hub of transportation for the Podlaskie Voivodeship and the entire northeastern section of Poland. It is a major city on the European Union roadways (Via Baltica) and railways (Rail Baltica) to the Baltic Republics and Finland. It is also a main gateway of trade with Belarus due to its proximity to the border and its current and longstanding relationship with Hrodno, Belarus.

Podlaskie is the land of the confluence of cultures – Polish, Belarusian, Ukrainian and Lithuanian – and is indicative of the ethnic territories limits. At the end of 2009 in Podlaskie Voivodeship there were 1192.7 thousand inhabitants, 3.1 per cent of the total population of Poland. The average density of the population, the number of the population per 1 km², was 59. The urban population in the same period was 60.2 per cent of the total number of inhabitants of the voivodeship (Anon., 2010).

Favourable topography of the land is the basis for the development of agricultural activities. In the structure of agricultural land in the Podlaskie Voivodeship meadows and pastures constitute a far greater share than in other regions of the country. A characteristic feature of Podlasie countryside is a higher than average share in Poland of agricultural land in total area (Regionaly Operational Program).

Fig. 1. Location of the Podlasie Voivodship in Poland (https://en.wikipedia.org/wiki/Białystok#/media/File:Poland_location_map.svg).

Agriculture in Podlaskie Voivodeship functions in harsh natural, both climatic and soil conditions – a very short vegetation period, record temperature lows, poor soil and periodic water deficits. Podlaskie has a Warm Summer Continental or Hemiboreal climate (Dfb) according to the Köppen climate classification system, which is characterized by warm temperatures during summer and long and frosty winters. It is substantially different from most of the other Polish lowlands. The region is one of the coldest in Poland, with the average temperature in January being - −5°C. The average temperature in a year is 7°C. The number of frost days ranges from 50 to 60, with frost from 110 to 138 days and the duration of snow cover from 90 to 110 days. Mean annual rainfall values oscillate around 550 millimetres (21.7 in), and the vegetation period lasts 200 to 210 days. Podlaskie is the coldest region of Poland, located in the very northeast of the country near the border with Belarus and Lithuania. The region has a continental climate which is characterized by high temperatures during summer and long and frosty winters. The climate is affected by the cold fronts which come from Scandinavia and Siberia. The average temperature in the winter ranges from -15°C to -4°C (Górniak 2000).

Despite this, there are over 100000 rural farms in the region, using an average surface of about 13 hectares. The structure of rural areas makes good conditions for further development of the production of milk and beef. Potatoes are mainly cultivated in the area of the province of Podlasie, as well as cereals (rye, oats, wheat, corn) and sugar beets. In the last years, the owners of rural farms have seen more and more success –in their agrotouristic activities (Regionaly Operational Program).

Materials and Methods

Fieldwork research. Fieldwork research was conducted in the area of Podlasie in 2010-2013. In order to obtain a large number of data on lichen biota diversity in the agricultural landscape in Podlasie positions were set using the "counsel" method. In total, 35 research plots were determined. These surfaces were established within the following communities differing in the degree of anthropogenic transformation: natural communities (fresh mixed forests, fresh forests, fresh mixed coniferous forests, fresh coniferous forests), semi-natural communities (meadows and pastures, woodlands, grasslands) and anthropogenic communities (ruderal, segetal). A habitat was considered a stand within which the census of lichens was made from all available substrates. Names of trees, which were the source of epiphytic lichens observations are given in accordance with the development of Mirek *et al.* (2002). For each habitat coordinates are specified.

Taxonomic identification: For most taxa, taxonomic identification was carried out in laboratory conditions. Downloaded specimens were determined on the basis of morphological and anatomical (macroscopic and microscopic analysis). Lichens were also determined based on the presence of fouling compounds (secondary metabolites) - test reactions. Thin-layer chromatography (TLC) was used to identify the types of secondary metabolites, mainly from the genus *Cladonia* and *Lepraria*. This method was conducted in accordance with the guidelines from Culberson & Ammann (1979) and Orange *et al*. (2001). Lichen naming was adopted from Diederich *et al*. (2015) except for the following taxa *Circinaria calcarea, C. caesiocinerea, C. contorta, C. gibbosa* (Nordin *et al*., 2010), *Lecanora saxicola* (Laundon, 2010) oraz *Calogaya decipiens, C. pusilla, Flavoplaca citrina, F. oasis, Polycauliona polycarpa, Rusavskia elegans* (Arup *et al*., 2013).

Characteristic of species:

In order to characterize recorded taxa the following data were included: 1. morphological forms of thallus by Nimis & Martellos, (2008), 2. habitat group, 3. degree of prevalence - based on the frequency of occurrence in the study area (Table 1).

Table 1. The categories for specific characteristics of lichens.

Characteristic	Categories
Growth and life forms	C – Crustose S – Squamulose Fw – Wide foliose type *Parmelia* Fn – Narrow foliose type *Physcia* F – Fruticose
Substrate type	Epiphytic: Growing on the bark of trees Epigeic = Terricolous: growing on soil Epixylic = Lignicolous: growing on rotten, decayed and dead wood Epilithic = Saxicolous: growing on rocks and concrete Epibryophytic = Growing on mosses: found on terricolous mosses
Degree of prevalence	Very – Taxon occurring for 1 – 2 stands Rare – Taxon occuring for 3 – 5 stands Frequent – Taxon occuring for 6 – 15 stands Common – Taxon occurring for > 15 stands

Statistical development: The collected data on the degree of differentiation of lichen species and species richness of particular morphological forms were subjected to basic statistical analysis (mean, standard deviation, range of variation).

Nonparametric ANOVA rank Kruskal Wallis test was used to test the significance of differences between the average of the degree of variation in lichen species and richness of various morphological forms of lichens. Lichens are assigned to various morphological forms, taking into account the type of communities with different degrees of anthropogenic transformation, in which they were listed. The results were gathered in the framework of research on the diversity of lichens and their functional groups conducted in a completely randomized design.

The dependent variable was defined as the degree of variation of lichen species and species richness of various morphological forms. The degree of variation in lichen species is defined as the total number of species (Nalls) reported on the test area. Species are assigned to functional groups distinguished on the basis of the type of morphological forms of fronds: crustose lichens (NsC), squamose (NsS), wide foliose type of *Parmelia* (NsFW) narrow foliose type *Physcia* (NsFn), fruticose (NsF). As an explanatory variable a kind of community was assumed (Type of habitat).

Selected types of communities, which are assigned to research areas are:

Natural: 1. Deciduous forests: fresh mixed forest, fresh forest, moist forest; 2. Coniferous forests: fresh mixed coniferous forest, fresh coniferous forest, moist coniferous forest;

Semi-natural: 3. Meadows and pastures; 4. Plantings (mid-field, at watercourse); 5. Grasslands;

Anthropogenic: 6. Ruderal (on roadsides and within dense rural and urban built-up), 7. Segetal (cultivated fields and associated field margins);

List of research stands

1. Druga (53°48′16.6″N 22°53′41.4″E), agricultural landscape, boulders on meadow, artificial bedrock containing calcium carbonate, *Betula pendula*, *Fraxinus* cfr. *excelsior, Padus serotina, Populus* spp., *Salix* spp.,*Ulmus minor,* 2010.06.15.

2. Sokole (53°05′09″N 23°30′59″E), 2.5 km to the SSE, fresh pine forest, *Pinus sylvestris, Betula pendula,* soil, bryophytes and remains of vascular plants, wood, 2011.09.15.

3. Gródek (53°05′48″N 23°39′24″E), 2 km to the SE, open area, trees of the field, *Fraxinus* cfr. *excelsior, Populus tremula*, *Salix* spp., concrete poles, soil, 2011.09.16.

4. Zucielec (53°20′58″N 22°41′42″E), agricultural landscape, sand pit, boulders, artificial bedrock containing calcium carbonate, *Frangula alnus, Fraxinus* cfr. *excelsior, Populus tremula, Salix* spp., 2011.09.16.

5. Korycin (53°27′00″N 23°05′00″E), 1 km to the N, open area, pasture, artificial bedrock containing calcium carbonate, *Fraxinus* cfr. *excelsior, Populus tremula, Salix* spp., 2011.09.25.

6. Baciuty (53°03′11″N 22°58′59″E), 1.5 km to the SWW, venerable tree in the meadows by the river Narew, artificial bedrock containing calcium carbonate, *Fraxinus* cfr. *excelsior, Salix* spp., *Quercus robur*, 2012.09.09

7. Suraż (52°57′00″N 22°57′00″E), 1 km to the SSE, agricultural landscape, pasture, boulders, artificial bedrock containing calcium carbonate, *Populus tremula, Salix* spp., 2012.09.09.

8. Doktorce (52°54′53.50″N 23°05′01.75″E), 2.5 km to the E, fresh coniferous forest, soil, bryophytes and remains of vascular plants, wood, *Pinus sylvestris,* 2012.09.09.

9. Kaniuki (52°53′43″N 23°18′27″E), village, on the river Narew, artificial bedrock containing calcium carbonate, soil, *Acer platanoides, Aesculus hippocastanum, Alnus glutinosa, A. incana, Betula pendula, Fraxinus* cfr. *excelsior, Malus* spp., *Prunus* spp., *Salix* spp., *Tilia cordata, Ulmus minor,* 2013.06.15.

10. Siemianówka (52°53′58″N 23°50′21″E), fresh pine forest, *Betula pendula, Padus serotina, Pinus sylvestris*, soil, wood, 2013.06.16.

11. Surroundings of Serpelice (52°16'40″N 23°03'11″E), pine forest, *Juniperus communis, Pinus sylvestris*, soil, 2010.05.22.

12. Forestry Mierzwice (52°19'50″N 22°59'09″E), pine forest, *Juniperus communis, Picea abies, Pinus sylvestris*, soil, wood, 2010.05.22.

13. Boćki (52°39′00″N 23°02′00″E), road to the village Engines, roadside trees, 2011.04.15.

14. Mielnik (52°19′38″N 23°02′55″E), around chalk mine, open area and grasslands, stones, artificial bedrock containing calcium carbonate, soil, *Fraxinus* cfr. *excelsior, Populus tremula, Salix* spp., *Sambucus nigra, Sorbus aucuparia, Tilia platyphyllos,* 2012.05.14.

15. Narew (52°54′46″N 23°31′15″E), agricultural landscape, roadside trees, *Fraxinus* cfr. *excelsior*, *Populus* spp., *Salix* spp., 2012.05.14.

16. Drohiczyn (52°24′00″N 22°39′00″E), area along the Bug River, stones, artificial bedrock containing calcium carbonate, *Acer campestre, A, platanoides, Alnus glutinosa, A. incana, Fraxinus* cfr. *excelsior,* 2012.06.12.

17. Białowieża (52°42′04″N 23°52′10″E), open area, trees, *Fraxinus* cfr. *excelsior, Pinus sylvestris, Quercus robur,* artificial bedrock containing calcium carbonate, 2012.07.15.

18. Supraśl (53°12′20″N 23°20′17″E), venerable tree in the meadows by the river Supraśl, *Betula pendula, Fraxinus* cfr. *excelsior, Populus tremula, Robinia pseudoacacia, Salix* spp., 2013.06.15.

19. Ryboły (52°56′00″N 23°16′00″E), agricultural landscape, pasture, boulders, artificial bedrock containing calcium carbonate, *Salix* spp., 2013.09.14.

20. Orla (52°42′13″N 23°19′59″E), abandoned Jewish cemetery, meadow, gravestones, 2013.09.14.

21. Harkawicze (53°19′18″N 23°43′29.4″E), fields, boulders and tree on the field, artificial bedrock containing calcium carbonate, *Fraxinus* cfr. *excelsior, Malus* spp., *Robinia pseudoacacia, Salix* spp., *Sambucus nigra,* 2013.09.15.

22. Tykocin (53°12′11″N 22°46′15″E), agricultural landscape, pasture, artificial bedrock containing calcium carbonate, *Fraxinus* cfr. *excelsior, Frangula alnus, Salix* spp., 2012.04.12.

23. Ciełuszki (52°54′12.6″N 23°21′43.2″E), trees in a meadow by the river Narew, *Fraxinus* cfr. *excelsior, Robinia pseudoacacia, Salix* spp., 2013.09.14.

24. Trześcianka (52°56′17.7″N 23°26′52.9″E), farmland, tree in a field, *Frangula alnus, Fraxinus* cfr. *excelsior*, artificial bedrock containing calcium carbonate, 2013.09.14.

25. Krynice (53°13'53″N 23°01'35″E), 0.5 km to the W, small forest in an agricultural landscape, stones, artificial bedrock containing calcium carbonate, soil, wood, *Frangula alnus, Fraxinus* cfr. *excelsior, Populus tremula, Salix* spp. 2011.05.04.

26. Zagruszany (53°02′00″N 23°17′00″E), small-field forests, concrete pole, artificial bedrock containing calcium carbonate, soil, *Pinus sylvestris*, *Populus tremula,* 2011.05.14

27. Koryciny (52°38′53″N 22°44′45″E), 1 km to the W, oak forest as nature park, *Carpinus betulus, Eunonymus europaea, Quercus robur, Pinus sylvestris*, 2011.05.14

28. Glinnik (52°48′22″N 22°48′05″E), 2 km to the S, regenerating forest hail, *Padus serotina, Populus tremula,* 2011.06.02

29. Milejczyce (52°31′10.4″N 23°07′54.1″E), 2 km to the W, sand calcareous grasslands turf, brushwood pine, soil, *Juniperus communis, Pinus sylvestris, Populus tremula,* 2011.09.09

30. Jaginty on the river Biebrza (53°40′23.88″N 23°34′24.63″E), cultivation of pine trees, xerothermic grass, boulders, artificial bedrock containing calcium carbonate, soil, wood, *Pinus sylvestris,* 2012.08.14

31. Brzeziny Kapickie (53°33′58″N 22°39′38″E), swamp forest, wood (stump), *Betula pendula, Populus tremula,* 2011.08.14

32. Kuźnica Białostocka (53°30′35″N 23°38′37″E), 0.5 km to the S, xerothermic grass, boulder, artificial bedrock containing calcium carbonate, soil, *Populus tremula, Quercus robur,* 2013.09.15

33. Krynki (53°15′55.00″N 23°46′19.89″E), 1 km to the S, xerothermic grass, lonely tree, artificial bedrock containing calcium carbonate, soil, *Betula pendula, Populus tremula, Quercus robur*, 2013.09.15

34. Górany (53°12′54.66″N 23°40′41.82″E), on the edge of mixed forest, *Carpinus betulus, Quercus robur,* 2012.04.18

35. Stanisławowo (53°04′42.81″N 23°12′23.76″E), on the edge of mixed forest, *Quercus robur, Pinus sylvestris*, *Populus tremula*, 2010.09.15.

Research areas are assigned to the following communities.

Natural communities: 1. Deciduous forest – stands: 27, 28, 31, 34, 35; **2.** Coniferous forest – stands: 2, 8, 10, 11, 12.

Semi-natural communities: 3. Meadows and pastures – stands: 5, 7, 19, 20, 22; 4. Plantings (mid-field, at watercourse) – stands: 6, 18, 23, 25, 26; 5. Grasslands – stands: 4, 29, 30, 32, 33.

Anthropogenic communities: 6. Ruderal (on roadsides and within dense rural and urban built-up) – stands: 9, 13, 15. 16, 17; **7**. Segetal (cultivated fields and associated field) – stands: 1, 3, 4, 21, 24.

List of taxa

The list presented below includes 156 lichen taxa found in the study area. For each taxon the following information is given: a substrate, the number of quotations and a list of posts.

Acarospora fuscata (Schrad.) Th. Fr. – Loc. 1, 7, 16, 19, 20, 21: on stones, frequent species, 6: stones

Anaptychia ciliaris (L.) Körb. – Loc. 5, 6, 17, 18, 22, 23: on bark of *Fraxinus* cfr. *excelsior*, *Populus tremula*, *Salix* spp., frequent species, 5: *Fraxinus* cfr. *excelsior*, 1: *Populus tremula*, 1: *Salix* spp.

Aspicilia cinerea (Ach.) Körb. – Loc. 4, 14, 20, 21, 25, 32: on stones, frequent species, 6 stands: stones

Buellia punctata (Hoffm.) A. Massal. – Loc. 6, 9, 14, 16, 18, 21, 23, 27, 32, 35: on wood (branches, pieces of bark, stump), bark of *Acer campestre*, *A. platanoides*, *Aesculus hippocastanum*, *Alnus glutinosa*, *Betula pendula*, *Carpinus betulus*, *Fraxinus* cfr. *excelsior*, *Malus* spp, *Populus tremula*, *Prunus* spp., *Quercus robur*, *Robinia pseudoacacia*, *Salix* spp., *Sambucus nigra*, *Sorbus aucuparia*, *Tilia cordata*, *T. platyphyllos*, *Ulmus minor*, frequent species, 2: wood (branches, pieces of bark, stump), 1: *Acer campestre*, 2: *A. platanoides*, 1: *Aesculus hippocastanum*, 1: *Alnus glutinosa*, 3: *Betula pendula*, 1: *Carpinus betulus*, 3: *Fraxinus* cfr. *excelsior*, 1: *Malus* spp, 3: *Populus tremula*, 1: *Prunus* spp., 1: *Quercus robur*, 1: *Robinia pseudoacacia*, 4: *Salix* spp., 1: *Sambucus nigra*, 1: *Sorbus aucuparia*, 1: *Tilia cordata*, 1: *T. platyphyllos*, 1: *Ulmus minor*.

Circinaria calcarea (L.) A. Nordin, S. Savić & Tibell – Loc. 9, 14, 16, 30: on artificial bedrock containing calcium carbonate (building, fence), rare species, 4: artificial bedrock containing calcium carbonate.

Circinaria caesiocinerea (Nyl. ex Malbr.) A. Nordin, S. Savić & Tibell – Loc. 1: on boulder, very rare species, 1: boulder.

Circinaria contorta (Hoffm.) A. Nordin, S. Savić & Tibell – Loc. 16: on artificial bedrock containing calcium carbonate (fence), very rare species, 1: artificial bedrock containing calcium carbonate (fence).

Circinaria gibbosa (Hoffm.) A. Nordin, S. Savić & Tibell – Loc. 1, 4, 32: on stones, rare species, 3: stones.

Bacidia bagliettoana (A. Massal. & De Not.) Jatta – Loc. 14, 30, 32, on soil, rare species, 3: soil

Bacidia rubella (Hoffm.) A. Massal. – Loc. 27, on bark of *Quercus robur*, very rare species, 1: *Quercus robur*

Baeomyces rufus (Huds.) Rebent. – Loc. 2, 10, on soil, very rare species, 2: soil.

Bryoria fuscescens (Gyeln.) Brodo & D. Hawksw. – bark of *Betula pendula*, very rare species; 1 stand: 31.

Buellia griseovirens (Sm.) Almb. – Loc. 27, 34, 35, on bark of *Quercus robur,* rare species, 3: *Quercus robur*

Calogaya decipiens (Arnold) Arup, Frödén & Søchting – Loc. 3, 9, 14, 16, 21, 24, 26, 32, 33, on artificial bedrock containing calcium carbonate (building, fence, pole), common species, 9: artificial bedrock containing calcium carbonate

Calogaya pusilla (A. Massal.) Arup, Frödén & Søchting – Loc. 1, 3, 5, 6, 7, 9, 17, 19, 21, 22, 25, 26, 32, on artificial bedrock containing calcium carbonate (fence pole), common species, 13: artificial bedrock containing calcium carbonate

Caloplaca cerina (Hedw.) Th. Fr. – Loc. 14, 32, on bark of *Populus tremula*, very rare species, 2: *Populus tremula*

Caloplaca teicholyta (Ach.) J. Steiner – Loc. 3, 4, 33, on artificial bedrock containing calcium carbonate (fence), rare species, 3: artificial bedrock containing calcium carbonate (fence).

Candelaria concolor (Dicks.) Stein – Loc. 1, 5, 9, 22, 23, on bark of *Acer platanoides*, *Alnus glutinosa*, *Frangula alnus*, *Fraxinus* cfr. *excelsior*, *Populus* spp., *Pyrus communis*, *Quercus robur*, *Robinia pseudoacacia*, *Salix* spp., *Tilia cordata*, *Ulmus minor*, rare species, 1: on *Acer platanoides*, 1: *Alnus glutinosa*, 1: *Frangula alnus*, 1: *Fraxinus* cfr. *excelsior*, 3: *Populus* spp., 1: *Pyrus communis*, 1: *Quercus robur*, 1: *Robinia pseudoacacia*, 2: *Salix* spp., 1: *Tilia cordata*, 1: *Ulmus minor*.

Candelariella aurella (Hoffm.) Zahlbr. – Loc. 1, 3, 5, 6, 7, 9, 14, 19, 22, 24, 25, 26, 32, 33, on artificial bedrock containing calcium carbonate (fence, pole), frequent species, 14: artificial bedrock containing calcium carbonate.

Candelariella coralliza (Nyl.) H. Magn. – Loc. 4, 19, 20, on stone, rare species, 3: on stone.

Candelariella reflexa (Nyl.) Lettau – Loc. 21, on bark of *Malus* spp., *Robinia pseudoacacia, Salix* spp., very rare species, 1: *Malus* spp., 1: *Robinia pseudoacacia,* 1: *Salix* spp.

Candelariella vitellina (Hoffm.) Müll. Arg. – Loc. 1, 4, 9, 19, 20, 30, 32, on stone, artificial bedrock containing calcium carbonate (fence, pole), frequent species, 7: on stone, 7: artificial bedrock containing calcium carbonate.

Candelariella xanthostigma (Ach.) Lettau – Loc. 3-6, 9, 14-18, 21-24, 26, 28, 31-33, on bark of *Aesculus hippocastanum*, *Fraxinus* cfr. *excelsior*, *Malus* spp., *Populus* spp., *Pyrus communis*, *Robinia pseudoacacia*, *Quercus robur*, *Q. rubra*, *Salix* spp., *Sambucus nigra*, *Sorbus aucuparia*, *Tilia cordata*, common species, 1: *Aesculus hippocastanum*, 7: *Fraxinus* cfr. *excelsior*, 1: *Malus* spp., 8: *Populus* spp., 1: *Pyrus communis*, 1: *Robinia pseudoacacia*, 3: *Quercus robur*, 1: *Q. rubra*, 6: *Salix* spp., 1: *Sambucus nigra*, 1: *Sorbus aucuparia*, 2: *Tilia cordata*.

Cetraria aculeata (Schreb.) Fr. – Loc. 8, 9, 33, on soil, rare species, 3: soil

Cetraria ericetorum Opiz – Loc. 8, 10, 12, 30, 33, on soil, rare species; 5: soil

Cetraria islandica (L.) Ach. – Loc. 8, 10, 11, 12, 30, 33, on soil, rare species, 6: soil

Cladonia arbuscula (Wallr.) Flot. – Loc. 2, 3, 8, 10, 12, 25, 30, 33, on soil, frequent species, 8: soil

Cladonia arbuscula (Wallr.) Flot. subsp. ***mitis*** (Sandst.) Ruoss – Loc. 10, on soil, very rare species; 1: soil

Cladonia botrytes (K. G. Hagen) Willd. – Loc. 2, on wood (snag), very rare species, 1: wood (snag)

Cladonia cariosa (Ach.) Spreng. – Loc. 10, 30, 33, on soil, rare species, 3: soil

Cladonia cenotea (Ach.) Schaer. – Loc. 2, 3, 8, 12, on wood (pieces of bark, stump), rare species, 4: wood

Cladonia cervicornis ssp. ***verticillata*** (Hoffm.) Ahti – Loc. 2, 8, 10, 12, 29, 33, on soil, frequent species, 6: soil

Cladonia chlorophaea s.lat. (Sommerf.) Spreng. – Loc. 2, 8, 9, 10, 12, 14, 26-28, 30, 33, on wood (pieces of bark, snag), soil, bark of *Betula pendula*, *Quercus robur*, *Salix* spp., bryophytes and remains of vascular plants, frequent species, 2: on wood (pieces of bark, snag), 3: soil, 3: *Betula pendula*, 2: *Quercus robur*, 1: *Salix* spp., 5: bryophytes and remains of vascular plants.

Cladonia ciliata var. ***tenuis*** (Flörke) Ahti – Loc. 8, 10, on soil, very rare species, 2: soil

Cladonia coccifera (L.) Willd. – Loc. 10, on soil, very rare species, 1: soil

Cladonia coniocraea (Flörke) Spreng., nom. cons. – Loc. 2, 8, 9, 10, 14, 26, 28, 31, 34, 35, on wood (branches, pieces of bark, fence, stump), soil, stone, bark of *Alnus glutinosa*, *Betula pendula*, *Frangula alnus*, *Fraxinus* cfr. *excelsior*, *Malus* spp., *Pinus sylvestris*, *Quercus robur*, *Salix* spp., bryophytes and remains of vascular plants, artificial bedrock containing calcium carbonate (pole), frequent species, 3: on wood (branches, pieces of bark, fence, stump), 2: soil, 1: stone, 1: *Alnus glutinosa*, 5: *Betula pendula*, 1: *Frangula alnus*, 3: *Fraxinus* cfr. *excelsior*, 1: *Malus* spp., 4: *Pinus sylvestris*, 4: *Quercus robur*, 2: *Salix* spp., 2: bryophytes and remains of vascular plants, 2: artificial bedrock containing calcium carbonate.

Cladonia cornuta (L.) Hoffm. – Loc. 2, 8, 10, 12, 25, 30, on wood (branches, pieces of bark, stump), soil, bark of *Pinus sylvestris*, frequent species, 2: on wood, 4: soil, 1: *Pinus sylvestris*.

Cladonia crispata (Ach.) Flot. – Loc. 12, on soil, very rare species, 1: soil

Cladonia deformis (L.) Hoffm. – Loc. 8, 10, 11, 12, on wood (pieces of bark, stump), soil, rare species, 1: on wood (pieces of bark, stump), 4: soil.

Cladonia digitata (L.) Hoffm. – Loc. 2, 10, 12, on wood (branches, pieces of bark, stump), soil, bryophytes and remains of vascular plants, rare species, 1: on wood, 2: soil, 1: bryophytes and remains of vascular plants.

Cladonia fimbriata (L.) Fr. – Loc. 8, 10, 11, 12, 14, 25-28, 30, 32-35, on wood (branches, pieces of bark, fence, stump), soil, stone, bark of *Alnus glutinosa*, *Betula pendula*, *Malus* spp., *Pinus sylvestris*, *Populus tremula*, *Quercus robur, Salix* spp., bryophytes and remains of vascular plants, artificial bedrock containing calcium carbonate (pole), common species, 4: on wood (branches, pieces of bark, fence, stump), 4: soil, 2: stone, 1: *Alnus glutinosa*, 5: *Betula pendula*, 2: *Malus* spp., 6: *Pinus sylvestris*, 2: *Populus tremula*, 3: *Quercus robur,* 1: *Salix* spp., 2: bryophytes and remains of vascular plants, 2: artificial bedrock containing calcium carbonate.

Cladonia floerkeana (Fr.) Flörke – Loc. 10, 11, 12, on wood (pieces of bark, stump), soil, rare species, 2: on wood, 1: soil

Cladonia furcata (Huds.) Schrad. – Loc. 2, 8, 10, 11, 12, 25, 26, 29, 30, 33, on soil, frequent species, 10: soil

Cladonia glauca Flörke – Loc. 2, 8, 10, 12, 25, 26, 28-33, on wood (branches, pieces of bark, stump), soil, frequent species, 3: on wood, 8: soil

Cladonia gracilis (L.) Willd. – Loc. 2, 8, 10, 12, on wood (pieces of bark, stump), soil, bryophytes and remains of vascular plants, rare species, 1: on wood, 2: soil, 2: bryophytes and remains of vascular plants

Cladonia grayi Sandst. – Loc. 12, on soil, very rare species, 1: soil

Cladonia macilenta Hoffm. – Loc. 2, 8, 10, on wood (branches, pieces of bark, stump), soil, rare species, 1: on wood, 2: soil

Cladonia macilenta Hoffm. var. ***bacillaris*** (Genth) Schaer. – Loc. 10, on wood (pieces of bark, stump), soil, bark of *Betula pendula*, *Pinus sylvestris*, very rare species, 1: on wood, 1: soil, 1: *Betula pendula*, 1: *Pinus sylvestris*

Cladonia merochlorophaea Asahina – Loc. 12, on soil, very rare species, 1: soil

Cladonia merochlorophaea var. ***novochlorophaea*** Sipman – Loc. 12, on soil, very rare species, 1: soil

Cladonia ochrochlora Flörke – Loc. 10, 25, on wood (pieces of bark, fence, stump), soil, very rare species, 1: on wood, 2: soil

Cladonia phyllophora Hoffm. – Loc. 2, 8, 10, 11, 12, 26, 30, 33, on soil, frequent species, 8: soil

Cladonia pleurota (Flörke) Schaerer – Loc. 10, on soil, very rare species, 1: soil

Cladonia portentosa (Dufour) Coem. – Loc. 10, 12, on soil, very rare species, 2: soil

Cladonia pyxidata (L.) Hoffm. – Loc. 10, 30, 33, on soil, very rare species, 3: soil

Cladonia pyxidata subsp. ***pocillum*** (Ach.) Schaer. – Loc. 14, on soil, very rare species, 1: soil

Cladonia ramulosa (With.) J. R. Laundon – Loc. 10, 12, on soil, very rare species, 2: soil

Cladonia rangiferina (L.) F. H. Wigg. – Loc. 8, 10, 11, 12, 30, on soil, rare species, 5: soil

Cladonia rangiformis Hoffm. – Loc. 33, on soil, very rare species, 1: soil

Cladonia rei Schaer. – Loc. 12, on wood (pieces of bark), on soil, very rare species, 1: on wood, 1: soil

Cladonia squamosa Hoffm. – Loc. 10, 12, on soil, very rare species, 2: soil

Cladonia subulata (L.) F. H. Wigg. – Loc. 2, 8, 10, 25, 29, 30, 33, on soil, frequent species, 7: soil

Cladonia sulphurina (Michx.) Fr. – Loc. 10, on soil, very rare species, 1: soil

Cladonia uncialis (L.) F. H. Wigg. – Loc. 8, 10, 11, 12, on soil, rare species, 4: soil

Collema limosum (Ach.) Ach. – Loc. 14, on soil, very rare species, 1: soil

Collema tenax (Sw.) Ach. – Loc. 14, 30, 33, on soil, rare species, 3: soil

Dibaeis baeomyces (L. f.) Rambold & Hertel – Loc. 33, on soil, very rare species, 1: soil

Diploschistes muscorum (Scop.) R. Sant. – Loc. 30, 32, 33, on soil, organic debris, rare species, 3: on soil, 2: organic debris

Endocarpon pusillum Hedw. – Loc. 14, on soil, very rare species, 1: soil

Evernia prunastri (L.) Ach. – Loc. 5, 7, 9, 10, 15-18, 22, 23, 26-29, 31-33, 35, on bark of *Acer platanoides*, *Betula pendula*, *Pinus sylvestris*, *Quercus robur*, *Salix* spp., common species, 4: on *Acer platanoides*, 5: *Betula pendula*, 5: *Pinus sylvestris*, 5: *Quercus robur*, 4: *Salix* spp.

Flavoplaca citrina (Hoffm.) Arup, Frödén & Søchting – Loc. 7, 9, 19, 21, 26, on artificial bedrock containing calcium carbonate (building, curb, fence, pole, well), rare species, 5: on artificial bedrock containing calcium carbonate.

Flavoplaca oasis (A. Massal.) Arup, Frödén & Søchting – Loc. 3, 4, 5, 6, 9, 14, 16, 18, 21, 23-25, 30, 32, on bark of *Alnus glutinosa*, *Fraxinus* cfr. *excelsior*, *Populus* spp., *Quercus robur*, *Tilia cordata*, artificial bedrock containing calcium carbonate (pole, fence), common species, 1: on *Alnus glutinosa*, 5: *Fraxinus* cfr. *excelsior*, 3: *Populus* spp., 2: *Quercus robur*, 1: *Tilia cordata*, **3:** artificial bedrock containing calcium carbonate.

Hypocenomyce scalaris (Ach.) M. Choisy – Loc. 1-3, 6, 8-12, 18, 21, 24, 26-29, 31, on wood (branches, pieces of bark, fence, stump), bark of *Acer platanoides*, *Aesculus hippocastanum*, *Alnus glutinosa*, *Betula pendula*, *Fraxinus* cfr. *excelsior*, *Malus* spp., *Picea abies*, *Pinus sylvestris*, *Populus* spp., *Quercus robur*, *Salix* spp., *Sambucus nigra*, *Tilia cordata*, common species, 2: on wood (branches, pieces of bark, fence, stump), 1: *Acer platanoides*, 1: *Aesculus hippocastanum*, 1: *Alnus glutinosa*, 6: *Betula pendula*, 5: *Fraxinus* cfr. *excelsior*, 1: *Malus* spp., 1: *Picea abies*, 5: *Pinus sylvestris*, 1: *Populus* spp., 2: *Quercus robur*, 1: *Salix* spp., 1: *Sambucus nigra*, 1: *Tilia cordata*.

Hypogymnia physodes (L.) Nyl. – Loc. 1, 2, 5-11, 15-18, 20-23, 25-28, 30-31, 33-35, on wood (branches, pieces of bark, stump), bark of *Acer platanoides*, *Alnus glutinosa*, *Betula pendula*, *Juniperus communis*, *Fraxinus* cfr. *excelsior*, *Malus* spp., *Quercus robur*, *Padus serotina*, *Picea abies*, *Pinus sylvestris*, *Populus* spp., *Prunus* spp., *Robinia pseudoacacia*, *Salix* spp., *Tilia cordata*, *T. platyphyllos*, bryophytes, stone, common species, 2: on wood, 2: *Acer platanoides*, 3: *Alnus glutinosa*, 5: *Betula pendula*, 2: *Juniperus communis*, 4: *Fraxinus* cfr. *excelsior*, 2: *Malus* spp., 3: *Quercus robur*, 2: *Padus serotina*, 1: *Picea abies*, 5: *Pinus sylvestris*, 2: *Populus* spp., 1: *Prunus* spp., 1: *Robinia pseudoacacia*, 3: *Salix* spp., *Tilia cordata*, 1: *T. platyphyllos*, 1: bryophytes, 2: stone.

Hypogymnia tubulosa (Schaer.) Hav. – Loc. 31, 35, on wood (branches), bark of *Betula pendula*, very rare species, 1: on wood (branches), 1: *Betula pendula*.

Imshaugia aleurites (Ach.) S. L. F. Meyer – Loc. 2, 10, 12, 27, on wood (pieces of bark), bark of *Pinus sylvestris*, rare species, 2: on wood, 3: *Pinus sylvestris*.

Lecania cyrtella (Ach.) Th. Fr. – Loc. 9, 12, 21, 32, on bark of *Alnus glutinosa*, *Fraxinus* cfr. *excelsior*, *Malus* spp., *Populus tremula, Tilia cordata*, rare species, 1: on *Alnus glutinosa*, 2: *Fraxinus* cfr. *excelsior*, 1: *Malus* spp., 2: *Populus tremula,* 1: *Tilia cordata*.

Lecanora albescens (Hoffm.) Flörke – Loc. 1, 3, 9, 17, 26, on artificial bedrock containing calcium carbonate (building, fence), rare species, 5: on artificial bedrock containing calcium carbonate.

Lecanora allophana Nyl. – Loc. 4, 7, 25, 26, 28, 29, 33, on bark of *Populus tremula,* frequent species, 7: *Populus tremula*.

Lecanora argentata (Ach.) Malme – Loc. 9, 16, on bark of *Acer platanoides*, very rare species, 2: on *Acer platanoides*.

Lecanora carpinea (L.) Vain. – Loc. 1, 3, 5, 7-9, 16, 18, 21, 23-26, 28-29, 31-33, on bark of *Carpinus betulus*, *Fraxinus* cfr. *excelsior*, *Malus* spp., *Populus* spp., *Quercus robur*, *Ulmus minor*, common species, 2: on *Carpinus betulus*, 5: *Fraxinus* cfr. *excelsior*, 2: *Malus* spp., 5: *Populus* spp., 4: *Quercus robur*, 2: *Ulmus minor*.

Lecanora chlarotera Nyl. – Loc. 9, 21, 23, 26, 27, on wood (branches, stump), bark of *Acer campestre*, *A. platanoides*, *Alnus glutinosa*, *A. incana*, *Frangula alnus*, *Fraxinus* cfr. *excelsior*, *Malus* spp., *Populus* spp., *Pyrus communis*, *Quercus robur*, *Robinia pseudoacacia*, *Salix* spp., *Ulmus minor*, rare species, 1: on wood, 1: *Acer campestre*, 1: *A. platanoides*, 1: *Alnus glutinosa*, 1: *A. incana*, 1: *Frangula alnus*, 2: *Fraxinus* cfr. *excelsior*, 1: *Malus* spp., 1: *Populus* spp., 1: *Pyrus communis*, 1: *Quercus robur*, 1: *Robinia pseudoacacia*, 1: *Salix* spp., 1: *Ulmus minor*.

Lecanora conizaeoides Cromb. – Loc. , 3, 6, 8-13, 24, 26-29, 31, on wood (branches, pieces of bark, fence, stump), bark of *Acer platanoides*, *Aesculus hippocastanum*, *Alnus glutinosa*, *Betula pendula*, *Carpinus betulus*, *Fraxinus* cfr. *excelsior*, *Juniperus communis*, *Padus serotina*, *Picea abies*, *Pinus sylvestris*, *Populus* spp., *Prunus* spp., *Pyrus communis*, *Quercus robur*, *Robinia pseudoacacia*, *Sambucus nigra*, *Sorbus accuparia*, *Tilia cordata*, *Ulmus minor*, common species, 2: on wood, 1: *Acer platanoides*, 1: *Aesculus hippocastanum*, 1: *Alnus glutinosa*, 1: *Betula pendula*, 1: *Carpinus betulus*, 1: *Fraxinus* cfr. *excelsior*, 1: *Juniperus communis*, 1: *Padus serotina*, 1: *Picea abies*, 5: *Pinus sylvestris*, 2: *Populus* spp., 1: *Prunus* spp., 1: *Pyrus communis*, 2: *Quercus robur*, 1: 1: *Robinia pseudoacacia*, 1: *Sambucus nigra*, 1: *Sorbus accuparia*, 1: *Tilia cordata*, 1: *Ulmus minor*.

Lecanora dispersa s.lat. (Pers.) Sommerf. – Loc. 1, 3, 5, 6, 9, 16, 17, 22, 24, 25, 32, on artificial bedrock containing calcium carbonate (building, pole, fence), frequent species, 11: on artificial bedrock containing calcium carbonate.

Lecanora expallens Ach. – Loc. 5, 9, 22, 26, 32, on wood (pieces of bark, fencing), bark of *Acer platanoides*, *Aesculus hippocastanum*, *Alnus glutinosa*, *Betula pendula*, *Fraxinus* cfr. *excelsior*, *Malus* spp., *Pinus sylvestris*, *Populus* spp., *Quercus robur*, *Robinia pseudoacacia*, *Salix* spp., *Sorbus aucuparia*, *Tilia cordata*, rare species, 1: on wood, 1: *Acer platanoides*, 1: *Aesculus hippocastanum*, 1: *Alnus glutinosa*, 2: *Betula pendula*, 1: *Fraxinus* cfr. *excelsior*, 2: *Malus* spp., 2: *Pinus sylvestris*, 2: *Populus* spp., 1: *Quercus robur*, 1: *Robinia pseudoacacia*, 1: *Salix* spp., 1: *Sorbus aucuparia*, 1: *Tilia cordata*.

Lecanora hagenii (Ach.) Ach. – Loc. 3, 9, 16, 18, 24-26, 32, on wood (branches, pieces of bark, stump), bark of *Alnus glutinosa*, *Betula pendula*, *Carpinus betulus*, *Frangula alnus*, *Fraxinus* cfr. *excelsior*, *Malus* spp., *Populus* spp., *Pyrus communis*, *Quercus robur*, *Salix* spp., *Sambucus nigra*, *Tilia cordata*, *Ulmus minor*, frequent species, 2: on wood (branches, pieces of bark, stump), 2: *Alnus glutinosa*, 2: *Betula pendula*, 1: *Carpinus betulus*, 1: *Frangula alnus*, 3: *Fraxinus* cfr. *excelsior*, 1: *Malus* spp., 1: *Populus* spp., 1: *Pyrus communis*, 1: *Quercus robur*, 2: *Salix* spp., 1: *Sambucus nigra*, 1: *Tilia cordata*, 1: *Ulmus minor.*

Lecanora saxicola (Pollich) Ach. – Loc 1, 3, 4, 7, 9, 16, 19, 24, 25, 32, on artificial bedrock containing calcium carbonate (sidewalk, fencing, wells, pole), frequent species, 10: on artificial bedrock containing calcium carbonate.

Lecanora polytropa (Hoffm.) Rabenh. – Loc. 4, 9, 19, 32, on stone, rare species, 4: stone.

Lecanora pulicaris (Pers.) Ach. – Loc. 1, 9-10, 16, 18, 21, 23, 26, 28, 30-31, on wood (stump), bark of *Alnus glutinosa*, *Betula pendula*, *Fraxinus* cfr. *excelsior*, *Malus* spp., *Pinus sylvestris*, *Populus* spp., *Pyrus communis*, *Populus* spp., *Quercus robur*, *Robinia pseudoacacia*, *Salix* spp., *Sambucus nigra*, *Tilia cordata*, *Ulmus minor*, frequent species, 2: on wood (stump), 1: *Alnus glutinosa*, 2: *Betula pendula*, 3: *Fraxinus* cfr. *excelsior*, 1: *Malus* spp., 1: *Pinus sylvestris*, 2: *Populus* spp., 1: *Pyrus communis*, 3: *Populus* spp., 2: *Quercus robur*, 1: *Robinia pseudoacacia*, 2: *Salix* spp., 1: *Sambucus nigra*, 1: *Tilia cordata*, 1: *Ulmus minor.*

Lecanora rupicola (L.) Zahlbr. – Loc. 1, 9, 20, 32, on stone, rare species, 4: stone.

Lecanora saligna (Schrader) Zahlbr. – Loc. 4, 6, 16, 18, 25, 26, 29, on wood (branches), bark of *Carpinus betulus*, *Fraxinus* cfr. *excelsior*, *Populus* spp., *Pyrus communis*, *Tilia cordata*, *Salix* spp., *Sambucus nigra*, frequent species, 1: on wood, 1: *Carpinus betulus*, 2: *Fraxinus* cfr. *excelsior*, 3: *Populus* spp., 1: *Pyrus communis*, 1: *Tilia cordata*, 1: *Salix* spp., 1: *Sambucus nigra*.

Lecanora symmicta (Ach.) Ach. – Loc. 10, 18, 31, on wood (stump), bark of *Malus* spp., *Quercus robur*, *Populus* spp., rare species, 1: on wood (stump), 1: bark of *Malus* spp., 1: *Quercus robur*, 1: *Populus* spp.

Lecanora umbrina (Ach.) A. Massal. – Loc. 4, 7, 16, on bark of *Populus tremula, Salix* spp., rare species, 2: on *Populus tremula,* 2: *Salix* spp.

Lecanora varia (Hoffm.) Ach. – Loc. 3, 9, 24, 26, 28, 29, 31-33, on wood (fence), bark of *Fraxinus* cfr. *excelsior*, *Pyrus communis*, *Tilia cordata*, frequent species, 7: on wood (fence), 2: *Fraxinus* cfr. *excelsior*, 1: *Pyrus communis*, 1: *Tilia cordata*.

Lecidea fuscoatra (L.) Ach. – Loc. 9, 19, 20, on stone, rare species, 3: stone.

Lecidella elaeochroma (Ach.) M. Choisy – Loc. 5, 7, 9, 16, 21, 22, 23, 26, 27, 31-33, 35, on wood (branches), bark of *Alnus glutinosa*, *Acer platanoides*, *Frangula alnus*, *Fraxinus* cfr. *excelsior*, *Populus* spp., *Quercus robur*, *Salix* spp., frequent species, 2: on wood, 1: *Alnus glutinosa*, 2: *Acer platanoides*, 1: *Frangula alnus*, 4: *Fraxinus* cfr. *excelsior*, 4: *Populus* spp., 3: *Quercus robur*, 3: *Salix* spp.

Lecidella stigmatea (Ach.) Hertel & Leuckert – Loc. 9, 16, 19, 25, 26, on stone, artificial bedrock containing calcium carbonate (pole), rare species, 4: on stone, 2: artificial bedrock containing calcium carbonate.

Lepraria elobata Tønsberg – Loc. 11, 12, on wood (stump), bark of *Pinus sylvestris*, very rare species, 1: on wood, 2: *Pinus sylvestris*.

Lepraria incana (L.) Ach. – Loc. 12, 23, 34, 35, on wood (branches, pieces of bark, stump), bark of *Pinus sylvestris*, *Picea abies*, *Populus* spp., *Quercus robur*, *Salix* spp., bryophytes and remains of vascular plants, rare species, 1: on wood (branches, pieces of bark, stump), 4: *Pinus sylvestris*, 1: *Picea abies*, 1: *Populus* spp., 4: *Quercus robur*, 4: *Salix* spp., 3: bryophytes and remains of vascular plants.

Melanelixia fuliginosa (Duby) O. Blanco, A. Crespo, Divakar, Essl., D. Hawksw. & Lumbsch – Loc. 9, 10, 18, 21, 31, 35, on wood (pieces of bark, fence), bark of *Alnus glutinosa*, *Betula pendula*, *Fraxinus* cfr. *excelsior*, *Populus* spp., *Quercus robur*, *Sambucus nigra*, *Tilia cordata*, frequent species, 2: on wood, 1: *Alnus glutinosa*, 2: *Betula pendula*, 3: *Fraxinus* cfr. *excelsior*, 2: *Populus* spp., 1: *Quercus robur*, 1: *Sambucus nigra*, 1: *Tilia cordata*.

Melanelixia glabratula (Lamy) Sandler & Arup – Loc. 9, 26, 27, 32, on wood (pieces of bark), bark of *Betula pendula*, *Quercus robur*, *Salix* spp., *Tilia platyphyllos*, rare species, 1: on wood, 2: *Betula pendula*, 1: *Quercus robur*, 1: *Salix* spp., 1: *Tilia platyphyllos*.

Melanelixia subargentifera (Nyl.) O. Blanco, A. Crespo, Divakar, Essl., D. Hawksw. & Lumbsch – Loc. 6, 33, on bark of *Quercus robur*, very rare species, 2: *Quercus robur.*

Melanohalea exasperatula (Nyl.) O. Blanco A. Crespo, Divakar, Essl., D. Hawksw. & Lumbsch – Loc. 1, 6, 9, 18, 23, 25, 26, 28, 29, 32, 33, on bark of *Alnus glutinosa*, *Fraxinus* cfr. *excelsior*, *Malus* spp., *Pinus sylvestris*, *Populus* spp., *Quercus robur*, *Salix* spp., *Tilia cordata*, frequent species, 2: on *Alnus glutinosa*, 4: *Fraxinus* cfr. *excelsior*, 1: *Malus* spp., 1: *Pinus sylvestris*, 2: *Populus* spp., 2: *Quercus robur*, 2: *Salix* spp., 2: *Tilia cordata*.

Micarea denigrata (Fr.) Hedl. – Loc. 12, 26, on wood (branches, pieces of bark, stump), bark of *Pinus sylvestris*, very rare species, 1: on wood, 2 *Pinus sylvestris.*

Micarea prasina s.lat. Fr. – Loc. 9, 31, on wood (branches, pieces of bark, stump), bark of *Betula pendula*, very rare species, 1: on wood, 2: *Betula pendula*.

Parmelia saxatilis (L.) Ach. – Loc. 1, on wood (pieces of bark), stone, very rare species, 1: wood, 1: stone.

Parmelia sulcata Taylor – Loc. 1, 2, 4-7, 9, 10, 12, 15-17, 18, 21-23, 25, 26, 28, 30, 32-35, on wood (branches, pieces of bark, fence, stump), bark of *Alnus glutinosa*, *Betula pendula*, *Carpinus betulus*, *Fraxinus* cfr. *excelsior*, *Padus serotina*, *Pinus sylvestris*, *Populus* spp., *Prunus* spp., *Quercus robur*, *Robinia pseudoacacia*, *Salix* spp., *Sambucus nigra*, *Tilia cordata*, *T. platyphyllos*, common species, 4: on wood, 2: *Alnus glutinosa*, 3: *Betula pendula*, 1: *Carpinus betulus*, 4: *Fraxinus* cfr. *excelsior*, 1: *Padus serotina*, 1: *Pinus sylvestris*, 4: *Populus* spp., 1: *Prunus* spp., 2: *Quercus robur*, 2: *Robinia pseudoacacia*, 5: *Salix* spp., 1: *Sambucus nigra*, 2: *Tilia cordata*, 2: *T. platyphyllos*, 24.

Parmeliopsis ambigua (Wulfen) Nyl. – Loc. 2, 8, 10, 12, 31, on wood (fence), bark of *Betula pendula*, *Quercus robur*, *Pinus sylvestris*, rare species, 1: on wood, 1: *Betula pendula*, 1: *Quercus robur*, 2: *Pinus sylvestris*.

Peltigera canina (L.) Willd. – Loc. 12, 33, on soil, very rare species, 2: soil.

Peltigera didactyla (With.) J. R. Laundon – Loc. 10, 12, 30, 33, on soil, rare species, 4: soil.

Peltigera rufescens (Weiss) Humb. – Loc. 4, 5, 9, 11, 12, 30, 33, on soil, bryophytes and remains of vascular plants, frequent species, 7: on soil, 3: bryophytes and remains of vascular plants.

Phaeophyscia nigricans (Flörke) Moberg – Loc. 1, 3, 6, 7, 9, 16, 24, 25, 32, 33, on bark of *Alnus glutinosa*, *Fraxinus* cfr. *excelsior*, *Malus* spp., *Populus* spp., *Pyrus communis*, *Quercus robur*, *Sambucus nigra*, *Salix* spp., *Tilia cordata*, artificial bedrock containing calcium carbonate (fence, pole), frequent species, 1: on *Alnus glutinosa*, 2: *Fraxinus* cfr. *excelsior*, 1: *Malus* spp., 2: *Populus* spp., 1: *Pyrus communis*, 1: *Quercus robur*, 1: *Sambucus nigra*, 1: *Salix* spp., 1: *Tilia cordata*, 8: artificial bedrock containing calcium carbonate.

Phaeophyscia orbicularis (Neck.) Moberg – Loc. stands: 1, 3-5, 7, 9, 10, 13, 15-18, 21-24, 26, 28, 32, 33, on wood (pieces of bark, branches, stump), stone, bark of *Acer platanoides*, *Alnus glutinosa*, *Eunonymus europaea*, *Fraxinus* cfr. *excelsior*, *Malus* spp., *Populus* spp., *Prunus* spp., *Pyrus communis*, *Robinia pseudoacacia*, *Quercus robur*, *Salix* spp., *Sambucus nigra*, *Tilia cordata*, *T. platyphyllos*, *Ulmus minor*, artificial bedrock containing calcium carbonate (outbuildings), common species, 4: on wood, stone, 2: *Acer platanoides*, 3: *Alnus glutinosa*, 1: *Eunonymus europaea*, 4: *Fraxinus* cfr. *excelsior*, 1: *Malus* spp., 5: *Populus* spp., 2: *Prunus* spp., 1: *Pyrus communis*, 1: *Robinia pseudoacacia*, 1: *Quercus robur*, 2: *Salix* spp., 1: *Sambucus nigra*, 2: *Tilia cordata*, 1: *T. platyphyllos*, 2: *Ulmus minor*, 10: artificial bedrock containing calcium carbonate.

Phlyctis argena (Spreng.) Flotow – Loc. 6, 10, 17, 18, 26, 27, on bark of *Acer platanoides*, *Alnus glutinosa*, *Fraxinus* cfr. *excelsior*, *Quercus robur*, *Salix* spp., *Tilia cordata*, rare species, 1: on *Acer platanoides*, 2: *Alnus glutinosa*, 2: *Fraxinus* cfr. *excelsior*, 1: *Quercus robur*, 2: *Salix* spp., 1: *Tilia cordata*.

Physcia adscendens (Fr.) H. Olivier – Loc. 1, 3-7, 9, 10, 13, 16, 18, 19, 21, 22- 26, 28, 31-33, 35, on wood (pieces of bark, stump, branches), bark of *Acer campestre*, *A. platanoides*, *Aesculus hippocastanum*, *Alnus glutinosa*, *A. incana*, *Betula pendula*, *Carpinus betulus*, *Frangula alnus*, *Fraxinus* cfr. *excelsior*, *Malus* spp., *Quercus robur*, *Populus* spp., *Prunus* spp., *Pyrus communis*, *Robinia pseudoacacia*, *Salix* spp., *Sambucus nigra*, *Tilia cordata*, *T. plathyphyllos*, *Ulmus minor*; artificial bedrock containing calcium carbonate (fence, pole), stone, common species, 4: on wood, 2: *Acer campestre*, 2: *A. platanoides*, 2: *Aesculus hippocastanum*, 4: *Alnus glutinosa*, 2: *A. incana*, 2; *Betula pendula*, 1: *Carpinus betulus*, 1: *Frangula alnus*, 6: *Fraxinus* cfr. *excelsior*, 2: *Malus* spp., 2: *Quercus robur*, 5: *Populus* spp., 1: *Prunus* spp., 1: *Pyrus communis*, 1: *Robinia pseudoacacia*, 4: *Salix* spp., 1: *Sambucus nigra*, 2: *Tilia cordata*, 2: *T. plathyphyllos*, 1: *Ulmus minor*, 7: artificial bedrock containing calcium carbonate, 5: stone.

Physcia aipolia (Humb.) Fürnr. – Loc. 9, 16, bark of *Fraxinus* cfr. *excelsior*, very rare species, 2: on *Fraxinus* cfr. *excelsior*.

Physcia caesia (Hoffm.) Fürnr. – Loc. 1, 3, 4, 5, 7, 9, 19, 22, 24, 25, 32, on artificial bedrock containing calcium carbonate (outbuildings, pole, fence), stone, frequent species, 11: on artificial bedrock containing calcium carbonate (outbuildings, pole, fence), 6: stone.

Physcia dubia (Hoffm.) Lettau – Loc. 1, 4, 5, 7, 9, 13, 16, 18, 19, 21-26, 28, 31, 32, on bark of *Fraxinus* cfr. *excelsior*, *Malus* spp., *Populus* spp., *Quercus robur*, *Salix* spp., artificial bedrock containing calcium carbonate (fence), common species, 3: on *Fraxinus* cfr. *excelsior*, 2: *Malus* spp., 5: *Populus* spp., 2: *Quercus robur*, 2: 2: *Salix* spp., 6: artificial bedrock containing calcium carbonate.

Physcia stellaris (L.) Nyl. – Loc. 3-5, 7, 9, 10, 12, 18, 22-26, 28, 32, 33, on bark of *Alnus glutinosa*, *Fraxinus* cfr. *excelsior*, *Malus* spp., *Populus* spp., *Quercus robur*, *Salix* spp., *Tilia cordata*, common species, 2: on *Alnus glutinosa*, 5: *Fraxinus* cfr. *excelsior*, 1: *Malus* spp., 5: *Populus* spp., 2: *Quercus robur*, 2: *Salix* spp., 2: *Tilia cordata*

Physcia tenella (Scop.) DC. – Loc. 6, 17, 18, 21, 23, on wood (branches, stump), stone, bark of *Alnus glutinosa*, *Betula pendula*, *Carpinus betulus*, *Fraxinus* cfr. *excelsior*, *Malus* spp., *Padus serotina*, *Prunus* spp., *Populus* spp., *Quercus robur*, *Salix* spp., *Sambucus nigra*, *Ulmus minor*, rare species, 1: on wood, 1: stone, 1: *Alnus glutinosa*, 1: *Betula pendula*, 1: *Carpinus betulus*, 2: *Fraxinus* cfr. *excelsior*, 1: *Malus* spp., 1: *Padus serotina*, 1: 1: *Prunus* spp., 1: *Populus* spp., 1: *Quercus robur*, 1: *Salix* spp., 1: *Sambucus nigra*, 1: *Ulmus minor*.

Physconia enteroxantha (Nyl.) Poelt – Loc. 6, 16, 21, 23, 26, 32, on bark of *Fraxinus* cfr. *excelsior*, *Populus* spp., *Salix* spp., frequent species, 3: on *Fraxinus* cfr. *excelsior*, 3: *Populus* spp., 2: *Salix* spp.

Physconia distorta (With.) J. R. Laundon – Loc. 17, on bark of *Betula pendula,* very rare species, 1: on *Betula pendula*

Physconia grisea (Lam.) Poelt – Loc. 9, 16-18, on bark of *Alnus glutinosa*, *Fraxinus* cfr. *excelsior*, *Malus* spp., *Populus* spp., *Pyrus communis*, *Robinia pseudoacacia*, *Quercus robur*, *Salix* spp., *Tilia platyphyllos*, rare species, 1: on *Alnus glutinosa*, 1: *Fraxinus* cfr. *excelsior*, 1: *Malus* spp., 1: *Populus* spp., 1: *Pyrus communis*, 1: *Robinia pseudoacacia*, 1: *Quercus robur*, 1: *Salix* spp., 1: *Tilia platyphyllos*.

Physconia perisidiosa (Erichsen) Moberg – Loc. 1, on bark of *Salix* spp., very rare species, 1: *Salix* spp.

Placynthiella oligotropha (J. R. Laundon) Coppins & P. James – Loc. 8, 30, on wood (pieces of bark, stump), soil, very rare species, 1: on wood, 1: soil.

Placynthiella uliginosa (Schrad.) Coppins & P. James – Loc. 9, 10, 12, on wood (branches, pieces of bark, fence drewniane, stump), soil, rare species, 2: on wood, 3: soil.

Platismatia glauca (L.) W.L. Culb. & C. F. Culb. – Loc. 31, on bark of *Betula pendula*, wood (branches, pieces of bark, stump), very rare species, 1: on *Betula pundula*, 1: wood.

Pleurosticta acetabulum (Neck.) Elix & Lumbsch – Loc. 6, on bark of *Fraxinus* cfr. *excelsior*, very rare species, 1: *Fraxinus* cfr. *Excelsior*.

Polycauliona candelaria (L.) Frödén, Arup & Søchting – Loc. 1, 6, 9, 23, 26, 28, 29, 33, on wood (branches, fence, stump), bark of *Acer campestre*, *Alnus glutinosa*, *Betula pendula*, *Fraxinus* cfr. *excelsior*, *Malus* spp., *Quercus robur*, *Populus* spp., *Robinia pseudoacacia*, *Salix* spp., *Sambucus nigra*, *Tilia cordata*, frequent species, 1: on wood, 1: *Acer campestre*, 1: *Alnus glutinosa*, 1: *Betula pendula*, 2: *Fraxinus* cfr. *excelsior*, 1: *Malus* spp., 1: *Quercus robur*, 1: *Populus* spp., 1: *Robinia pseudoacacia*, 1: *Salix* spp., 1: *Sambucus nigra*, 1: *Tilia cordata*.

Polycauliona polycarpa (Hoffm.) Frödén, Arup & Søchting – Loc. 1, 3-7, 9, 15, 16, 18, 21, 23, 24, 25, 26, 28, 29, 31-33, on wood (branches, fence), bark of *Acer platanoides, Alnus glutinosa*, *Betula pendula*, *Frangula alnus*, *Fraxinus* cfr. *excelsior*, *Malus* spp., *Quercus robur*, *Populus* spp., *Prunus* spp., *Pyrus communis*, *Robinia pseudoacacia*, *Salix* spp., *Sambucus nigra*, *Sorbus aucuparia*, *Tilia cordata*, *T. platyphyllos*, *Ulmus minor*, artificial bedrock containing calcium carbonate (fence, pole), common species, 2: on wood (branches, fence), 2: *Acer platanoides,* 2: *Alnus glutinosa*, 2: *Betula pendula*, 1: *Frangula alnus*, 3: *Fraxinus* cfr. *excelsior*, 2: *Malus* spp., 2: *Quercus robur*, 3: *Populus* spp., 1: *Prunus* spp., 1: *Pyrus communis*, 1: *Robinia pseudoacacia*, 3: *Salix* spp., 1: *Sambucus nigra*, 1: *Sorbus aucuparia*, 1: *Tilia cordata*, 1: *T. platyphyllos*, 1: *Ulmus minor*, 1: artificial bedrock containing calcium carbonate.

Polysporina simplex (Davies) Vězda – Loc. 6, on stone, very rare species, 1: on stone.

Porpidia crustulata (Ach.) Hertel & Knoph – Loc. 9, 30, 32, on stone, rare species, 3: on stone.

Pseudevernia furfuracea (L.) Zopf – Loc. 2, 6-8, 10, 17, 25-27, 29, 30, 31, 33, on wood (branches), bark of *Alnus glutinosa*, *Pinus sylvestris*, *Quercus robur,* frequent species, 2: on wood, 1: *Alnus glutinosa*, 10: *Pinus sylvestris*, 4: *Quercus robur*.

Ramalina farinacea (L.) Ach. – Loc. 6, 9, 10, 17, 18, 21, 25, 35, on bark of *Fraxinus* cfr. *excelsior*, *Pyrus communis*, *Populus* spp., *Quercus robur*, *Salix* spp., *Tilia cordata*, *Salix alba*, frequent species, 4: on *Fraxinus* cfr. *excelsior*, 1: *Pyrus communis*, 3: *Populus* spp., 4: *Quercus robur*, 3: *Salix* spp., 2: *Tilia cordata*.

Ramalina fraxinea (L.) Ach. – Loc. 1, 4-7, 9, 13, 15, 17, 18, 22, 25, 26, 28, 32, 33, on bark of *Fraxinus* cfr. *excelsior, Quercus robur*, *Salix alba,* common species, 10: on *Fraxinus* cfr. *excelsior,* 4: *Quercus robur*, 5: *Salix alba*.

Ramalina pollinaria (Westr.) Ach. – Loc. 17, on bark of *Fraxinus* cfr. *excelsior*, very rare species, 1: *Fraxinus* cfr. *excelsior*

Rhizocarpon distinctum Th. Fr. – Loc. 7, 9, 30, 32, on stone, rare species, 4: stone.

Rhizocarpon reductum Th. Fr. – Loc. 20, on stone, very rare species, 1: stone.

Rinodina pyrina (Ach.) Arnold – Loc. 32, 33, on bark of *Quercus robur*, very rare species, 2: *Quercus robur*.

Rusavskia elegans (Link) S. Y. Kondr. & Kärnefelt. – Loc. 1, 3, 6, 9, 16, 24, on artificial bedrock containing calcium carbonate (fence, pole), frequent species, 6: artificial bedrock containing calcium carbonate.

Sarcogyne regularis Körb. – Loc. 32, on artificial bedrock containing calcium carbonate (fence), very rare species, 1: artificial bedrock containing calcium carbonate.

Scoliciosporum chlorococcum (Stenh.) Vězda – Loc. 7, 8, 9, 12, 26, 30-32, on wood (branches, pieces of bark), bark of *Alnus glutinosa*, *Fraxinus* cfr. *excelsior*, *Pinus sylvestris*, *Populus* spp., *Quercus robur*, *Sorbus aucuparia*, frequent species, 2: on wood (branches, pieces of bark), 1: *Alnus glutinosa*, 2: *Fraxinus* cfr. *excelsior*, 2: *Pinus sylvestris*, 2: *Populus* spp., 2: *Quercus robur*, 1: *Sorbus aucuparia*.

Scoliciosporum umbrinum (Ach.) Arnold – Loc. 4, 5, 7, 32, 35, on stones, rare species, 5: stones.

Stereocaulon condensatum Hoffm. – Loc. 10, on soil, very rare species, 1: soil.

Stereocaulon incrustatum Flörke – Loc. 10, on soil, very rare species, 1: soil.

Trapeliopsis flexuosa (Fr.) Coppins & P. James – Loc. 2, 4, 5, 8, 9, 12, 25, on wood (branches, pieces of bark, stump), soil, bark of *Alnus glutinosa*, *Betula pendula*, *Fraxinus* cfr. *excelsior*, *Pinus sylvestris*, frequent species, 3: on wood, soil, 1: *Alnus glutinosa*, 2: *Betula pendula*, 2: *Fraxinus* cfr. *excelsior*, 1: *Pinus sylvestris*.

Trapeliopsis granulosa (Hoffm.) Lumbsch – Loc. 8, 9, 10, 12, 29, on wood (branches, pieces of bark, fence, stump), soil, bark of *Alnus glutinosa*, *Betula pendula*, *Fraxinus* cfr. *excelsior*, *Quercus robur*, *Pinus sylvestris*, bryophytes and remains of vascular plants, rare species, 2: on wood, 2: soil, 1: *Alnus glutinosa*, 1: *Betula pendula*, 1: *Fraxinus* cfr. *excelsior*, 1: *Quercus robur*, 1: *Pinus sylvestris*, 1: bryophytes and remains of vascular plants.

Tuckermannopsis chlorophylla (Willd.) Hale – Loc. 31, 33, on bark of *Populus tremula,* very rare species, 2: *Populus tremula*.

Tuckermanopsis sepincola (Ehrh.) Hale – Loc. 2, 10, 31, on bark of *Betula pendula*, rare species, 3: *Betula pendula*.

Usnea hirta (L.) F. H. Wigg. – Loc. 2, 8, 11, 27, 35, on bark of *Pinus sylvestris,* rare species, 5: *Pinus sylvestris*.

Usnea subfloridana Stirt. – Loc. 10, 17, on bark of *Pinus sylvestris*, *Quercus robur*, very rare species, 1: *Pinus sylvestris,* 1: *Quercur robur*.

Verrucaria muralis Ach. – Loc. 33, on artificial bedrock containing calcium carbonate (fence, pole), very rare species, 1: on artificial bedrock containing calcium carbonate.

Verrucaria nigrescens Pers. – Loc. 9, 26, on artificial bedrock containing calcium carbonate (fence, pole), very rare species, 2: on artificial bedrock containing calcium carbonate.

Vulpicida pinastri (Scop.) J.–E. Mattson & M. J. Lai – Loc. 31, on wood (stump), bark of *Betula pendula*, very rare species, 1: on wood, *Betula pendula*.

Xanthoparmelia conspersa (Ach.) Hale – Loc. 1, 4, 5, 7, 19, 20, 30, 32, on stone, frequent species, 8: stone.

Xanthopramelia loxodes (Nyl.) O. Blanco, A. Crespo, Elix, D. Hawksw. & Lumbsch – Loc. 20, on stone, very rare species, 1: stone.

Xanthoparmelia pulla (Ach.) O. Blanco, A. Crespo, Elix, D. Hawksw. & Lumbsch – Loc. 1, 4, 7, 19, 20, 30, on stone, frequent species, 6: stone.

Xanthoparmelia verruculifera (Nyl.) O. Blanco, A. Crespo, Elix, D. Hawksw. & Lumbsch – Loc. 20, on stone, very rare species, 1: stone.

Xanthoria parietina (L.) Th. Fr. – Loc. 1, 3, 6, 7, 9, 10, 13, 15-18, 21-26, 28, 29, 31-33, 35, on wood (branches), stone, bark of *Acer platanoides, Alnus glutinosa*, *Betula pendula*, *Carpinus betulus*, *Frangula alnus*, *Fraxinus* cfr. *excelsior*, *Malus* spp., *Quercus robur*, *Populus* spp., *Pyrus communis*, *Robinia pseudoacacia*, *Salix* spp., *Sambucus nigra*, *Sorbus aucuparia*, *Tilia cordata*, *T. platyphyllos*, common species, 5: on wood, 4: stone, 2: *Acer platanoides,* 1: *Alnus glutinosa*, 2: *Betula pendula*, 1: *Carpinus betulus*, 1: *Frangula alnus*, 4: *Fraxinus* cfr. *excelsior*, 2: *Malus* spp., 1: *Quercus robur*, 2: *Populus* spp., 2: *Pyrus communis*, 1: *Robinia pseudoacacia*, 4: *Salix* spp., 1: *Sambucus nigra*, 1: *Sorbus aucuparia*, 2: *Tilia cordata*, 1: *T. platyphyllos* 23.

Characteristics of lichens in agricultural landscape: Lichens found in the agricultural landscape of the Podlasie region represented the following habitat groups: epiphytic (72 species), epigeic (53), epixylic (45), epilithic (45) and epibryophytic (7). Most species were found on the bark of trees. Less variation was observed among the lichens that inhabit soil and bedrock. Lichens growing on bryophytes and remain of vascular plants remain very rarely reported. These include: *Cladonia chlorophaea, C. coniocraea, C. fimbriata, C. gracilis, Hypogymnia physodes, Lepraria incana* and *Peltigera rufescens*.

Epiphytes: Among the habitat groups occurring in the rural landscape of Podlasie the greatest differentiation was demonstrated for epiphytes. In total, 72 species were found. Their records come from the bark of trees growing along the roads alone, in the fields, meadows and pastures or within the countryside buildings and on the edge of forests.

The richest epiphytic biota is exhibited by *Quercus robur, Populus* spp., *Fraxinus* cfr. *excelsior*, *Salix* spp., *Alnus glutinosa*, which are colonized by respectively 43, 40, 38, and 37 species respectively. Quite a large variation was also observed on the bark of *Alnus* spp. (30 species) and *Tilia cordata* (28). In the lists of coniferous phorophytes the individual registers are dominated by *Pinus sylvestris*, the bark of which showed the presence of 23 species. Among trees of foreign origin most epiphytic species (16) belong to *Robinia pseudoacacia*. Apple tree was singled out in a group of fruit trees in connection with the greatest diversity of lichens found on its bark (25 species), much fewer of them were found on bark of *Pyrus communis* (15) and *Prunus* spp. (9). Single records of common lichens are registered from shrubs. Here a richer record appears to belong to *Sambucus nigra* only, whose bark was colonized by 17 species.

Most epiphytes were found on the trunk and in crown of trees, and the fewest at the base of the trunk. On the trunk, along with his height, changing the share morphological forms of lichen. At the base of the trunk strongly dominated by crustose thallus of lichens (eg. *Lecanora carpinea, L. expallens, Scoliciosporum chlorococcum*), at the trunk and crown dominated foliose (eg. *Melanohalea exasperatula, Parmelia sulcata, Physcia dubia, Ph. tenella, Physconia enteroxantha, Ph. grisea, Polycauliona polycarpa, Xanthoria parietina*) and fruticose thallus (*Ramalina farinacea, R. fraxinea, R. pollinaria*).

The most numerous in species is genus *Lecanora* (12 species). The following species were found on the largest number of phorophytes: *Lecanora conizaeoides* (19), *Buellia punctata* (16), *Physcia adscendens* (16) and *Polycauliona polycarpa* (15). Among the epiphytic lichens there dominate lichens with crustose thalli - 31 species. Next group of lichens is represented by foliose lichens (25 species: wide foliose - 10, narrow foliose - 15), fruticose (14) and squamulose (2). Most of the observed species are found in more sunlight and little shading.

On the bark of trees in rural landscape lichens under legal protection in Poland were noted, i.e. *Bryoria fuscescens*, *Hypogymnia tubulosa*, *Imshaugia aleurites*, *Pleurosticta acetabulum*, *Ramalina farinacea*, *Usnea hirta*, *Vulpicida pinastri*, or threatened, i.e. *Anaptychia ciliaris, Bacidia rubella*, *Bryoria fuscescens, Evernia prunastri*, *Melanelixia subargentifera*, *R. pollinaria*, *Usnea hirta*, *U. subfloridana* (Regulation, 2014; Cieśliński *et al*., 2006).

Epixylic lichens: Typical substrates occupied by epixylous lichens in rural landscape are wooden walls and roofs of farm buildings and fences placed, inter alia, along meadows, pastures and buildings. In addition, members of this group can be seen on the wood of stumps, logs and branches of trees, poles (e.g. energy poles) standing in the meadows or within woodlots. The epixylic list consists of 46 species. The most numerous are genera *Cladonia* (12 species) and *Lecanora* (8 species). Other taxa are mainly crustose and foliose lichens.

Nearly half of the epixylic lichens are crustose taxa (19 species), followed by foliose (14: wide foliose type *Parmelia* – 7, narrow foliose type *Physcia* – 7) and fruticose taxa (13).

Most of the observed epixylic lichens are common lichenized fungi. Only on wood there were registered *Cladonia botrytes, C. cenotea, C. deformis*; records of other species come also from other types of substrates. The value of these habitats increases due to the presence of a taxon rare in the area of NE Poland, i.e. *Cladonia botrytes* and taxa included in the list of lichens protected by law (Regulation, 2014), i.e. *Usnea hirta*. Only two species, i.e. *Cladonia botrytes* and *Usnea hirta* are inscribed in the national red list (Cieśliński *et al*., 2006).

Epigeic lichens: In rural areas of the Podlasie region the presence of 53 species of lichens growing on soil was recorded. Favorable conditions for development are encountered by epigeic lichens, especially in grasslands and ruderal communities and in nearby coniferous forests. The largest differentiation was demonstrated for genus *Cladonia*, represented by 32 taxa. Furthermore, lichens of genera *Cetraria*, *Peltigera*, *Placynthiella* and *Trapeliopsis* were also observed. What might be considered interesting is the occupation of the soil by species of genus *Bacidia*, *Baeomyces*, *Collema*, *Dibaeis*, *Diploschistes, Endocarpon*, *Stereocaulon*, inhabiting the soil on grasslands, including xerothermic grasses.

The epigeic lichen biota of meadows, pastures, woodlots and edges of fields is poor. It consists of single taxon of genus *Cladonia, Peltigera*, *Placynthiella uliginosa* and *Trapeliopsis granulosa*.

In the listing of epigeic lichens taxa with fruticose thalli clearly prevail (41 species), which is associated with the dominance of lichens of genus *Cladonia*. A much smaller proportion is exhibited by foliose lichens (3 species: wide foliose type *Parmelia* - 3) and crustose (9). Most epigeic lichens show preference for growth in natural habitats or those slightly transformed by human activity. Lichens occur mainly on substrates poor in nutrients. Only *Peltigera rufescens* is tied to slightly eutrophic places.

Other interesting epigeic lichens occurring in the agricultural landscape of Podlasie include *Cladonia grayi, C. merochlorophaea, C. merochlorophaea* var. *novochlorophaea*, *C. subulata* and *C. rei* which were determined by thin layer chromatography. Notable is the presence of protected species in rural landscape (Regulation, 2014), i.e. *Cetraria ericetorum, C. arbuscula*, *C. portentosa*, *C. rangiferina, Peltigera canina*. Among the endangered species (Cieśliński *et al.*, 2006), however, *Cladonia botrytes*, *Cetraria ericetorum*, *C. islandica*, *Endocarpon pusillum*, *Peltigera canina, Stereocaulon condensatum* and *S. incrustatum* can be found.

Epilithic lichens: The presence of rock lichens in rural landscape is marked, inter alia, on poles, fences and walls of farm buildings. Artificial anthropogenic substrate rich in calcium carbonate is mainly inhabited by calciphilous species. Quotations of epilitic lichens also come from natural substrates of rock, which in the study area are stones found in meadows, pastures, cultivated fields, within woodlots or the ones used to build such poles and fences. In total, 45 species were shown on rock substrates.

Among lichens observed on substrates of anthropogenic origin were: *Circinaria calcarea*, *C. contorta*, *Calogaya decipiens*, *C. fimbriata*, *Lecanora albescens*, *L. dispersa*, *Physcia adscendens*, *Ph. caesia*, *Sarcogyne regularis*, *Verrucaria muralis* and others. On stones the following species were recorded: *Acarospora fuscata*, *Circinaria caesiocinerea*, *Candelariella coralliza*, *C. vittelina*, *Parmelia saxatilis*, *Polysporina simplex*, *Porpidia crustulata*, *Rhizocarpon distinctum*, *Xanthoparmelia conpersa,* and others.

Most of the located epilithic lichens are taxa of crustose thalli (26 species), which outweigh those of foliose (17: wide foliose type *Parmelia* – 7, narrow foliose type *Physcia* – 10) and fruticose (2) thalli. A distinctive tendency of the discussed group of lichens to occupy places in direct sunlight has been shown.

Noteworthy is the presence of protected species in rural landscape (Regulation, 2014), i.e. *Xanthoparmelia pulla* and *X. verruculifera*. Among the epilithic lichens only *Circinaria contorta* is a valuable record in connection with its few quotations in NE Poland.

Synanthropic lichens: Reported synanthropic lichens are grouped according to the classification of Faltynowicz (1994) marking off apophytic lichens (eu-apophytes, mesoautoapophytes, ephemeroapophytes) and anthropophytes (eu-anthropophytes). The species are assigned to the appropriate groups depending on the frequency of record (cf. Szczepańska, 2008; Zarabska, 2011). In the study area 127 species of synanthropic lichens were found, which included all the lichens having at least one quote habitat of anthropogenic origin (cf. Szczepańska 2008; Zarabska, 2011). Among apophytes mesoautoapophytes dominated, followed by ephemeroapophytes, eu-apophytes and eu-anthropophytes. The anthropophytization index for lichen biota of the study area, which determines the percentage of apolitical species of lichen biota, amounted to 81.4%. The largest group of synanthropic lichens, as many as 41% of the total, are mesoautoapophytes. Lichens which were classified as mesoautoapophytes were those whose half or fewer quotes came from anthropogenic positions. In the list lichens of crustose and fruticose thalli dominate. The largest participation is exhibited by lichens inhabiting tree bark, soil and dead matter. Many of the mesoautoapophytes are acidophilous rock lichens. They colonize rocks and stones used as building material.

Quite frequently represented is an ephemeroapophytic group, which are transitional species dragged into habitats of anthropogenic origin. In the list taxa of crustose lichens dominate. The highest species diversity was demonstrated for epiphytes, epigeic and epilithic lichens. The species ranked as ephemeroapophytes were those whose number of record on anthropogenic habitats does not exceed three.

The smallest variation of apophythic lichens was observed among eu-apophytes, which include taxa occurring mainly in habitats of anthropogenic origin. The species were considered eu-apophytes when all or more than half of the quotations in the study area came from anthropogenic habitats. Among them lichens of foliose thallus dominate. The participation of epiphytes is clearly noteceable here.

Only three taxa (*Melanelixia subargentifera, Melanohalea exasperatula*, *Pleurosticta acetabulum*) were listed as eu-anthropophytes, or species alien to native lichen biota, however, both have been permanently established here. The records of these species, which are representatives of lichens of foliose thallus, are derived from the bark of trees.

The influence of the type of habitat on lichen biota: The values of the degree of species diversity for all species and for different morphological forms taking into account the type of habitat are presented in Table. 2.

Diversity of species: The degree of species variation of lichens has developed at a higher level in natural communities (coniferous forests) compared with the seminatural and anthropogenic habitats (Fig. 2). In rural areas, a greater percentage of species was noted within woodlots and at watercourses, while a smaller number of taxa was observed in ruderal habitats. The total number of identified species did not differ significantly between the different types of habitats.

Morphological form of thallus: There was no effect of the covariate on the percentage of species of particular types of thallus. The share of crustose lichens is higher in habitats associated with agricultural landscape, however, statistically significant differences are marked within the same habitats assigned to the landscape (Fig. 3). For the most part, significantly lower values of the examined parameter were observed in communities of meadows and pastures as well as natural habitats.

In relation to the number of species of squamulose lichens the difference was reported only on surfaces of natural communities (forests), and anthropogenic communities (segetal) (Fig. 4). The value of the parameter examined was not statistically significant.

The average number of species of narrow foliose lichens differed significantly between the surfaces of the communities of trees and forests, ruderal communities and grassland, segetal communities and grassland, meadows and pastures, trees and ruderal communities (Fig. 5). A higher share of narrow foliose lichens was noted in selected communities in the agricultural landscape, i.e. segetal, ruderal, meadows and pastures and woodlots.

The share of lichens of wide foliose thalli of type *Parmelia* is higher in communities associated with agricultural landscape (woodlots, meadows and pastures, grasslands), but no statistically significant differences were found within the same communities assigned to the landscape (Fig. 6). The highest average number of species of wide foliose lichens was reported in the communities of trees.

The highest average number of fruticose lichen species was recorded in natural communities (forests) and seminatural communities (grasslands) (Fig. 7).

Table 2. The degree of variation in species and relative species richness of selected parameters X ± *SD*.

Parametr	1	2	3	4	5	6	7
Nalls	16.6 ± 7.16	31.8 ± 16.05	19.4 ± 5.96	30.6 ± 7.16	30.2 ± 14.46	24.4 ± 22.06	25.2 ± 3.96
NsC	5.6 ± 2.51	4.8 ± 3.27	8.0 ± 1.58	11.0 ± 4.06	14.8 ± 8.17	10.2 ± 12.37	10.8 ± 1.92
NsS	0.6 ± 0.55	1.0 ± 0.00	0.4 ± 0.55	0.8 ± 0.45	0.2 ± 0.45	0.4 ± 0.89	1.0 ± 0.71
NsFn	2.6 ± 2.70	2.0 ± 1.57	5.4 ± 3.36	5.25 ± 1.14	4.6 ± 4.39	6.6 ± 5.24	9.2 ± 1.64
NsFw	3.8 ± 2.16	2.8 ± 1.64	4.0 ± 1.00	4.8 ± 0.83	4.0 ± 3.08	3.4 ± 2.19	3.0 ± 2.12
NsF	4.0 ± 1.58	19.2 ± 11.09	1.8 ± 1.64	5.6 ± 2.89	8.6 ± 5.68	3.4 ± 2.88	1.2 ± 0.83

Explanation: Natural communities: 1 – Deciduous forests, 2 – Coniferous Forest, Semi-natural communities: 3 – Meadows and pastures, 4 – Plantings, 5 – Grasslands, Anthropogenic communities: 6 – Ruderal, 7 – Segetal; Nalls – the number of all species; NsC – the number of crustose species, NsS – the number of squamulose species, NsFn – the number of narrow foliose species, NsFw – the number of wide foliose species, NsF – the number of fruticose species

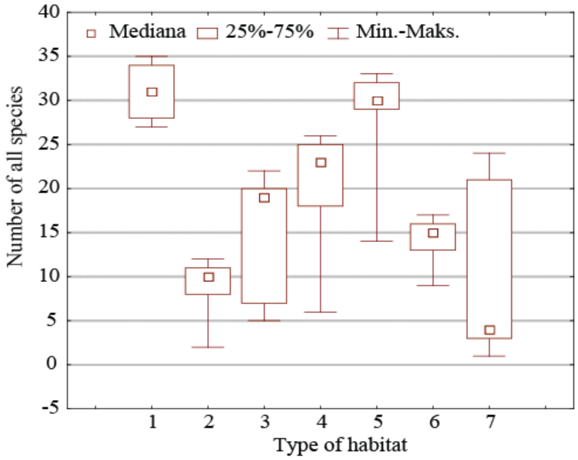

Fig. 2. The range of variation of the total number of lichen species found on the research surfaces, depending on their belonging to the type of habitat.

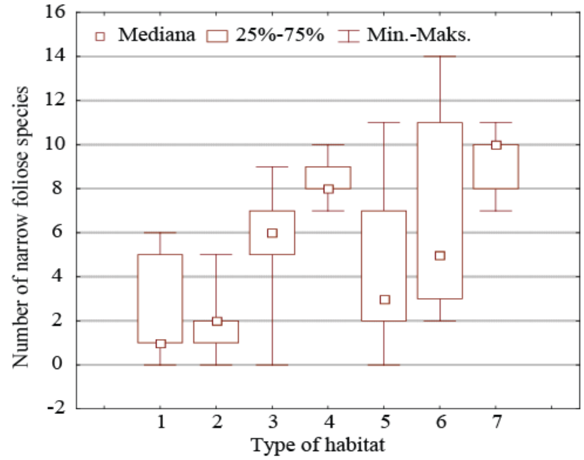

Fig. 5. The range of variation of the number of lichen species of narrow foliose thalli found on research plots, depending on their belonging of the type of habitat.

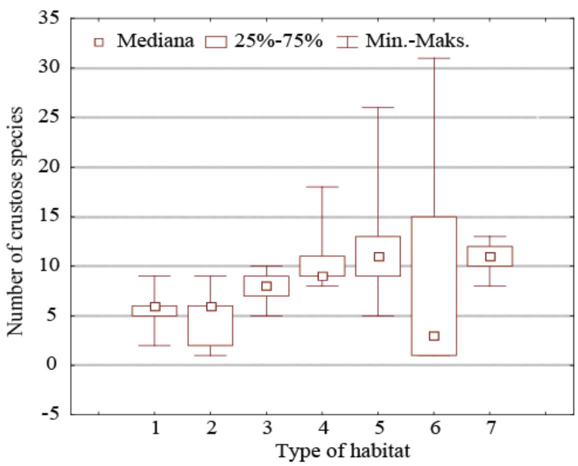

Fig. 3. The range of variation of the number of lichen species of crustose thalli found on research plots, depending on their belonging of the type of habitat.

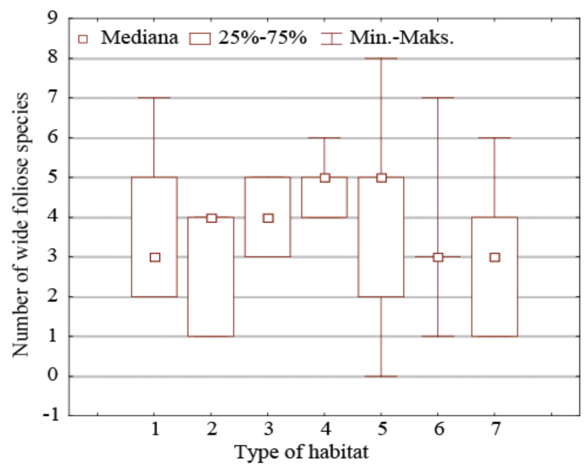

Fig. 6. The range of variation of the number of lichen species of wide foliose thalli found on research plots, depending on their belonging of the type of habitat.

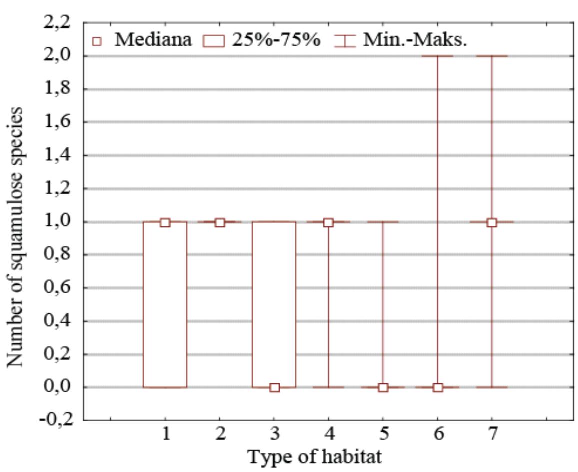

Fig. 4. The range of variation of the number of lichen species of squamulose thalli found on research plots, depending on their belonging of the type of habitat.

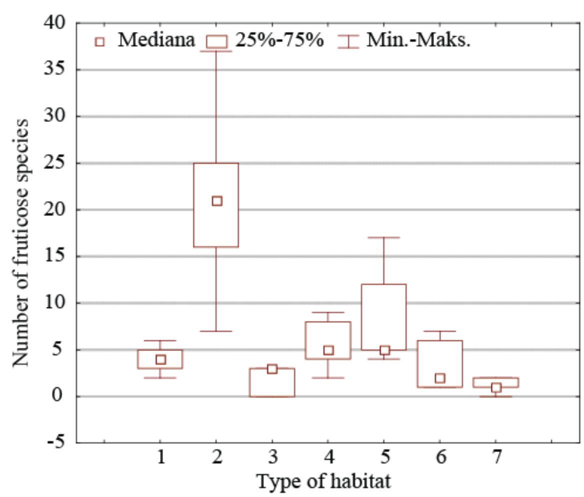

Fig. 7. The range of variation of the number of lichen species of fruticose thalli found on research plots, depending on their belonging of the type of habitat.

Discussion and Conclusions

In the 90s of the twentieth century NE Poland was cited among the regions best known in the lowlands for the presence of lichens (Fałtynowicz, 2003; Cieśliński, 2003). Most of the data were collected in the late 90s, thus information on the contemporary presence of lichens in Podlasie is not sufficient. The works on lichens in the region are mainly on natural areas, forests (Cieśliński & Tobolewski, 1988; Fałtynowicz, 1994; Bystrek & Kolanko, 2000 and others) and urban areas (Matwiejuk & Kolanko, 2007; Matwiejuk, 2007, 2008, 2009a, b). A need for lichenological research in agricultural areas is therefore justified to fill gaps in the knowledge of the distribution of lichens in the area. Cieśliński (2003) mentions 597 species of lichens from NE Poland. Taking into account the statement of lichens from this region of Poland (Cieśliński, 2003), approximately 26% of the total of lichens contained there were found in the Podlasie region, in rural areas. The obtained result on farmland of Podlasie was probably shaped by the specificity of the studied landscape covered by agricultural activities. The adopted way of collecting data, based mainly on the conduct of censuses within the randomly designated area of research probably also limited the possibility of finding a larger number of taxa.

The lichen biota of agricultural landscape of Podlasie consists of 156 species of lichens. This number is relatively large considering the results of research conducted in a similar type of landscape in other parts of the country. In north-eastern Poland, in a selected portion of Warmia plains covered by agricultural activity 98 species of lichens were observed (Szymczyk & Zalewska, 2008), in the area of Sandr Nowotomyski–175 taxa (Zarabska, 2011), on Choszczeńskie Lakeland – 184 species, but some of them were found only in the forest communities of the mesoregion (Lipnicki, 1990), Kalisz Upland (Krawiec, 1955) – 142 taxa. Taking into account the statements of lichens in areas of NE Poland undergoing anthropogenic activities the degree of lichen differentiation in the Podlasie region can be regarded as approximate to that of Białystok (Matwiejuk, 2007) – 151 species, in Boćki (Matwiejuk, 2009a) – 118. Among the lichens of the studied region epiphytic and epigeic lichens exhibit a significant share. The dominance of arboreal lichens and a large share of terrestrial lichens affect the nature of lichen biota occurring in this region of Poland (Cieśliński, 2003). A large abundance of epiphytes, compared with other habitat groups, is also observed in other parts of NE Poland (Cieśliński, 2003).

Epiphytes are the most numerous habitat group in rural areas. The number of 72 taxa found in Podlasie is comparable with the data from other parts of the country. The epiphytic biota from Choszczeńskie Lakeland consisted of 75 species (Lipnicki, 1990), from the Plain of Warmia – 60 (Szymczyk & Zalewska, 2008), from Sandr Nowotomyski – 92 (Zarabska, 2011). In the areas of Alpine foothills in Switzerland 84 species of epiphytes were recorded (Ruoss, 1999). Typical substrates for the development of this group in the agricultural landscape is the bark of roadside trees growing at farmhouses, fields, meadows and pastures, orchards, and rural parks (e.g. Lipnicki, 1990; Szczepańska, 2008; Szymczyk & Zalewska, 2008; Zarabska, 2011). Among the epiphytic lichens species common in the country dominate. Some of these species are nitrophilous and coniophilous lichens.

In rural areas of the study area, as in other parts of the country, the presence of epixylic lichens is marked on the wooden buildings, fences around fields, buildings, gardens, pillars (Szymczyk & Zalewska, 2008; Zarabska, 2011; Matwiejuk, 2009a, b). The list of this group is dominated by common lichen taxa and those exhibiting a wide range of ecological spectrum, developing both on the wood and the bark of trees and on soil.

The natural conditions of Podlasie favor the development of epigeic lichen biota, which could partially affect quite a number of quotations of this habitat group in this type of landscape. Among the epigeic lichens genus *Cladonia* is most abundantly represented in species. Rich epigeic lichen biota from rural Podlasie can be observed most often in communities of psammophilous grasslands occurring, among others, on the slopes of unwooded dunes or uncultivated agricultural lands, in the communities of xerothermic grasslands and pine plantings and on the edge of forests. Listing of lichens rare here in the lowlands, such as *Endocarpon pusillum, Collema limosum, C. tenax* confirm observations from other parts of NE Poland concerning the presence of interesting epigeic lichens within grasslands (Cieśliński, 2003). Despite the good diagnosis of the type of *Cladonia* in NE Poland, efforts to show the position of *Cladonia merochlorophaea* and *C. merochlorophaea* var. *novochlorophaea*, new taxa of Podlasie, failed (Cieśliński, 2003). The literature data on the occurrence of terrestrial lichens in areas undergoing agricultural activities are scarce, therefore it is difficult to distinguish a group of species typical of these areas.

Observations of epilithic lichens in this part of the country come from natural and anthropogenic habitats (e.g. Cieśliński, 2003). In agricultural areas of Podlasie boulders are often encountered, hence a relatively large number of epilithic lichens are found on natural habitats. There grow *Acarospora fuscata, Apicilia cinerea, Candelariella coralliza, Lecanora polytropa, Porpidia crustulata, Rhizocarpon distinctum, Xanthoparmelia conspersa* and *X. pulla*. In the discussed area the epilithic biota is rich in species growing in anthropogenic habitats. It consists mainly of common and widespread taxa found in other regions of Poland (Lipnicki, 1990; Cieśliński, 2003; Zarabska, 2011). A large part of the reported epilithic lichens is characterized as heliophilous, calciphilous, nitrophilous and coniphilous (cf. Fałtynowicz, 1997). These properties, however, do not seem to be exclusive to the species found in rural landscape. They are also common in lichens listed in urban areas (cf. Matwiejuk, 2007, 2008, 2009a, b). Quotations of *Cladonia merochlorophaea* var. *novochlorophaea* from Podlasie is the first listing of this taxon in the region. The findings of this lichen are known mainly from the northern part of Poland (Kowalewska *et al*., 2008). In other parts of the country this lichen was very rarely recorded (Zarabska, 2011).

Rare species recorded during surveys in rural areas of Podlasie are *Caloplaca cerina*, a species showing preference for aspen bark growing on the edges of forests, clearings, *Cladonia grayi* – a terrestrial species listed on the outskirts of pine forests, *C. pocillum* – a species growing on soils rich in calcium carbonate in grasslands, *C. rei* - a species growing on grasslands, *Dibaeis baeomyces* and *Diploschistres muscorum* - species prefering humus - rich soil in grasslands. Most of the statements of *Cladonia rei* in Poland come from the eastern, south-eastern and central parts of the country (Syrek & Kukwa, 2008). *Diploschistes muscorum* was noted from a few localities in northern and central Poland (Lipnicki & Grochowski, 2011). Also *Candelariella reflexa* is known from a small number of positions in NE Poland (Cieślinski, 2003). Over the past several years the spread of this taxon has clearly been indicated (van Herk *et al.,* 2002; Aptroot, 2008; van Herk, 2009).

In Podlasie, there has been found a high proportion of synanthropic taxa in the general statement of lichen biota of the study area. This indicates the importance of agricultural landscape in shaping the habitats occupied by lichens and its impact on the degree of differentiation of lichen biota. Most apophytic taxa were found among epiphytic lichens. Among the apophytes in the lichen biota of the study area mesoautoapophytes had the largest share. Some of these species are lichens of a wide range of organic farming, such as *Hypogymnia physodes, Melanelixia fuliginosa, Melanohalea exasperatula*, which grow in natural forest communities but can pass onto anthropogenic habitats, for example, on the bark of roadside trees, fruit trees and wooden structures. The large share is also exhibited by epheromoapophytes. Its characteristic large species richness in the Podlasie region is associated with broad participation of synanthropic species of lichens rarely quoted in the study area. Epheromoapophytes are defined as species occasionally appearing on the surfaces under the influence of human activities, while prevailing in the natural habitats. Considering, however, the composition of the species of the epheromoapophyte – forming group we can observe the advantage of taxa typical of open places. In the study area they are therefore associated with anthropogenic habitats, but poorly distributed. The dominance of arboreal lichens among eu-apophytes was also observed in the agricultural landscape of the Plains of Warmia (Szymczyk and Zalewska, 2008), Sandr Nowotomyski (Zarabska, 2011). The advantage of epigeic lichens among mesoautoapophytes can be partially attributed to a high proportion of terrestrial lichens in forest communities in the studied region. Similarly, the high value of the anthropophytization index (81.4%) was found in the agricultural landscape of Sandr Nowotomyski – 84.9% (Zarabska, 2011). Lower values of this index are given for Massif Śnieżnik and Bialskie Mountains – 63% (Szczepańska, 2009), for the Bieszczady Low – approximately 60% (Kościelniak, 2004), and for the BNP – 4.26% (Cieśliński & Czyżewska, 1998). The higher the human intervention in the area, the higher the result of synanthropisation of lichen biota.

The occurrence of lichens in habitats created by human activities is associated with their environmental requirements and morphological, chemical and physiological considerations of these organisms (cf. Fałtynowicz, 1992). Studies have shown a higher degree of differentiation among crustose lichens found in certain types of communities covered by agricultural use. The crustose lichens in rural areas fall mainly in the epiphytic and epilitic lichen biota. A higher share of narrow foliose lichens was marked in the segetal and ruderal communities and woodlots, as well as streams, meadows and pastures. This may be related to the fact of the composition of this group mainly by nitrophilous, coniophilous, heliophilous and xerophilic lichens of genus *Physcia, Physconia, Phaeophyscia* and some *Xanthoria* particularly associated with rural areas. A higher share of foliose lichens in open areas is due to the favorable impact of higher intensity of light reaching the lower parts of the trunks of trees growing in open areas compared to phorophytes of forest communities (Dietrich & Scheidegger, 1997). Additionally, the presence of appropriate phorophytes of cracked bark is favourable for their development, e.g., of genus *Salix, Tilia, Fraxinus*, which allows effective anchoring of the lichen thalli to the substrate (Fałtynowicz, 1992). A significant share of fruticose lichens of grassland in comparison with other types of communities in the open landscape is probably related not so much to the impact of farming, as the natural determinants of the region. These lichens are represented primarily by epigeic lichens of genus *Cladonia* (Zarabska, 2011).

The lichen biota of this area, despite the various anthropogenic factors, has remained rich and varied, despite the multitude of anthropogenic factors.

Acknowledgements

I am indebted to Beata Ostrowiecka (University in Bialystok) for the execution of figures. I am also indebted to reviewer for suggestions on the manuscript.

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(Received for publication 4 February 2015)