Lichens
of the protected areas in the Euroregion Niemen

Anna Zalewska & Wiesław Fałtynowicz (eds.)

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FOREWORD

Lichens are organisms of unusual biology and ecology that commonly occur in the nature. More than 15000 species have been described all over the world and somewhat less than 1600 only in Poland. Already a short time ago, lichens were included into the Plant kingdom but at present they are placed in the Fungi kingdom. However, the lichen is a very specific organism as it is composed of two elements: a fungus from the sac fungi (*Ascomycota*) or exceptionally from the club fungi (*Basidiomycota*) or the imperfect fungi (Fungi Imperfecti), and an autotrophic partner (partners), i.e. a green (*Chlorophyta*) or blue-green (*Cyanoprocaryota*) alga. In this association, the fungus produces a thallus completely unlike to each component body. The process, in which a lichen originates is called „lichenization", thus the present-day name of lichens is lichenicolous fungi. Relations between integral parts in a lichen thallus are really intricate and have not been explained entirely. Interdependence described earlier as symbiosis is rather of parasitism or helotism character.

In comparison with other fungi, lichens possess many specific features. The most important are as follows:

- specific morphological and anatomical structure;
- characteristic metabolism, in result of which peculiar chemical compounds, i.e. secondary metabolites are produced;
- exclusive peculiar to lichens asexual reproduction by diaspores such as soredia or isidia comprising cells of both partners.

Four basic morphological types of lichen thalli are distinguished: crustaceous, squamulose, foliose and fruticose. Individual forms build up *Cladonia* species. They are dimorphic and consist of a primary squamulose thallus and fruticose podetia arising from it.

Lichens may grow almost everywhere except places constantly submerged in saline water, fields, fresh or wet meadows, and reed or sedge communities.

They do not grow in areas with considerably polluted either air nor substratum. The most important habitat lichen groups are epiphytic, epilithic, terricolous and epixylic. Lichens develop also, sometimes in masses, on substrata created by man, for example on concrete, bricks, tiles, metallic objects, glass or even on plastic. This ubiquitous character results, among other things, from strong resistance of many species to extreme habitat conditions such as drought, low or high temperatures, and minimal nutrient content in a substratum, etc. First of all, lichens enter these places where they nearly do not compete with vascular plants or mosses. Their competitive strength is little because of a small size and relatively slow growth. Lichens are pioneers at many kinds of substrata and often, together with bacteria and other fungi, the only organisms inhabiting them.

Most of the lichen species are attributed to narrow ecological scales and therefore they are very sensitive indicators of habitat changes and rapidly react to a slender variation in the environment. They are especially sensitive to air pollution and owing to this feature they have been used all over the world as excellent bioindicators of air cleanness from more than a hundred of years. The least resistant are lichens of fruticose thalli.

For some time, significant restriction of occurrence or even vanishing of many species has been observed. The main reason of this process is not only air pollution but also transformation of forest communities caused by economic activities as well as cutting of old roadside trees, drainage of habitats, urbanisation and motorization.

Sensibility of lichens to habitat changes brings strong threat to them. On„Red list of extinct and endangered lichens in Poland" more than 50% of all species known from the country has been involved and nearly 150 of them are regarded as extinct. In addition, more than 200 species is protected by law. First of all, these are fruticose and foliose lichens.

A knowledge of lichens, though their wide distribution is little or even imperceptible among the Polish community. It issues considerably from a small size of lichen thalli and also through lack of sufficient literature on them. Those facts were the reasons to undertake a project „Protection of lichens in preserved areas of Euroregion Niemen". The main aim of the project was to evaluate species diversity and distribution of lichens in the area of Suwalski Landscape Park and Romincka Primeval Forest in its both the Polish and Russian parts. The project was worked out by Association „Man and Nature" and financed by funds of Euroregion Niemen, Programme of Small Grants GEF, Provincial Fund of Environment Protection and Water Management in Olsztyn, Communal Fund of Environment Protection and Water Management in Gołdap and by Forest Inspectorate of Gołdap. One of the results of the project is the present publication, reading of which the authors kindly recommend.

Lichens of Suwalski Landscape Park

Anna Zalewska[1], Wiesław Fałtynowicz[2], Anna Krzysztofiak[3], Lech Krzysztofiak[3], Joanna Picińska-Fałtynowicz[4]

[1] Department of Botany and Nature Protection, Warmia and-Mazury University, pl. Łódzki 1, 10-727 Olsztyn, e-mail: annazalw@moskit.uwm.edu.pl;
[2] Department of Systematics and Phytosociology, Wrocław University, ul. Kanonia 6/8, 50-328 Wrocław, e-mail: wiefalty@biol.uni.wroc.pl;
[3] Wigry National Park, Krzywe 82, 16-400 Suwałki, e-mail: krzysztofiak@itm.com.pl;
[4] Institute of Meteorology and Water Management, Wrocław Branch, Laboratory of Water Quality Research, ul. Parkowa 30, 51-616 Wrocław, e-mail: joannapf@wp.pl.

Introduction

Suwalski Landscape Park is an area of an unusual natural attractiveness. However, the survey of its vegetation and fauna has tradition of several score years only. Vascular plant flora and plant communities of the Park have been researched quite well (Sokołowski 1973a, b, Sokołowski 1984, Podbielkowski & Tomaszewicz 1977, Sokołowski & Kawecka 1984, Kawecka 1991), as well as lake biocenoses [Hillbricht-Ilkowska & Wiśniewski (eds.) 1994], but a knowledge of other organisms occurring here is far insufficient.

Two works published recently, i.e. S. Cieśliński's monograph (2003a) and K. Jando's & M. Kukwa's article (2003) contain the most complete information on lichens of the Suwalski Landscape Park, while earlier information on numerous species from the Park area was given, e.g. by W. Fałtynowicz (1981, 1999), K. Karczmarz et al. (1988), S. Cieśliński & Z. Tobolewski (1989), and also by M. Kukwa & W. Fałtynowicz (2002). These publications comprise data of numerous taxa of lichens and lichenicolous fungi, however refer to a dozen or so especially alluring sites in the Park only. In addition, several interesting lichen species from the protection zone of Suwalski Landscape Park, namely from the neighbourhood of Prudziszki village were described by J. Motiejûnaitë & W. Fałtynowicz (2004).

1. Characteristics of the study area

Suwalski Landscape Park was established in 1976 as the first landscape park in Poland and occupies an area of 6284 ha. More than 60% of it is covered by arable land, whereas less than 24% by forests. Only 20% of the Park area belongs to the Polish Treasury, while 80% - to private owners.

According to the physico-geographical division of Poland (Kondracki 1998), the Park is located in the mesoregion Eastern Suwałki Lakeland, and in the macroregion Lithuanian Lakeland. Concerning the geobotanical division of the country (Szafer 1972), the studied area belongs to Suwalsko-Augustowski Land, within the range of the North Divide.

One of the most valuable features of the Park is young postglacial diversified relief, shaped by the North Poland glaciation.The main relief forms are morainic plateau and valleys of Czarna Hańcza and Szeszupa rivers. In them, various geomorphological forms, such as frontal, ground and heapped moraines, kames, kame terraces, fields of erratics and boulders, little sandres, melt-out hollows and others are present (Kondracki 1972, Bogacki 1985). From the authors' point of view, the very essential is the presence of thousands of erratics of various size that provide substrata for numerous lichen species; many of them have there the only or one of few localities within the Polish lowland. Differentiation of a relative height is unusually large in the Park area as far as lowland is cocnerned and the highest point is located at 275 m a.s.l. and the lowest one at 146 m a.s.l.

The Park is situated in the river Niemen basin and is drained by two rivers: Czarna Hańcza and Szeszupa. The important elements of a hydrographic network are lakes. There are 22 lakes of an area of more than 1 ha (Bajkiewicz-Grabowska 1985) and among them the largest and deepest one is Hańcza lake with a depth of 108.5 m

Suwalski Landscape Park belongs to the masurian climatic province. Because of the influence of arctic and continental air masses and a high location above sea level, the Park and its surroundings are regarded as the coolest region in the country. The vegetation season lasts here 180 days only and is shorter in 1 month and a half compared with the central Poland. Winter is frosty and prolonged, twice longer than in the west part of the country, spring – late and cold, and summer – short and torrid. The average annual air temperature equals ca +6°C, and the average air temperatures in January and July are repectively: -5°C and +17°C. Extreme temperatures noted in this region were +36°C and -38°C. Snow usually covers the ground for 100 days, however during extreme frosty years it may lie even for 160 days. The average annual precipitation is more than 600 mm, and west and south-east winds prevail here (Kondracki 1972, Stopa-Boryczka & Martyn 1985). The continentality index calculated by Ellenberg's method on the basis of species composition

of dry-ground forest phytocoenoses is the highest here and exceeds 3.9 (Degórski 1984). This fact is distinctly reflected by flora and fauna as well as by plant communities of the Park (Szafer 1972, Matuszkiewicz 1991). The phenomenon is manifested, for example, by exceptionally great number of boreal and continental species and also by common presence of spruce in majority of forest communities (Podbielkowski & Tomaszewicz 1977, Sokołowski 1973a, 1980, 1984, Sokołowski & Kawecka 1984, Kawecka 1991, Sokołowski & Kot 1996).

Biotic and abiotic components of the nature of Suwalski Landscape Park have been strongly modified as a result of man economic activities. First man settlements were set up there not late than 5000-6000 years ago. In the early Middle Ages, Jaćwings' culture flourished and a new tribal centre on Zamkowa Góra hill near Szurpiły as well as new settlements, such as Szurpiły, Turtul and Bachanowo arised. Jaćwings were exterminated in the XIIIth century, but as early as the beginning of the XVI century, colonisation of the post-Jaćwings sites had started and became more intense after the Cameldolites moved into that province in the XVIIIth century [Brzozowski 1995, Strumiłło (ed.) 1999]. One of the more significant effects of anthropopression was cutting of majority of forests and places obtained in that way were transformed into plough-land and meadows. Simultaneously, in preserved forest complexes, the quantitative share of deciduous tree species diminished considerably, whereas the share of coniferous species preferred by foresters, such as spruce and pine, increased.

Described above man economic activities have caused strong alteration of vegetation as transforming forest communities into non-forest ones, though phytocoenoses of numerous rare vascular plant assemblages have been still present here (Podbielkowski & Tomaszewicz 1977, Sokołowski & Kawecka 1984). Presumably, the flora of that area underwent minor changes, however populations of many species have decreased. From the area of Suwalski Landscape Park nearly 700 species of vascular plants have been reported, in them many rare not only in the region but elsewhere in Poland (Kawecka 1991, Sokołowski & Kot 1996).

The nature of Suwalski Landscape Park is protected in four reserves: "Jezioro Hańcza" lake, "Głazowisko Bachanowo nad Czarną Hańczą" field of boulders, "Głazowisko Łopuchowskie" field of boulders and „Rutka", which altogether cover less than 400 ha (Sokołowski & Kot 1996). Apart from the first reserve, the remaining three protect one of the biggest accumulation of erratics in lowland, e.g. in „Głazowisko Bachanowo" there are ca 10000 of erratics and quite the same number of them in the reserve surroundings. Another one reserve is planned, "Jezioro Jaczno" lake together with its surroundings overgrown by forest communities.

Compared with other regions of the country, the north-east Poland is characterised by particularly weak air pollution (Stan środowiska… 1998, Wawrzoniak et al. 1999). Lichens are regarded as organisms very sensitive to toxic substances

and therefore are commonly used as excellent bioindicators of air pollution (Hawksworth & Rose 1976, Nash & Wirth 1988, Herzig & Urech 1991, Kiszka 1995 et al.). Good quality of air in the studied region causes that lichen biota of this part of Poland is especially rich both qualitatively and quantitatively. The presence of more than 600 species (cf. Cieśliński 2003a) distinguishes positively the north-east Poland on the background of the whole middle European Lowland (por. np. Fałtynowicz 1992, Litterski 1999, Motiejûnaitë 1999).

2. Methods and list of localities

2.1. Methods

Information on a lichen biota of Suwalski Landscape Park has been obtained from 27 localities (Fig. 1). Data from 15 sites have been gathered by the authors of this work. The remaining 12 localities were investigated mainly by S. Cieśliński (2003a), and also by M. Kukwa & W. Fałtynowicz (2002), K. Jando & M. Kukwa (2003) as well as by K. Karczmarz et al. (1988) (cf. Chapter 2.2).

Material for the study was collected or registered from all available substrata and habitats. Collected specimens were identified following routine lichenological methods and deposited in herbaria of Warmia and Mazury University in Olsztyn (OLS) and University of Wrocław (WRSL).

A list of species protected in Poland by law was applied (Fałtynowicz 1998). Information on threatened and extinct lichen species in Poland has been derived from "Red List of extinct and threatened lichens in Poland" (Cieśliński et al. 2003), whereas of these from the north-east part of the country – from „Red List of threatened lichens in North Eastern Poland" (Cieśliński 2003b). Assessment of anthropogenic changes of the lichen biota was done according to the publications of W. Fałtynowicz (1994) and S. Cieśliński (2003a).

Frequency of lichen species has been evaluated according to the scale prepared by S. Cieśliński (2003a):

I – species occurs at not more than 19.9% of localities;
II – species occurs at 20 to 39.9% of localities;
III – species occurs at 40 to 59.9% of localities;
IV – species occurs at 60 to 79.9% of localities;
V – species occurs at 80 to100% of localities.

Lichen taxa have been named according to W. Fałtynowicz (2003a). In the list of species, in square brackets numbers of ATPOL squares are specified (cf. Cieśliński & Fałtynowicz 1993).

2.2. List of localities:

1. The reserve „Rutka" near Rutka village [Af99]; 01.04.2004; a field of boulders in an open area (pasture); boulders and trees along a country road; abandoned settlements – concrete, stonewalls, old fruit trees, a wooden umbrella roof in a sight point at Linówko lake.
2. Between Turtul and Szeszupka villages [Af98]; 1-2.04.2004; stones, single trees along a country road, roadside scarps.
3. Wodziłki village [Af98]; 02.04.2004; singly growing trees, boulders, wood.
4. Łopuchowo village (from the side of Błaskowizna village) [Af98]; 2-3.04.2004; roadside trees, boulders, soil, pines, a moist hollow with young alders.

5. The reserve „Głazowisko Łopuchowskie" field of boulders and its surroundings [Af98]; 03.04.2004; boulders, soil, wooden posts on a pasture, an abandoned settlement – single trees, pine plantings.
6. Udziejek Dolny, ca 1 km to SE, neighbourhood of Udziejek lake [Af98]; 03.04.2004; single trees, boulders, wooden posts, concrete poles, a small gravel-pit on a roadside scarp – soil, pebbles.
7. Góra Leszczynowa hill at Hańcza lake [Af97]; 04.04.2004; trees in dry-ground forests, boulders on a pasture, swards, wooden frame of a sight tower.
8. Cisówek near Dzierwany, ca 0.5-1 km to N [Af98]; 04.04.2004; a piece of a dried alder carr; trees, boulders along a ground road; ruins of farm buildings – a stone-wall, concrete, wood.
9. Smolniki, ca 2 km to S, the forest section no. 70 in the range Kojle [Af98]; 04.04.2004; pine plantings with spruce and birch; a humid hollow with a piece of alder tree stand; roadside trees.
10. Postawele, ca 2 km to S, neighbourhood of Postawelek lake [Af98]; 04.04.2004; concrete edge of a small bridge on the river Szeszupa, riverside willows; a piece of a riverside carr by the lake; spruce plantings with pines on dry-ground forest habitats.
11. Sidory, ca 500 m to S, by an asphalt road: Rutka Tartak-Jeleniewo, about 100 m to S of the crossing with a road towards Smolniki village [Af98]; 04.04.2004; high scarps of W exposure on the left side of the road – soil in swards overgrown by trees, trees.
12. The range Wodziłki and its SE margin [Af98]; 05.04.2004; forest and singly growing trees, boulders, wood of fences.
13. Wodziłki, ca 1.5 km to E, forest (the forest section no. 167), a forest margin [Af98]; 05.04.2004; bark of trees, concrete.
14. On the isthmus between Hańcza and Boczniel lakes, to N of Błaskowizna [Af98]; 05.04. 2004; trees and logs in forest communities of a riverside carr character; boulders and wood in a forest margin.
15. Hańcza, ca 2 km to NE, by an asphalt road Hańcza-Mierkinie [Af97]; 05.04.2004; roadside trees, wood of posts, fences, boulders.
16. A planned reserve at Jaczno lake and its surroundings [Af98]; trees in forests and singly growing, wood, boulders, soil (acc. Jando & Kukwa 2003).
17. The reserve „Głazowisko Bachanowo" field of boulders and its surroundings [Af97]; erratics, a riverside carr, soil (acc. Kukwa & Fałtynowicz 2002, Cieśliński 2003a);
18. Stara Hańcza [Af87]; an old park and ruins of a mansion on NW shore of Hańcza lake (acc. Cieśliński 2003a).
19. Smolniki [Af88]; cemetery, concrete, boulders, trees (acc. Cieśliński 2003a).
20. Kleszczówek [Af98]; an open area, wall (acc. Cieśliński 2003a).

21. Turtul [Af98]; trees, soil, boulders, concrete (acc. Cieśliński 2003a).
22. Kruszki [Af97]; an open area (acc. Cieśliński 2003a).
23. Błaskowizna [Af97]; an open area (acc. Cieśliński 2003a).
24. N shore of Szurpiły lake [Af98]; an open area (acc. Cieśliński 2003a).
25. Góra Cisowa hill near Gulbieniszki [Af98]; boulders (acc. Cieśliński 2003a).
26. Turtul, 1 km to E [Af98]; an open area (acc. Cieśliński 2003a);
27. Szurpiły, neighbourhood of the village [Af98]; boulders (acc. Karczmarz *et. al*. 1988).

3. Results

3.1. General characteristics of the lichen biota

Until now, in the area of Suwalski Landscape Park 231 lichen species and 14 lichenicolous and allied fungi have been found. In greatest number, following genera are represented: *Lecanora* (22 species), *Lepraria* (8), *Rhizocarpon* (7) and also *Aspicilia, Caloplaca, Chaenotheca, Peltigera* and *Xanthoria* (each of them by 6 species). 37 genera were represented only by 1 species each.

Compared with the other studied protected areas of Niemen Euroregion: Puszcza Romincka Forest Landscape Park and Wisztynieckoje Protected Area, relatively small both qualitative and quantitative contribution of macrolichens, i.e. 81 species (ca 35% of the total lichen biota) have been stated in the Park. As much as 21 macrolichen species belong to the genus *Cladonia*. Most of them produce small populations and grow on single sites; only four ubiquitous species: *C. coniocraea, C. fimbriata, C. ochrochlora* and *C. pyxidata*, and one sward species *C. furcata* occur in a greater number of localities.

Most of the species of Suwalski Landscape Park, i.e. 161 (nearly 70% of the whole biota) were given I class of frequency (not more than 5 localities– cf. Chapter 2.1.), and next 34 (ca 15%) – the II class of frequency. Only 6 species, listed below, obtained V class of frequency:

Lecanora carpinea
Parmelia sulcata
Physcia adscendens
Protoparmeliopsis muralis
Xanthoria parietina
Xanthoria polycarpa,

and 11 species were given IV class of frequency:

Evernia prunastri
Hypogymnia physodes
Lecanora pulicaris
Lecidella elaeochroma
Melanelia exasperatula
Neofuscelia loxodes
Phaeophyscia orbicularis
Phlyctis argena
Physcia stellaris
Physcia tenella
Xanthoparmelia conspersa.

Most of the commonest species are regarded as photophilous or tolerant to high insolation organisms, which grow on fertile substrata and three of them: *Neofuscelia loxodes, Protoparmeliopsis muralis* and *Xanthoparmelia conspersa* occur commonly on erratics in well insolated sites.

Lichenicolous fungi have not been sufficiently known in Poland yet. In Suwalski Landscape Park, 14 species have been observed, but surely there may grow much more species of them.

3.2. Lichens of various habitats

Composition of ecological groups and their contribution to local or regional lichen biotas depend on physiography and vegetation diversity. These factors determine kinds of habitats and substrata available for lichens, and also decide about their frequency. In addition, the current structure of a lichen biota is determined by historic and contemporary anthropogenic factors. Apart from urbanised and industrial areas, among pressures that cause a decrease in a number of species in relation to potential capacity of natural habitats, very important is air pollution of "far-away distance" (Hawksworth & Rose 1976, Fabiszewski et al. 1983, Herzig & Urech 1991, Jacobsen 1992). Even low concentration of toxic substances originating from nearer or considerably remote sources may exterminate sensitive lichens, particularly both fruticose and foliose epiphytes.

Transformations caused by forest management impact also very strongly; they induce vanishing of many higro- and skiophilous forest lichen species, mainly crustous epiphytes and epixiles. The most common reason is disappearance of suitable niches in consequence of an exchange of decidous or mixed forest communities into coniferous monocultures, or microclimatic changes caused by clear cuttings within large areas (cf. Czyżewska 1976, Cieśliński & Czyżewska 1992, Fałtynowicz 1997a).

Less frequently in literature is emphasized a positive influence of man activities that induces enrichment of local lichen species composition and/or an increase of frequency of some taxa. Enlargement of lichen diversity is an unintended effect of introducing artificial rock substrata by man, for instance concrete frames inhabited by epilithic calciphilous species or creating new habitats for epiphytic, epixylic, epilithic or epigeic forms, with substrata of a character similar to natural ones, e.g. roadside tree lanes, parks, wooden frames, stony forest section posts in forests, walls built from field stones, and uncovered parts of soil in gravel-pits or on roadside scarps (cf. Fałtynowicz 1994).

In almost each region of European lowland, a lichen biota reflects natural physiographic factors to some extent only and usually strongly differs from a lichen biota of primeval forests existing here in the past. In Suwalski Landscape Park, substantial landscape structural transformations have happened. Forests have been

preserved in small fragments of the area only and do not form large complexes, and structure and species composition of forest communities have been modified drastically. As a result, diversity of both microhabitats and substrata available for lichens, in particular for higro- and skiophilous species has decreased significantly (cf. e.g. Barkman 1969). Most of the area has been utilised for agriculture purposes for centuries, and is accessible for lichens to a very limited extent only. These anthropogenic changes have caused creating of new potential niches within many habitats for photo- and thermophilous lichens or for species tolerant for insolation or warming of a substratum (Brown 1992, 1996).

On the other hand, factors advantageous for lichen development, such as very weak air pollution (cf. Chapter 1), dispersed buildings, complete absence of industry, and a very poor network of roads with bituminous surface exist here.

3.2.1. Epiphytic lichens

The most important factors that influence epiphytic communities are chemical and physical properties of tree bark, mainly the pH, content of mineral components, water capacity, and also microrelief and a way of bark peeling process (cf. Barkman 1969, Halonen et al. 1991, Dietrich & Scheiddeger 1996, Kuusinen 1996 et al.). Some of the features, particularly these related to bark structure may change during a phorophyte life, and model following succession stages of epiphytic communities (see eg. Fałtynowicz 1992, Ferry & Lodge 1996). In many regions, natural chemism of bark is modified by industrial air pollution (cf. Hawksworth & Rose 1976, Herzig & Urech 1991, Jacobsen 1992); this factor does not play any role in the studied area.

In most regional lichen biotas, the really important components are epiphytes. Similar pattern has been observed in Suwalski Landscape Park, however the number of epiphytic species (123) is only a bit larger than the number of species found on rock substrata (102).

The largest number of species has been observed on trees growing naturally in humid habitats, in riverside carr forests or along various water reservoirs and small streams – on *Fraxinus excelsior, Alnus glutinosa* as well as on *Salix* spp. (Table 1). Special attention should be paid to the ash tree; on its bark interesting communities of crustous lichens develop, composed mainly of taxa from two genera: *Arthonia* and *Lecanora*, as well as of *Arthothelium ruanum, Buellia griseovirens, Dimerella pineti, Lecidella elaeochroma, Opegrapha atra* and *O. rufescens*. On trunks of *Fraxinus excelsior*, a few very rare lichen species have been found, among others: *Anisomeridium polypori, Arthopyrenia salicis, Bacidia subincompta, Lecania cyrtellina, Pachyphiale fagicola, Rinodina colobina, Sclerophora nivea* and *Xanthoria fulva*.

Table 1 The most important tree species and a number of lichen species found on each phorophyte in Suwalski Landscape Park.

Phorophyte	Number of epiphytic lichen species
Fraxinus excelsior	65
Alnus glutinosa	59
Salix spp.	40
Populus tremula	38
Betula pendula	36
Acer platanoides	33
Tilia cordata	25
Sorbus aucuparia	23
Carpinus betulus	19
Pinus sylvestris	17
Quercus robur	17
Padus avium	16
Ulmus spp.	14
Malus domestica	13
Picea abies	12

Quite large number of species has been observed on trunks of *Acer platanoides* and *Populus tremula*. In the studied area, both tree species grow in bare sites along roadsides, near buildings and in forest margins. Epiphytic lichen communities on their bark are prevalently composed of photophilous, more or less nitrophilous species with foliose or fruticose thalli, mainly of *Physcia tenella* and *Ph. adscendens,* and on aspen trees only of *Ph. stellaris*, *Physconia enteroxantha*, *Ramalina fraxinea* and – more rarely – of *R. farinacea* and *R. fastigiata*, *Xanthoria parietina* and *X. polycarpa*, as well as of *Anaptychia ciliaris* and *Phaeophyscia orbicularis*. Crustous lichens with similar habitat demands that usually accompany them are: *Candelariella xanthostigma* and *Amandinea punctata*, and on aspen trees exclusively – *Caloplaca holocarpa*. Permanent and sometimes significant quantitative contribution have also anitrophilous, torelant to strong insolation or simply demanding good light species of a character of mesoapolichens (cf. Fałtynowicz 1994), most often: *Evernia prunastri, Hypogymnia physodes, Lecanora argentata, Lecidella elaeochroma, Melanelia exasperatula, Parmelia sulcata, Phlyctis argena, Pleurosticta acetabulum* and *Pseudevernia furfuracea*.

Differentiated epiphytic communities develop on bark of *Betula pendula*. In the Park, these trees grow in very various habitat conditions, in forests as well as in non-forest areas. In forests, on birch trunks occur few lichen species, most of all common acidophilous ones such as *Hypogymnia physodes*, *Lecanora conizaeoides* and *Lepraria* spp. and a few taxa from the genus *Cladonia*, that often form only

scales of primary thalli difficult to identify them, and also species from the genus *Chaenotheca* (*Ch. chrysocephala, Ch. ferruginea* and *Ch. trichialis*). Considerably much more species occur on trunks of birches growing in forest margins, among fields and along roads. Their bark is often enriched as a result of dust blow and their trunks often possess wounds from which sap exudes. Such birch trees are usually occupied by *Physcia adscendens, Ph. tenella* and *Xanthoria polycarpa*, and sometimes also by *Lecanora carpinea* and *L. pulicaris*.

In Suwalski Landscape Park, many epiphytic species occur in large quantities. Tree trunks are usually overgrown profusely by lichen thalli. Particular attention should be paid to species belonging to the genera: *Ramalina*, *Anaptychia* and *Pleurosticta*, that produce numerous, shapely thalli; they are protected by law and also are included to the list of threatened lichens in Poland (cf. Cieśliński et al. 2003).

3.2.2. Epixilic lichens

Epixilic lichen biota of Suwalski Landscape Park is not rich – on this kind of substratum only 50 species have been found and 9 of them grow there accidentally. Most of the species growing on wood is met so often on other substrata, particularly on tree bark. In the studied area, twelve taxa, such as:

Bryoria fuscescens
Chaenotheca brachypoda
Chaenotheca furfuracea
Chaenotheca xyloxena
Cladonia cenotea
Lecanora hypopta
Lecanora varia
Placynthiella uliginosa
Pycnora sorophora
Strangospora moriformis
Thelomma ocellatum
Trapeliopsis flexuosa
occurred on wood exclusively.

The very interesting epixilic species are: *Chaenotheca brachypoda, Lecanora hypopta* and *Pycnora sorophora* (cf. Chapter 3.3.). Noteworthy is the only in the Park, locality of *Bryoria fuscescens*; in Poland, this mainly epiphytic species appears more often and often in anthropogenic sites, just on wood (Fałtynowicz 2004). Compared with other regions of Poland, small qualitative and quantitative contribution of species from the genus *Micarea* on wood are salient (these species are also poorly represented on tree bark). The phenomenon seems to result from anthropogenic

deformation of habitats.

Relatively large moisture of both air and substrata in forest communities of Suwalski Landscape Park causes that epixilic lichens grow here in small quantities and give way to stronger in intraspecific competition mosses. Rare and rare usage of wood as a building material do not favour epixilic lichens because it implies decreasing of differentiation of epixilic communities in a range much more greater than a regional one.

3.2.3. Epilithic lichens

In the studied area, most of epilithic species grows on erratics and stones. In Polish lowland, erratics are usually non-calcareous rocks, and are built of granite, gneiss and granite-gneiss (cf. Czernicka-Chodkowska 1977-1983). Physico-chemical parameters of rock substrata such as hardness, acidity and lack of calcium are similar, so factors differentiating epilithic biota are habitat conditions in particular. Rock substrata containing calcium carbonate are mainly of an anthropogenic origin, rarely one can find small shell conglomerates

In Suwalski Landscape Park, on rock substrata as much as 102 species have been noted. Such a great qualitative diversity of epilithic lichens distinguishes the studied area from other lowland territories; in Poland, only Pojezierze Kaszubskie lakeland is characterized by comparably rich epilithic biota (cf. Fałtynowicz & Tobolewski 1989, Fałtynowicz 1997b).

The most abounding with lichens are erratics in open places but located at some distance from roads and plough fields. On them, in great number are represented taxa with foliose as well as crustous thalli. The most frequent lichens occurring in such conditions are:

Acarospora fuscata, Aspicilia cinerea, Candelariella vitellina, Lecanora polytropa, L. rupicola, Neofuscelia loxodes, Protoparmeliopsis muralis, Scoliciosporum umbrinum, Tephromela atra and *Xanthoparmelia conspersa*. Quite frequently *Neofuscelia pulla* can be found, and in Suwalski Landscape Park the largest Polish population of this species is present.

Erratics located along communication routes or at field balks and edges are often very strongly covered by dust, therefore conio- and nitrophilous species from the genus *Physcia* (*Ph. adscendens, Ph. caesia, Ph. dubia* and *Ph. tenella*) and also *Phaeophyscia orbicularis* appear on them, sometimes in great quantities. As a result of dust cover, frequently the pH of a substratum has changed and on erratics begin to grow lichens usually observed on artificial rock substrata, e.g. *Caloplaca holocarpa, Candelariella aurella* and *Lecanora dispersa*. On well illuminated but situated close to old trees boulders, sometimes true epiphityc species, such as *Hypogymnia physodes, Melanelia exasperatula, Parmelia sulcata* and *Xanthoria polycarpa* may occur.

Boulders in forests possess a poorer lichen biota. Because of shading and considerable air and substratum humidity, usually mosses prevail on them and among few shade-tolerant and higrophilous species, particularly noteworthy are: *Aspicilia gibbosa, Caloplaca chlorina, Collema flaccidum, Leptogium lichenoides, Pseudosagedia chlorotica* and *Verrucaria hydrela*.

Among epilithic lichens found in Suwalski Landscape Park, there are many species rare or very rare in lowland (cf. Fałtynowicz 1992, 2003a, Cieśliński 2003a and Chapter 3.3.) such as:

Diploschistes muscorum
Lecanora cenisia
Lecanora soralifera
Melanelia sorediata
Neofuscelia verruculifera
Pertusaria corallina
Protoparmelia badia
Rhizocarpon geographicum
Rhizocarpon lecanorinum
Stereocaulon paschale
Stereocaulon taeniarum
Tephromela grumosa
Umbilicaria deusta
Umbilicaria polyphylla
Xanthoparmelia somloensis.

On calcareous rocks, mainly of an anthropogenic origin dominate following ordinary synanthropic species: *Aspicilia calcarea, A. moenium, Caloplaca citrina, C. decipiens, C. saxicola, Candelariella aurella* and *Lecanora dispersa* agg. As far as more interesting taxa are concerned, only *Lecania sylvestris* and *Phaeophyscia sciastra* have been rarely reported from Poland (cf. Fałtynowicz 2003a, Cieśliński 2003a).

3.2.4. Terricolous lichens

A small number of terricolous species (20) found in Suwalski Landscape Park results from small local frequency of suitable habitats for this group. Terricolous lichens grow there presumably in dry swards or on eroded gravely roadside scarps; such habitats cover imperceptible areas within the surveyed territory. More frequent species growing on soil are only *Cladonia furcata* and *Peltigera rufescens*. On single sites in termophilous swards, a few interesting species have occurred, such as: *Cladonia foliacea, C. pocillum, C. rangiformis, C. scabriuscula, C. symphycarpa, Collema tenax* and *Myxobilimbia sabuletorum*. Noteworthy is a locality of *Cladonia scabriuscula*, a sub-atlantic species that in Poland grows in greatest number

along the Baltic coast, and less frequently and in smaller quantities – in swards in the south part of the country (Fałtynowicz 1992, 2003a). In the north-east Poland, this species is very rare (por. Cieśliński 2003a). In addition, ephemerolichens *Collema limosum* and *Leptogium biatorinum* have been found on few localities.

3.3. Protected, rare and interesting species

Nature of Suwalski Landscape Park has been impacted by anthropopressure for hundreds of years. First of all, most of forests were cut down and the remaining pieces have strongly modified treestand dominated by pines *Pinus sylvestris* that have been planted.The rest of area has been utilised as plough-land, meadows, pastures or built over with farm buildings.These forms of land use have impacted very strong transformations of the lichen biota, which at present is mainly composed of common and frequent species with relatively wide ecological scales.

However, in spite of great anthropogenic changes, within the territory of Suwalski Landscape Park as much as 38 species protected by law (15,5% of the total biota) have been found. There are as follows:

Anaptychia ciliaris
Bryoria fuscescens
Cetraria aculeata
Cetraria chlorophylla
Cetraria sepincola
Cladonia arbuscula
Evernia prunastri
Hypogymnia tubulosa
Imshaugia aleurites
Melanelia exasperatula
Melanelia elegantula
Melanelia fuliginosa
Melanelia sorediata
Melanelia subargentifera
Parmelia saxatilis
Parmelina tiliacea
Parmeliopsis ambigua
Peltigera didactyla
Peltigera membranacea
Peltigera neckeri
Peltigera polydactylon
Peltigera praetextata
Peltigera rufescens
Platismatia glauca
Pleurosticta acetabulum
Pseudevernia furfuracea
Ramalina farinacea
Ramalina fastigiata
Ramalina fraxinea
Ramalina pollinaria
Stereocaulon paschale
Stereocaulon taeniarum
Umbilicaria deusta
Umbilicaria polyphylla
Usnea hirta
Vulpicida pinastri
Xanthoparmelia conspersa
Xanthoparmelia somloensis

Taxa metioned above are rather frequent in Poland, particularly in the north part of the country. Nevertheless, the need of their protection results from the fact that these species represent macrolichens that most often die at first as they are

very sensitive to unfavourable changes of habitat conditions caused particularly by air pollution, forest management or by cutting off roadside trees.

Noteworthy are three species: *Anaptychia ciliaris*, *Melanelia subargentifera* and *Pleurosticta acetabulum*, occurring on roadside and singly growing trees, for which the north-east Poland is a specific refuge; they grow here more frequently and abundantly than elsewhere in the country. These species are probably eu-anthropolichens that came from south Europe and thanks to man have inhabited permanently territories located to the north of Carpathians (cf. Fałtynowicz 1992, 1994). They form here numerous and shapely thalli, often with a diameter up to 20 cm, and *Anaptychia ciliaris* as well as *Pleurosticta acetabulum* usually plentifully produce fruit bodies. Another eu-anthropolichen occurring here is *Parmelina tiliacea*, but the species is rare in this part of the country.

Other valuable species protected by law and growing in the Park are as follows:

Bryoria fuscescens: common in the north part of the country, mainly in larger forest complexes (cf. e.g. Fałtynowicz 1992, Cieśliński 2003a); rare in other areas, but lately reported from new localities where air pollution has diminished significantly (cf. Fałtynowicz 2004);

Melanelia elegantula: very rare in north-east Poland (Cieśliński 2003a), more frequent in the west and south parts of the country (Fałtynowicz 2003a);

Melanelia sorediata: very rare in Poland (Fałtynowicz 2003a) and presumably dying;

Umbilicaria deusta: this is one of several localities of this species in lowland;

Xanthoparmelia somloensis: known from few sites in the country, perhaps poorly distinguished;

Usnea hirta: similarly to *Bryioria fuscescens*, frequent in the north part of the country (cf. e.g. Fałtynowicz 1992, Cieśliński 2003a); rare in other areas but in the last few years observed on new localities where air pollution has diminished significantly (cf. Fałtynowicz 2004).

In the described area, other valuable species also occur and among them, the most interesting are:

Anisomeridium polypori: known from a few localities only, exclusively in the north part of Poland (Fałtynowicz 2003a); maybe overlooked;

Arthonia mediella: dispersed over the whole country (Fałtynowicz 2003a), but more frequent in the north-east Poland only (Cieśliński 2003a);

Arthopyrenia salicis: this is the second locality of the species in Poland, hitherto reported only from Puszcza Borecka Forest (Zalewska 2000);

Caloplaca cerinella: known from few sites in Poland (Fałtynowicz 2003a);

Chaenotheca brachypoda: in the past more frequent (cf. Fałtynowicz 2003),

but at present occurs in larger forest complexes only, rarely in old parks;

Cladonia scabriuscula: sub-atlantic species, rare in the north-east Poland, this is the first locality in Suwałki region (Cieśliński 2003a);

Cladonia symphycarpa: frequent in the south Poland in calciphilous swards (Tobolewski 1980, Fałtynowicz 2003a), in the north of the country extremely rare (Cieśliński 2003a);

Collema flaccidum: this is the only locality of the species in the north-east Poland and one of the five in the Polish lowland (Fałtynowicz 1999); recently found outside the state frontier, not far from the study area, in Russian part of Puszcza Romincka Forest (Zalewska et al. 2004);

Diploschistes scruposus: very rare on erratics in lowland (Fałtynowicz 2003a);

Fuscidea arboricola: in Poland known from four localities only; three of them are in the north-east part of the country (Fałtynowicz 2003a);

Lecania cyrtellina: reported from several localities in Poland (Fałtynowicz 2003a);

Lecania sylvestris: known from few sites in Poland (Fałtynowicz 2003a), presumably more frequent but overlooked;

Lecanora hypopta: very rare in Poland, perhaps poorly distinguished;

Lecanora persimilis: this is the fourth locality of the species in Poland, the earlier three were reported from the south-west part of the country (Fałtynowicz 2003a);

Lecanora soralifera: more frequent in mountains, in lowland reported only from Pojezierze Kaszubskie Lakeland (Fałtynowicz 1992);

Leptogium biatorinum: rarely noted in Poland, mainly in anthropogenic habitats (gravel-pits, roadside scarps), undoubtedly more frequent but omitted; the species represents a relatively poorly known group of ephemeroanthropolichens (Fałtynowicz 1994);

Pachyphiale fagicola: known from few localities in Poland (Fałtynowicz 2003a), presumably overlooked;

Pertusaria corallina: this is the first locality of the species in Polish lowland (cf. Fałtynowicz 2003a);

Porpidia glaucophaea: reported from few localities in the north Poland (Fałtynowicz 1992, Cieśliński 2003a);

Pycnora sorophora: until quite recently very rare species, now it seems to spread (cf. Cieśliński 2003a);

Rhizocarpon lecanorinum: this is the only locality of the species in the north-east Poland and one of the two in the lowland (Fałtynowicz 2003a);

Sclerophora nivea: this is one of the two localities in lowland of this rare in Poland species (Fałtynowicz 2003a);

Tephromela grumosa: very rare epilithic species in lowland;

Verrucaria hydrela: known from a few localities in lowland; more frequent in mountains;

Xanthoria fulva: until now, known just only from two present-day localities in Puszcza Romincka and Puszcza Augustowska Forests (Cieśliński 2003a), and from two historic sites in Pieniny and Sudety mountains (Fałtynowicz 2003a).

Nearly a half of the mentioned above group of 21 interesting species represents epilithic lichens. This is the feature distinguishing Suwalski Landscape Park from the other protected areas of Niemen Euroregion that results from accumulation of particularly large quantities of erratics and smaller boulders here.

In the studied area, only two lichen species regarded as bioindicators of lowland old-growth forests (see Czyżewska & Cieśliński 2003) have been found, namely: *Chaenotheca brachypoda* and *Pertusaria pupillaris* occurring in single sites in the best preserved forest pieces (Cieśliński 2003a, Jando & Kukwa 2003). This is another one evidence of very strong anthropogenic transformations of habitats in Suwalski Landscape Park.

Some interesting taxa of lichenicolous fungi have been identified. Particular attention should be paid to first findings in Poland of *Claussenomyces olivaceus, Lawalreea lecanorae* and *Taeniolella punctata* (Jando & Kukwa 2003). Very rare is also *Sphaerellothecium propinquellum*, which has the second Polish locality in the researched area. Another species, such as *Lichenoconium xanthoriae* and *Tremella lichenicola* have been also rarely reported from the country till now (Fałtynowicz 2003a).

3.4. A threat to the lichen biota

The main threat to lichens is man economic activity that impacts widely understood alterations of habitat conditions. Factors that negatively influence on lichens (Table 2), operate as a complex and in many cases there is difficult to point out the only one that is responsible for transformation of a lichen biota. It will not be an exaggeration to say that most of the lichen species are more or less threatened; even these that inhabit artificial rock substrata (concrete, tiles, bricks) have lesser and lesser possibilities to enter new habitats because of changes in both quality of building materials and technologies (Fałtynowicz 2003b).

Table 2. Factors impacting negatively on a lichen biota (acc. Fałtynowicz 2003b).

No.	Factor	Lichen group particularly endangered	Remarks
1	Air pollution	Species from all habitats and substrata	Large impact of trans-border pollution
2	Economic activities in forests	Epiphytic, epixilic and terricolous lichens	Changes of structure and species composition of tree stands, changes of phytoclimat, decrease in a number of old trees, decrease in amount of rotten wood

3	Cutting of old trees growing outside forests	Epiphytic lichens	Refers to roadside trees in particular
4	Agriculture	Mainly epiphytic and epilithic lichens	Impact of fertilisers and insecticides, dust cover
5	Changes of water regime (drainage)	Mainly epiphytes (psychro- and higrophilous)	Local impacts
6	Urbanization	Species from all habitats and substrata	Destroying of all habitats and substrata; local impacts
7	Motorization	Mainly epiphytes	Pollution, extension of road infrastructure
8	Tourism	Mainly epilithic lichens	Devastation of surface of erratics in lowland and of rocks in mountains; local impact
9	Exploitation of natural resources	Species from all habitats and substrata	Opencast mines, gravel-pits, quarries, harvesting of stones and boulders for building industry in lowland; local impact
10	Pollution of streams and rivers	Epilithic species	Vanishing of lichens growing on boulders located in a river/stream current and along their banks; refers to sub-mountain regions and south Poland
11	Collecting	Species from all habitats and substrata	In particular, collecting for scientific purposes

One way to present a threat to oranisms is preparing „red lists". Most of European countries have already prepared such lists for lichens. In Poland, three editions of "Red list of threatened lichens" have been published till now (Cieśliński et al. 1986, 1992, 2003). In each of the following editions, generally more and more numbers of species, as well as much more extinct and endangered taxa were given. For example, in 1986, 142 species were regarded as endangered, in 1992 – 180, and in 2003 – as much as 380. Data from 2003 locate Poland among countries with very strongly threatened lichen biota (cf. Pišut 1993, Siebel et al. 1992).

From among all lichens found in Suwalski Landscape Park, 70 species (30.3% of the total) are included on „Red List of extinct and threatened lichens in Poland", and only 39 (16.9%) – on „Red List of threatened lichens in North-Eastern Poland" (Table 3). This disproportion, i.e. nearly a twice smaller number of species threatened in the region than in Poland testifies to good conditons for lichens in this part of the country.

Table 3. Species occurring in Suwalski Landscape Park, included on Polish and regional lists of threatened lichens

Name of species	Category of threat	
	In Poland (acc. Cieśliński et al. 2003)	In the north-east Poland (acc. Cieśliński 2003b)
Acrocordia gemmata	VU	–
Anaptychia ciliaris	EN	–
Arthonia dispersa	VU	EN
Arthonia mediella	VU	VU
Arthothelium ruanum	NT	–
Aspicilia gibbosa	EN	–
Bacidia beckhausii	VU	VU
Bacidia rubella	VU	–
Bacidia subincompta	EN	VU
Bryoria fuscescens	VU	–
Buellia alboatra	VU	CR
Caloplaca cerinella	EN	EN
Caloplaca chlorina	EN	VU
Cetraria chlorophylla	VU	–
Cetraria sepincola	EN	–
Chaenotheca brachypoda	EN	EN
Chaenotheca furfuracea	NT	VU
Chaenotheca trichialis	NT	–
Chaenotheca xyloxena	VU	EN
Cladonia symphycarpa	–	LC
Collema flaccidum	EN	DD
Diploschistes scruposus	–	VU
Evernia prunastri	NT	–
Fuscidea arboricola	–	DD
Graphis scripta	NT	–
Hypogymnia tubulosa	NT	–
Lecania cyrtellina	DD	DD
Lecania globulosa	VU	–
Lecanora cenisia	–	NT
Lecanora intricata	–	LC
Lecanora persimilis	DD	–

Name of species	Category of threat	
	In Poland (acc. Cieśliński et al. 2003)	In the north-east Poland (acc. Cieśliński 2003b)
Lecanora soralifera	VU	–
Lecanora subrugosa	LC	VU
Lecidea nylanderi	–	DD
Leptogium lichenoides	LC	NT
Melanelia elegantula	VU	–
Melanelia subargentifera	VU	–
Neofuscelia pulla	NT	–
Neofuscelia verruculifera	EN	–
Ochrolechia androgyna	VU	–
Opegrapha atra	EN	EN
Opegrapha rufescens	VU	–
Opegrapha vatia	NT	–
Pachyphiale fagicola	VU	VU
Parmelina tiliacea	VU	–
Peltigera membranacea	DD	DD
Peltigera neckeri	NT	DD
Peltigera polydactylon	DD	VU
Peltigera praetextata	VU	–
Pertusaria corallina	NT	–
Pertusaria leioplaca	NT	–
Pertusaria pupillaris	NT	–
Phaeophyscia sciastra	LC	–
Physconia distorta	EN	–
Physconia perisidiosa	EN	–
Placynthiella dasaea	–	DD
Pleurosticta acetabulum	EN	–
Porpidia glaucophaea	VU	LC
Porpidia macrocarpa	–	NT
Protoparmelia badia	NT	–
Pseudosagedia chlorotica	–	NT
Ramalina farinacea	VU	–
Ramalina fastigiata	EN	–
Ramalina fraxinea	EN	–

Name of species	Category of threat	
	In Poland (acc. Cieśliński et al. 2003)	In the north-east Poland (acc. Cieśliński 2003b)
Ramalina pollinaria	VU	-
Rhizocarpon geographicum	-	VU
Rhizocarpon lecanorinum	VU	NT
Rinodina colobina	EN	EN
Sclerophora nivea	CR	CR
Staurothele ambrosiana	VU	-
Stereocaulon paschale	CR	CR
Stereocaulon taeniarum	VU	-
Tephromela atra	NT	-
Tephromela grumosa	-	LC
Umbilicaria deusta	LC	CR
Umbilicaria polyphylla	LC	EN
Usnea hirta	VU	-
Verrucaria hydrela	VU	-
Vulpicida pinastri	NT	-
Xanthoria fallax	VU	EN
Xanthoria fulva	DD	EN
Total	70	39

Numbers of lichen species in particular categories of threat are specified in Table 4. The highest category CR (Critically Endangered) was given to four species, and two of them– *Sclerophora nivea* and *Stereocaulon paschale* – are identically threatened in Poland as in the region. From the two remaining ones, *Umbilicaria deusta* is very frequent in mountains and is insignificantly threatened, whereas in the north-east part of the country the only locality of the species in the reserve „Głazowisko Bachanowo nad Czarną Hańczą" field of boulders in Suwalski Landscape Park is extremally exposured to distruction. On the other hand, *Buellia alboatra* is recently very rarely observed in Poland (see Fałtynowicz 2003a), and in the north-east part of the country has been found on three localities only (Cieśliński 2003a).

From among 16 species that possess in Poland the category EN (Endangered), as much as 9 of them are not included on „Red List of threatened lichens in North-Eastern Poland". Six of them, such as: *Anaptychia ciliaris, Physconia distorta, Ph. perisidiosa, Pleurosticta acetabulum, Ramalina fastigiata* and *R. fraxinea* are synanthropic lichens. They grow on roadside and single trees in well illuminated places; they may be regarded as species distinguishing non-forest areas with very weakly polluted

air. Such conditions prevail in Suwalski Landscape Park, similarly as in the most part of the south-east region of Poland. In the same group, next four species may be involved, such as: *Melanelia subargentifera, Parmelina tiliacea, Ramalina farinacea* and *R. pollinaria*, that in the Polish red list were categorised as VU (Vulnerable), but have not been specified in the list of NE Poland. Some other taxa that are not threatened in the south-east Poland, and elsewhere in the country are categorised as EN (*Cetraria sepincola*) or VU (*Acrocordia gemmata, Bacidia rubella, Cetraria chlorophylla*) are classified as apolichens (see Fałtynowicz 1994), reported very often from anthropogenic habitats. These types of habitats are inhabited more and more frequently also by *Bryoria fuscescens* and *Usnea hirta*; in Suwalski Landscape Park, their young thalli have been found on wooden fences. In a few recent years, these two species have been reported from many sites throughout the country from this very substratum (see Fałtynowicz 2004).

Five species not threatened in Poland are classified as highly threatened in the north-east part of the country. These are: *Diploschistes scruposus* (VU), *Rhizocarpon geographicum* (VU), *Umbilicaria deusta* (CR), *U. polyphylla* (EN) and *Xanthoria fulva* (EN). The first four species are common in the south of the country on mountain rocks, while distribution of the last one as well as its status in the list of threatened lichens need further study.

Table 4. Numbers of lichen species in particular categories of threat (according to Polish and regional lists of threatened lichens) in Suwalski Landscape Park.

Category of threat	Number of species	
	A	B
CR	2	4
EN	16	9
VU	27	10
NT	15	5
LC	5	4
DD	5	7

A – according to „Red List of extinct and threatened lichens in Poland" (Cieśliński et al. 2003a); B – according to „Red List of threatened lichens in North-Eastern Poland" (Cieśliński 2003b).

A habitat group that is more and more threatened in Suwalski Landscape Park as well as in the whole lowland are epilithic lichens. The main factors that negatively impact them can be classified as follows (see Fałtynowicz 1997b):

1/ natural:

a. succession of plant vegetation surrounding a boulder that implies alteration of microclimatic conditions such as: shade of a boulder, an increase of air and substratum humidity; such conditions are decidedly preferred by fast growing mossess, whereas slowly growing lichens are limited;
b. erosion of a boulder – causes permanent destruction of its surface and falling off lichen thalli together with rock pieces; erosion may be induced by physical or biological factors;
c. deposition of plant debris on a boulder surface and formation of a humus layer; this process takes place on boulders with nearly flat upper surface that usually only slightly protrude above the ground surface; as a result, a boulder surface is overgrown by mossess and then by vascular plants;

2/ anthropogenic:

a. destruction of a whole boulder or its part;
b. extermination, usually unintended, of organisms occupying boulders through climbing on boulders, engraving inscriptions in their surface, painting or lighting the fire close to them;
c. alteration of habitat conditions, e.g. through planting trees in a nearest vicinity of a boulder or cutting off a tree stand that sheltered it;
d. covering of a boulder surface by dust that usually causes the pH change and disappearance of acidophilous species; instead of them ordinary conio- and nitrophilous species begin to grow in great number.

The most serious threat to epilithic lichens in Suwalski Landscape Park is the secondary succession of vegetation in the vicinity of erratics and destruction of boulders. The first reason results from deterioration of shepherding; abandoned pastures with thousands of boulders on them have been rapidly overgrown by high plants. In addition, plenty of boulders have been utilised as building material and unfortunately, this practice has become more intense recently.

The basic condition, on which continuous presence of epilithic lichens in the studied area and generally – in the lowland may be preserved is constantly extended protection of rock substrata. Not only large „monumental" erratics should be maintained but also smaller boulders and stones, and their natural or anthropogenic accumulations as well. The field survey carried out in the north Poland (cf. e.g. Fałtynowicz 1992, Fałtynowicz & Tobolewski 1989, Cieśliński 2003a) as well as numerous unpublished data have pointed out that most of the very interesting epilithic lichen taxa were not found on huge erratics but on quite small boulders or stones. Considering this fact, a definition of an "erratic – nature monument" should be revised as at present it takes into account a size of erratics only, and organisms growing on them have no importance, whereas for epilithic lichens, the size of a boulder has minimal significance, if any at all.

4. List of species

Data from localities 1-15 have been prepared by authors of the work, while data concerning localities 16-27 have been obtained from Cieśliński (2003a) as well as from Karczmarz et al. (1988), Kukwa & Fałtynowicz (2002), and Jando & Kukwa (2003) (cf. List of localities in Chapter 2.2.).

Each taxon in the list has been described as follows:

Name of species–substratum– frequency (cf. Chapter 2.1.) – number of localities– list of localities (see Chapter 2.2.).

* - non-lichenized fungus, lichenicolous or saprotrophic.

Acarospora fuscata (Nyl.) Arnold – On boulders.
16 loc.: 1-5, 7, 8, 12, 15-17, 19, 21, 24, 26, 27.

A. heppii (Naeg. in Hepp) Naeg. in Körb. – On small stones.
3 loc.: 7, 17, 23.

A. veronensis A. Massal. – On boulders and stones.
4 loc.: 1, 3, 4, 7.

Acrocordia gemmata (Ach.) A. Massal. – On bark of *Fraxinus*.
1 loc.: 16.

Amandinea punctata (Hoffm.) Coppins & Scheid. – On bark of *Acer, Fraxinus, Populus, Sorbus*.
10 loc.: 4, 7, 16-21, 23, 24.

Anaptychia ciliaris (L.) Körb. – On bark of *Acer, Populus*.
5 Loc.: 8, 16, 18, 19, 24.

Anisomeridium polypori (M.B. Ellis & Everh.) M.E. Barr – On bark of *Fraxinus*.
1 loc.: 16.

Arthonia dispersa (Schrad.) Nyl. – On bark of *Fraxinus*.
1 loc.: 16.

A. mediella Nyl. – On bark of *Alnus* and *Fraxinus*.
2 loc.: 16, 18.

A. radiata (Pers.) Ach. – On bark of *Carpinus* and *Fraxinus*.
3 loc.: 16, 19, 23.

A. spadicea Leight. – On bark of *Alnus, Carpinus, Fraxinus, Sorbus*.
3 loc.: 7, 8, 10, 14, 16, 17.

Arthopyrenia salicis A. Massal. – On bark of *Fraxinus*.
1 loc.: 16.

Arthothelium ruanum (A. Massal.) Zwackh – On bark of *Alnus, Fraxinus* i *Ulmus*.
1 loc.: 16.

Aspicilia caesiocinerea (Nyl. ex Malbr.) Arnold – On boulders.
4 loc.: 1, 8, 16, 17.

A. calcarea (L.) Mudd – On concrete.
3 loc.: 19, 21, 26.
A. cinerea (L.) Körb. – On boulders.
8 loc.: 7, 12, 17, 19, 21-23, 27.
A. gibbosa (Ach.) Körb. – On boulders.
1 loc.: 19.
A. moenium (Vain.) Thor & Timdal – On concrete.
7 loc.: 6, 7, 8, 17, 19, 21, 26.
A. simoënsis Räsänen – On boulders.
1 loc.: 17.
**Athelia arachnoidea* (Berk.) Jülich. – On thalli of *Fuscidea pusilla, Lecanora conizaeoides, Lepraria incana* and *Xanthoria polycarpa* and on epiphytic algae.
1 loc.: 16.
Bacidia beckhausii Körb. – On bark.
1 loc.: 18.
B. rubella (Hoffm.) A. Massal. – On bark.
1 loc.: 18.
B. subincompta (Nyl.) Arnold – On bark of *Fraxinus*.
1 loc.: 16.
Bryoria fuscescens (Gyeln.) Brodo & D. Hawksw. – On wood.
3 loc.: 1, 7, 16.
Buellia alboatra (Hoffm.) Th. Fr. – On bark of *Acer*.
2 loc.: 18, 21.
B. griseovirens (Turner & Borrer ex Sm.) Almb. – On bark of *Alnus, Betula, Carpinus, Fraxinus, Malus, Padus, Pyrus, Salix, Sorbus, Tilia, Ulmus*.
8 loc.: 1, 7, 8, 9, 16, 17, 19, 23.
Caloplaca cerinella (Nyl.) Flagey – On bark of *Acer*.
1 loc.: 18.
C. chlorina (Flot.) Sandst. – On boulders in Czarna Hańcza.
1 loc.: 17.
C. citrina (Hoffm.) Th. Fr. – On concrete.
4 loc.: 1, 8, 16, 19.
C. decipiens (Arnold) Blomb. & Forss. – On concrete.
6 loc.: 1, 3, 13, 16, 19, 21.
C. holocarpa (Hoffm.) Wade – On bark of *Populus*, more rarely on boulders and small stones.
16 loc.: 1, 2, 4, 6-8, 11, 15, 16, 18-22, 24, 26.
C. saxicola (Hoffm.) Nordin – On concrete.
10 loc.: 1, 8, 13, 16, 19-22, 24, 26.
Candelaria concolor (Dicks.) Stein – On bark.
2 loc.: 19, 23.

Candelariella aurella (Hoffm.) Zahlbr. – On concrete, boulders and stones.
15 loc.: 1, 4-8, 10, 11, 16, 19-22, 24, 26.
C. coralliza (Nyl.) H. Magn. – On boulders.
4 loc.: 1, 5, 7, 8.
C. reflexa (Nyl.) Lettau – On bark of *Acer, Fraxinus, Salix, Tilia*.
8 loc.: 6-8, 10, 13-16.
C. vitellina (Hoffm.) Müll. Arg. – On boulders, in exceptional cases on wood.
16 loc.: 1-5, 7, 8, 12, 15-17, 19, 22, 24-26.
C. xanthostigma (Ach.) Lettau – On bark of *Alnus, Fraxinus, Malus, Padus, Populus, Salix, Tilia, Ulmus*.
11 loc.: 2, 6, 16-24.
Cetraria aculeata (Schreb.) Ach. – On soil.
1 loc.: 26.
C. chlorophylla (Willd.) Vain. – On bark of *Acer, Alnus, Populus, Pyrus*.
5 loc.: 4, 5, 7, 17, 18.
C. sepincola (Ehrh.) Ach. – On bark of *Alnus* and *Fraxinus*, and on wood.
4 loc.: 1, 4, 17, 21.
Chaenotheca brachypoda (Ach.) Tibell – On wood.
1 loc.: 18.
Ch. chrysocephala (Ach.) Th. Fr. – On bark of *Alnus, Betula, Padus*.
3 loc.: 9, 16, 18.
Ch. ferruginea (Turner ex Sm.) Migula – On bark of *Betula, Padus, Picea, Pinus*.
3 loc.: 9, 10, 16.
Ch. furfuracea (L.) Tibell – On wood.
2 loc.: 16, 17.
Ch. trichialis (Ach.) Th. Fr. – On bark of *Alnus, Betula*.
3 loc.: 9, 16, 18.
Ch. xyloxena Nádv. – On wood.
1 loc.: 18.
Cladonia arbuscula (Wallr.) Flot. em. Ruoss subsp. *mitis* (Sandst.) Ruoss – On boulders.
2 loc.: 17, 23.
C. cenotea (Ach.) Schaer. – On wood.
2 loc.: 16, 19.
C. cervicornis (Ach.) Flot. subsp. *verticillata* (Hoffm.) Ahti – On boulders.
2 loc.: 4, 17.
C. chlorophaea (Flörke ex Sommerf.) Spreng. s.s. – On bark of *Alnus* and on wood.
2 loc.: 16, 26.
C. coniocraea (Flörke) Vain. – On bark of *Alnus, Picea*, on wood.
6 loc.: 9, 10, 13, 17, 26, 27.

C. deformis (L.) Hoffm. – On a boulder.
1 loc.: 17.
C. digitata (L.) Hoffm. – On bark of *Alnus, Betula*.
3 loc.: 8, 9, 16.
C. fimbriata (L.) Fr. – On bark of *Alnus, Betula, Fraxinus, Picea, Pinus*, on wood, boulders and on soil.
12 loc.: 5, 8-14, 16, 17, 19, 23.
C. foliacea (Huds.) Willd. – On soil in insolated swards.
1 loc.: 11.
C. furcata (Huds.) Schrad. – On soil.
8 loc.: 1, 4, 5, 7, 17, 23, 26, 27.
C. glauca Flörke – On bark of *Betula*,
3 loc.: 9, 17, 23.
C. gracilis (L.) Willd. – On soil.
2 loc.: 17, 23.
C. macilenta Hoffm. – On bark of *Alnus, Betula, Fraxinus*, rarely on boulders.
3 loc.: 9, 16, 17.
C. ochrochlora Flörke – On wood, on bark of *Alnus, Betula, Fraxinus, Padus, Pinus*, rarely on boulders.
6 loc.: 4, 8, 9, 16, 17, 26.
C. phyllophora Hoffm. – On boulders.
2 loc.: 17, 23.
C. pocillum (Ach.) O.-J. Rich. – On soil in insolated swards.
1 loc.: 11.
C. pyxidata (L.) Hoffm. – On bark of *Picea*, On soil in swards.
8 loc.: 1, 7, 8, 10, 16, 17, 23, 27.
C. rangiformis Hoffm. – On soil.
3 loc.: 4, 23, 26.
C. scabriuscula (Delise) Leight. – On soil.
1 loc.: 1.
C. subulata (L.) Weber in Wigg. – On soil.
3 loc.: 1, 5, 17.
C. symphycarpa (Ach.) Fr. – On soil.
2 loc.: 4, 20.
**Claussenomyces olivaceus* (Fuckel) Sherw. – On spruce resin.
1 loc.: 16.
Collema flaccidum (Ach.) Ach. – On boulders in a river.
1 loc.: 17.
C. limosum (Ach.) Ach. – On soil in swards and among mosses on walls.
2 loc.: 1, 8.

C. tenax (Sw.) Ach. em. Degel. – On soil.
1 loc.: 20.

Dimerella pineti (Schrad. ex Ach.) Vězda – On bark of *Alnus, Corylus, Fraxinus, Picea, Pinus, Salix, Tilia, Ulmus*, rarely on wood.
9 loc.: 4, 7-10, 14, 16, 17, 23.

Diploschistes scruposus (Schreb.) Norman – On boulders.
2 loc.: 17, 23.

Evernia prunastri (L.) Ach. – On bark of *Acer, Alnus, Betula, Fraxinus, Populus, Quercus, Salix, Sorbus, Tilia*, rarely on wood.
18 loc.: 1, 4, 6-16, 18, 19, 21, 24, 26.

Fuscidea arboricola Coppins & Tønsberg in Tønsberg – On bark of *Betula*.
1 loc.: 16.

F. pusilla Tønsberg – On bark of *Alnus* and *Betula*.
2 loc.: 16, 17.

Graphis scripta (L.) Ach. – On bark of *Alnus, Carpinus, Fraxinus, Salis, Sorbus, Tilia, Ulmus*.
4 loc.: 7, 10, 16, 17.

Hypocenomyce scalaris (Ach.) Choisy – On bark of *Alnus, Betula, Picea, Pinus, Tilia*, on wood.
7 loc.: 4, 7, 14-16, 19, 24.

Hypogymnia physodes (L.) Nyl. – On bark of *Acer, Alnus, Betula, Euonymus, Fraxinus, Malus, Padus, Picea, Pinus, Pyrus, Quercus, Salix, Sorbus, Tilia, Ulmus*, on wood, rarely on boulders.
21 loc.: 1, 2, 4-10, 12-19, 21-24.

H. tubulosa (Schaer.) Hav. – On bark of *Acer, Alnus, Fraxinus, Populus, Quercus, Salix, Sorbus*, on wood, in exceptional cases on boulders.
12 loc.: 1, 4, 7, 11, 12, 14-19, 21.

Imshaugia aleurites (Ach.) S.L.F. Mey. – On bark of *Alnus*.
1 loc.: 17.

**Lawalreea lecanorae* Diederich – On apothecia of *Lecanora persimilis*.
1 loc.: 16.

Lecania cyrtella (Ach.) Th. Fr. – On bark of *Acer*.
2 loc.: 6, 18.

L. cyrtellina (Nyl.) Sandst. – On bark of *Fraxinus*.
2 loc.: 17.

L. globulosa (Flörke) van den Boom & Sérus. – On bark of *Salix*.
2 loc.: 16, 19.

L. naegelii (Hepp) Diederich & P. Boom – On bark of *Populus*.
1 loc.: 18.

L. sylvestris (Arnold) Arnold – On concrete.
1 loc.: 16.

Lecanora albescens (Hoffm.) Flörke – On concrete.
8 loc.: 1, 6, 10, 16, 19, 21, 22, 24.
L. allophana (Ach.) Nyl. – On bark of *Populus*.
1 loc.: 21.
L. argentata (Ach.) Malme – On bark of *Acer, Alnus, Betula, Fraxinus, Populus, Pyrus, Quercus, Salix, Sorbus*.
8 loc.: 1, 4, 12-14, 16, 18, 26.
L. carpinea (L.) Vain. – On bark of *Acer, Betula, Carpinus, Fraxinus, Populus, Pyrus, Quercus, Salix, Sorbus, Syringa, Tilia*.
24 loc.: 1-3, 5-24, 26.
L. cenisia Ach. – On boulders.
1 loc.: 17.
L. chlarotera Nyl. – On bark of *Alnus, Fraxinus, Populus, Quercus, Sorbus, Tilia*.
13 loc.: 1, 2, 4, 7, 13-16, 18-20, 22, 23.
L. conizaeoides Nyl. in Crombie – On bark of *Alnus, Betula, Carpinus, Fraxinus, Padus, Picea, Pinus, Sorbus*, on wood.
14 loc.: 1, 4, 5, 7, 9, 10, 12, 14, 16, 17, 19, 21, 23, 23, 26.
L. dispersa (Pers.) Sommerf. – On concrete and on small stones.
10 loc.: 1, 4, 6, 8, 11, 16, 19, 21, 22, 24.
L. expallens Ach. – On bark of *Acer, Alnus, Fraxinus, Malus, Padus, Populus, Salix*.
10 loc.: 1, 6, 10, 16-22.
L. hagenii (Ach.) Ach. – On bark of *Fraxinus*.
5 loc.: 16, 18, 20-22.
L. hypopta (Ach.) Vain. – On wood.
1 loc.: 16.
L. intricata (Ach.) Ach. – On boulders.
4 loc.: 15, 17, 24, 26.
L. persimilis (Th. Fr.) Nyl. – On bark of *Populus*.
1 loc.: 16.
L. polytropa (Ehrh.) Rabenh. – On boulders.
14 loc.: 1-5, 7, 8, 12, 14, 16, 17, 19, 22, 26.
L. pulicaris (Pers.) Ach. – On bark of *Acer, Alnus, Betula, Euonymus, Fraxinus, Picea, Pinus, Quercus, Salix, Sorbus, Tilia*, on wood.
17 loc.: 1, 3-5, 7-9, 12-17, 21, 23, 24, 26.
L. rupicola (L.) Zahlbr. – On boulders.
10 loc.: 1, 3-5, 8, 17, 19, 21, 22, 26.
L. saligna (Schrad.) Zahlbr. – On bark of *Acer, Fraxinus* i *Populus*, on wood.
14 loc.: 1, 4-8, 14, 16-18, 19-21, 24.
L. soralifera (Suza) Räsänen – On boulders.
1 loc.: 17.

L. subrugosa Nyl. – On bark.
1 loc.: 21.
L. symmicta (Ach.) Ach. – On bark of *Alnus, Fraxinus, Populus, Salix*, on wood,
9 loc.: 1, 4, 6, 7, 15, 16, 19, 21, 22.
L. umbrina (Ach.) A. Massal. – On bark of *Populus*.
5 loc.: 18-21, 26.
L. varia (Ehrh.) Ach. – On wood.
5 loc.: 1, 7, 21, 24, 26.
Lecidea fuscoatra (L.) Ach. – On boulders.
Loc.: 16, 17, 23, 25.
L. nylanderi (Anzi) Th. Fr. – On bark of *Alnus* and *Pinus*.
Loc.: 16.
Lecidella carpathica (Fr.) Körb. – On a boulder.
2 loc.: 16, 21.
L. elaeochroma (Ach.) Choisy – On bark of *Acer, Carpinus, Fraxinus, Populus, Salix, Sorbus, Ulmus*.
19 loc.: 1, 3, 4, 6-8, 10-16, 18-21, 23, 24.
L. stigmatea (Ach.) Hertel & Leuckert – On concrete.
5 loc.: 4, 16, 17, 19, 24.
Lepraria eburnea J.R. Laundon – On bark of *Alnus*, on wood and on a boulder.
1 loc.: 16.
L. elobata Tønsberg – On bark of *Alnus, Betula, Carpinus, Fraxinus, Malus, Padus, Pinus, Pyrus, Salix*, rarely on wood.
2 loc.: 16, 17.
L. incana (L.) Ach. – On bark of *Alnus, Fraxinus, Malus, Padus, Picea, Pinus, Salix*, rarely on wood.
2 loc.: 16, 17.
L. jackii Tønsberg – On bark of *Alnus, Betula* and *Pinus*.
1 loc.: 16.
L. lobificans Nyl. – On bark of *Alnus, Carpinus, Fraxinus, Malus* and *Salix*, on a boulder, wood and on soil.
2 loc.: 16, 17.
L. neglecta (Nyl.) Erichsen – On boulders and on bark of *Alnus*.
2 loc.: 17, 23.
L. rigidula (B. de Lesd.) Tønsberg – On bark of *Alnus*.
1 oc.: 16.
L. vouauxii (Hue) R.C. Harris – On bark of *Alnus* and *Salix*.
2 loc.: 16, 18.
Leptogium biatorinum (Nyl.) Leight. – On soil.
1 loc.: 20.

L. lichenoides (L.) Zahlbr. – On boulders in a river.
1 loc.: 17.

**Licea parasitica* (Zukal) Martin – On thalli of *Candelariella xanthostigma* and *Physconia perisidiosa*.
1 loc.: 16.

**Lichenoconium erodens* M.S. Christ. & D. Hawksw. in D. Hawksw. – On thalli of *Hypogymnia physodes, Lecanora carpinea, L. conizaeoides* and *Parmeliopsis ambigua*.
2 loc.: 16, 17.

**L. lecanorae* (Jaap) D. Hawksw. – On apothecia of *Lecanora carpinea, L. chlarotera* and *L. conizaeoides*.
2 loc.: 16, 17.

**L. pyxidatae* (Oudem.) Petr. & Syd. – On thalli of *Cladonia fimbriata*.
1 loc.: 16.

**L. xanthoriae* M.S. Christ. – On apothecia of *Xanthoria polycarpa*.
1 loc.: 16.

Melanelia elegantula (Zahlbr.) Essl. – On bark.
2 loc.: 18, 19.

M. exasperatula (Nyl.) Essl. – On bark of *Acer, Fraxinus, Malus, Populus, Quercus, Salix, Sorbus, Syringa, Tilia*, rarely on wood and on boulders.
21 loc.: 1-5, 7-10, 12-22, 24.

M. fuliginosa (Fr. ex Duby) Essl. – On bark of *Acer, Alnus, Betula, Carpinus, Fraxinus, Malus, Padus, Populus, Pyrus, Quercus, Salix, Sorbus, Tilia, Ulmus*, rarely on wood.
11 loc.: 2, 6-8, 11, 12, 14, 16-18, 21.

M. sorediosa (Almb.) Essl. – On boulders.
4 loc.: 4, 5, 17, 26.

M. subargentifera (Nyl.) Essl. – On bark.
2 loc.: 19, 20.

Micarea denigrata (Fr.) Hedl. – On wood and on bark of *Alnus* and *Betula*.
12 loc.: 1, 5, 7, 12, 15-19, 21, 24, 26.

M. prasina Fr. – On bark of *Alnus, Betula, Fraxinus, Padus, Picea* and *Pinus*.
2 loc.: 16, 17.

Mycobilimbia tetramera (De Not.) Vitik., Ahti, Kuusinen, Lommi & T. Ulvinen ex Hafellner & Türk – On concrete.
1 loc.: 19.

Mycoblastus fucatus (Stirt.) Zahlbr. – On bark of *Alnus, Betula, Fraxinus, Padus, Populus* and *Ulmus*.
3 loc.: 7, 8, 16.

Myxobilimbia sabuletorum (Schreb.) Hafellner – On soil in a thermophilous sward.
1 loc.: 1.

Neofuscelia loxodes (Nyl.) Essl. – On boulders.
18 loc.: 1, 3-5, 7, 8, 12, 15-17, 19, 21-27.
N. pulla (Ach.) Essl. – On boulders.
8 loc.: 1, 5, 17, 19, 22, 23, 26, 27.
N. verruculifera (Nyl.) Essl. – On boulders.
1 loc.: 17.
Ochrolechia androgyna (Hoffm.) Arnold – On bark of *Alnus*.
1 loc.: 17.
Opegrapha atra Pers. – On bark of *Fraxinus*.
1 loc.: 16.
O. rufescens Pers. – On bark of *Carpinus* and *Fraxinus*.
2 loc.: 16, 18.
O. varia Pers. – On bark.
1 loc.: 18.
Pachyphiale fagicola (Hepp in Arnold) Zwackh – On bark of *Fraxinus* and *Salix*.
1 loc.: 16.
Parmelia saxatilis (L.) Ach. – On boulders.
4 loc.: 1, 15, 17, 25.
P. sulcata Taylor – On bark of *Acer, Alnus, Betula, Carpinus, Euonymus, Fraxinus, Malus, Padus, Populus, Pyrus, Quercus, Salix, Sorbus, Syringa, Tilia, Ulmus*, on wood, in exceptional cases on boulders.
24 loc.: 1-9, 11-24, 26.
Parmelina tiliacea (Hoffm.) Hale – On bark.
1 loc.: 18.
Parmeliopsis ambigua (Wulfen in Jacq.) Nyl. – On bark of *Acer, Alnus, Betula, Fraxinus, Pinus, Tilia*, rarely on wood.
8 loc.: 7-9, 12, 14, 16, 17, 21.
Peltigera didactyla (With.) J.R. Laundon – On soil.
2 loc.: 20, 26.
P. membranacea (Ach.) Nyl. – On soil.
1 loc.: 17.
P. neckeri Hepp ex Müll. Arg. – On soil and on mosses covering concrete and wood.
3 loc.: 4, 7, 16.
P. polydactylon (Neck.) Hoffm. – On a log.
3 loc.: 4, 16, 23.
P. praetextata (Flörke ex Sommerf.) Zopf – On wood and logs, and also on boulders covered by mosses.
3 loc.: 16, 17, 23.
P. rufescens (Weiss) Humb. – On soil.
9 loc.: 1, 4, 6, 7, 11, 16, 17, 23, 26.

Pertusaria albescens (Huds.) Choisy & Werner in Werner – On bark.
1 loc.: 18.
P. amara (Ach.) Nyl. – On bark of *Alnus* and *Fraxinus*.
4 loc.: 14, 16, 18, 19.
P. corallina (L.) Arnold –On a boulder.
1 loc.: 1.
P. leioplaca DC. in Lam. & DC. – On bark of *Carpinus*,
1 loc.: 7.
P. pupillaris (Nyl.) Th. Fr. – On bark of *Carpinus*.
1 loc.: 16.
Phaeophyscia nigricans (Flörke) Moberg – On concrete, on dry shoots of *Artemisia* and on bark of *Salix*.
11 loc.: 4, 6, 15, 16, 19-24, 26.
Ph. orbicularis (Neck.) Moberg – On bark of *Acer, Fraxinus, Populus, Salix, Tilia*, on wood, boulders and on concrete.
17 loc.: 1-4, 6-8, 10, 13, 15, 16, 19-21, 23, 24, 26.
Ph. sciastra (Ach.) Moberg – On concrete.
1 loc.: 19.
Phlyctis argena (Ach.) Flot. – On bark of *Acer, Alnus, Betula, Carpinus, Fraxinus, Malus, Padus, Populus, Pyrus, Salix, Tilia, Ulmus*.
17 loc.: 1, 4-8, 10, 14, 16, 17-19, 21-24, 26.
Physcia adscendens (Fr.) Olivier – On bark of *Acer, Betula, Euonymus, Fraxinus, Populus, Quercus, Salix, Sorbus, Tilia, Ulmus*, rarely on boulders.
22 loc.: 1-4, 6, 8, 10-24, 26.
Ph. caesia (Hoffm.) Fürnrohr – On boulders.
13 loc.: 1, 2, 4, 6, 8, 11, 18-22, 25, 26.
Ph. dubia (Hoffm.) Lettau – On boulders, in exceptional cases on bark of *Acer*.
16 loc.: 1, 2, 4-8, 12, 14, 17-20, 22, 23, 26.
Ph. stellaris (L.) Nyl. – On bark of *Fraxinus, Populus, Quercus, Salix, Sorbus, Syringa*, in an exceptional case on a boulder.
17 loc.: 1, 2, 4-6, 9-13, 15, 16, 18, 19, 21, 23, 24.
Ph. tenella (Scop.) DC. in Lam. & DC. – On bark of *Acer, Alnus, Betula, Carpinus, Fraxinus, Malus, Populus, Quercus, Salix, Sorbus, Syringa, Tilia, Ulmus*, rarely on boulders, concrete and on wood.
19 loc.: 1, 2 (c.ap.), 3, 5-8, 11-13, 15, 16, 18, 19, 21-24, 26.
Physconia distorta (With.) J.R. Laundon – On bark.
1 loc.: 24.
Ph. enteroxantha (Nyl.) Poelt – On bark of *Acer, Fraxinus, Salix*, in an exceptional case on a boulder.
11 loc.: 6-8, 10, 16, 18-22, 24.

Ph. grisea (Lam.) Poelt – On bark of *Populus*.
1 loc.: 4.
Ph. perisidiosa (Erichsen) Moberg – On bark of *Fraxinus* and *Salix*.
2 loc.: 16, 18.
Placynthiella dasaea (Stirt.) Tønsberg – On wood, soil and on bark of *Betula*.
2 loc.: 16, 17.
P. icmalea (Ach.) Coppins & P. James – On wood and bark of *Betula*.
3 loc.: 16, 17, 19.
P. uliginosa (Schrad.) Coppins & P. James – On wood.
4 loc.: 4, 5, 12, 17.
Platismatia glauca (L.) W.L. Culb. & C.F. Culb. – On bark of *Alnus, Betula, Fraxinus, Pinus, Populus, Tilia*, on wood.
8 loc.: 4, 7-9, 14, 16, 17, 19.
Pleurosticta acetabulum (Neck.) Elix & Lumbsch – On bark of *Acer, Malus, Populus, Salix, Tilia*.
9 loc.: 1, 4, 6, 7, 10, 16, 117, 19, 22.
Porpidia crustulata (Ach.) Hertel & Knoph – On boulders and stones.
6 loc.: 2, 7, 11, 17, 19, 22.
P. glaucophaea (Körb.) Hertel & Knoph –On a boulder.
1 loc.: 17.
P. macrocarpa (DC.) Hertel & A.J. Schwab – On boulders.
1 loc.: 17.
P. soredizodes (Lamy) Schwab –On a boulder.
2 loc.: 7, 11.
P. tuberculosa (Sm.) Hertel & Knoph – On boulders.
4 loc.: 2, 17, 19, 26.
Protoparmelia badia (Hoffm.) Hafellner – On boulders.
5 loc.: 3, 5, 17, 23, 26.
Protoparmeliopsis muralis (Schreb.) Choisy – On boulders.
23 loc.: 1-8, 11, 12, 14-19, 21-27.
Pseudevernia furfuracea (L.) Zopf – On bark of *Alnus, Betula, Fraxinus, Pinus, Populus, Salix*, rarely on a boulder.
9 loc.: 3-5, 9, 14, 16, 17, 19, 21.
Pseudosagedia aenea (Wallr.) Zahlbr. – On bark of *Alnus, Carpinus, Fraxinus, Tilia*.
3 loc.: 7, 16, 17.
P. chlorotica (Ach.) Hafellner & Kalb – On a shaded stone.
2 loc.: 7, 16.
**Pycnidiella resinae* (Fr. ex Fr.) Höhnel (anamorf **Sarea resinae* (Fr. ex Fr.) Kuntze) – On congealed spruce resin.
4 loc.: 9, 12, 14, 16.

Pycnora sorophora (Vain.) Hafellner – On wood.
1 loc.: 17.
Ramalina farinacea (L.) Ach. – On bark of *Acer, Alnus, Fraxinus, Populus, Quercus, Salix*, on wood.
11 loc.: 4, 7, 10, 12-16, 18, 19, 23.
R. fastigiata (Pers.) Ach. – On bark of *Acer, Alnus, Populus, Salix*.
6 loc.: 4, 6, 7, 10, 14, 23.
R. fraxinea (L.) Ach. – On bark of *Acer, Fraxinus, Populus*, *Salix, Tilia*.
16 loc.: 2, 4, 6-9, 11, 14, 16, 18-24.
R. pollinaria (Westr.) Ach. – On bark of *Sorbus*.
2 loc.: 17, 18.
Rhizocarpon distinctum Th. Fr. – On boulders.
3 loc.: 17, 24, 26.
Rh. geographicum (L.) DC. – On boulders.
5 loc.: 5, 7, 17, 25, 26.
Rh. lecanorinum Anders – On boulders.
1 loc.: 17.
Rh. obscuratum (Ach.) A. Massal. – On boulders.
3 loc.: 16, 17, 23.
Rh. polycarpum (Hepp) Th. Fr. – On boulders.
1 loc.: 17.
Rh. reductum Th. Fr. – On boulders.
1 loc.: 17.
Rh. sp. – On boulders.
4 loc.: 1, 3, 4, 8.
Rinodina colobina (Ach.) Th. Fr. – On bark of *Fraxinus*.
1 loc.: 19.
R. pyrina (Ach.) Arnold – On bark.
4 loc.: 18, 20, 21, 23.
Ropalospora viridis (Tønsberg) Tønsberg – On bark of *Alnus, Carpinus* and *Populus*.
2 loc.: 4, 16.
Sarcogyne regularis Körb. – On boulders, stones and on concrete.
5 loc.: 5, 6, 8, 19, 26.
Sclerophora nivea (Hoffm.) Tibell – On bark of *Fraxinus*.
1 loc.: 18.
Scoliciosporum chlorococcum (Graeve ex Stenham.) Vězda – On bark of *Alnus, Betula, Fraxinus, Picea*.
5 loc.: 1, 5, 16, 17, 18, 21.
S. umbrinum (Ach.) Arnold – On boulders.
9 loc.: 1, 3, 5, 12, 14, 17, 21, 24, 26.

**Sphaerellothecium propinquellum* (Nyl.) Cl. Roux & Triebel – On apothecia of *Lecanora carpinea*.
1 loc.: 16.
Staurothele ambrosiana (A. Massal.) Zschacke – On a boulder.
1 loc.: 21.
Stereocaulon paschale (L.) Hoffm. – On a boulder.
1 loc.: 23.
S. taeniarum (H. Magn.) Kivistö – On a boulder.
1 loc.: 17.
Strangospora moriformis (Ach.) Stein – On wood.
1 loc.: 16.
**Taeniolella punctata* M.S. Christ. & D. Hawksw. – On a thallus of *Graphis scripta*.
1 loc.: 16.
Tephromela atra (Huds.) Hafellner in Kalb – On boulders.
9 loc.: 1, 4, 5, 7, 15, 17, 19, 24, 26.
T. grumosa (Pers.) Hafellner in Kalb – On boulders.
1 loc.: 17.
Thelocarpon laureri (Flot.) Nyl. –On a small stone.
3 loc.: 14, 21, 25.
Thelomma ocellatum (Körb.) Tibell – On wood.
3 loc.: 1, 14, 23.
Trapelia coarctata (Sm.) Choisy in Werner – On small stones.
1 loc.: 1.
T. obtegens (Th. Fr.) Hertel – On boulders.
6 loc.: 1, 4, 5, 12, 19, 21.
T. placodioides Coppins & P. James – On boulders.
3 loc.: 4, 5, 16.
Trapeliopsis flexuosa (Fr.) Coppins & P. James – On wood and on bark of *Alnus* and *Padus*.
8 loc.: 1, 4, 5, 7, 16, 17, 19, 21.
T. granulosa (Hoffm.) Lumbsch – On wood.
2 loc.: 9, 16.
**Tremella lichenicola* Diederich – On a thallus of *Mycoblastus fucatus*.
1 loc.: 16.
Umbilicaria deusta (L.) Baumg. – On boulders.
1 loc.: 17.
U. polyphylla (L.) Baumg. – On boulders.
1 loc.: 17.
Usnea hirta (L.) Weber ex F.H. Wigg. – On wood and on bark of *Salix*.
3 loc.: 1, 6, 16.

Verrucaria hydrela Ach. – On a stone in a stream.
1 loc.: 16.
V. muralis Ach. – On concrete.
2 loc.: 19-21.
V. nigrescens Pers. – On concrete.
2 loc.: 19-21.
V. sp. – On concrete and stones.
6 loc.: 4, 5, 8, 11, 16, 17.
**Vouauxiella lichenicola* (Lindsay) Petr. & Syd. – On a thallus of *Lecanora pulicaris*.
1 loc.: 16.
Vulpicida pinastri (Scop.) J.-E. Mattsson et M.J. Lai – On bark of *Alnus, Betula* and *Pinus*, and on wood.
6 loc.: 7, 9, 14, 16, 17, 26.
Xanthoparmelia conspersa (Ach.) Hale – On boulders, in exceptional cases on wood and on bark of *Alnus*.
18 loc.: 1-5, 7, 8, 12, 15-17, 19, 22-27.
X. somloensis (Gyeln.) Hale – On boulders.
3 loc.: 4, 12, 24.
Xanthoria candelaria (L.) Th. Fr. – On bark of *Tilia*.
5 loc.: 1, 2, 18, 22, 24.
X. elegans (Link.) Th. Fr. – On a boulder and on concrete.
6 loc.: 4, 16, 19, 20, 22, 24.
X. fallax (Hepp) Arnold – On bark of *Fraxinus*.
1 loc.: 18.
X. fulva (Hoffm.) Poelt & Petutschnig – On bark of *Fraxinus*.
1 loc.: 18.
X. parietina (L.) Th. Fr. – On bark of *Acer, Euonymus, Fraxinus, Populus, Quercus, Salix, Sorbus*, rarely on boulders and on concrete.
23 loc.: 1-16, 18-20, 22-24, 26.
X. polycarpa (Hoffm.) Rieber – On bark of *Acer, Alnus, Betula, Carpinus, Euonymus, Frangula, Fraxinus, Populus, Quercus, Salix, Sambucus, Sorbus, Syringa, Tilia, Ulmus*, on twigs of *Rubus*, in exceptional cases on dry shoots of *Artemisia*, and on wood and boulders.
24 loc.: 1-8, 10-24, 26.
**Xanthoriicola physciae* (Kalchbr.) D. Hawksw. – On apothecia of *Xanthoria parietina*.
1 loc.: 16.

5. Summary

Agricultural landscape of Suwalski Landscape Park with scatterred small fragments of forests mightly transformed by man, seemingly do not create suitable conditions for great differentiation of a lichen biota. In the area of ca 6000 ha, as much as 231 species have been identified. So great diversity is possible particularly thanks to especially large accumulation of erratics and clean air in this region and also owing to significant differentiation of habitats and substrata available to lichens.

The lichen biota of the studied area is characterised by exceptionally large contribution of epilithic species (102), very small – of terricolous (20 only) and proportionally small patricipation of epilithic ones (123 species). With the greatest frequency, photophilous or tolerant to strong insolation lichens growing on fertile bark of decidous trees or on erratics have been noted.

The most various communities of epiphytic lichens develop on bark of decidous trees growing in moist habitats and along roads (on *Fraxinus excelsior, Alnus glutinosa, Salix* spp. and also on *Populus tremula*). Observer's attention is attracted by quantitative richness of some epiphytic macrolichens that have been already rarely found in Poland such as, e.g. *Anaptychia ciliaris, Pleurosticta acetabulum* as well as species from the genera: *Physconia* and *Ramalina*.

In Suwalski Landscape Park, as much as 36 lichen species protected by law and next 21 – very rare within the country or in the lowland occur (cf. Chapter 3.3.). Considering very strong, anthropogenic transformations of habitats, only two species regarded as bioindicators of lowland old-growth forests: *Chaenotheca brachypoda* and *Pertusaria pupillaris* have been found in few sites in the best preserved pieces of forests.

Exceptionally interesting appears the biota of lichenicolous fungi. In Suwalski Landscape Park, the first in Poland localities of *Claussenomyces olivaceus, Lawalreea lecanorae* and *Taeniolella punctata* have been found. Additionally, very rare within the country territory species such as *Sphaerellothecium propinquellum*, *Lichenoconium xanthoriae* and *Tremella lichenicola* have been identified (Jando & Kukwa 2003).

Lichens of the studied area are relatively little threatened in comparison with other regions of Poland. From among all lichens occurring in Suwalski Landscape Park, 70 species (30.3% of the total) are included on „Red List of extinct and threatened lichens in Poland" and only 39 (16.9%) – on „Red List of threatened lichens in North-Eastern Poland" (cf. Table 3). From among 16 species classified in the country range as EN (Endangered), as many as 9 are not included on the regional „red list". Six of them, such as: *Anaptychia ciliaris, Physconia distorta, Ph. perisidiosa, Pleurosticta acetabulum, Ramalina fastigiata* and *R. fraxinea* are synanthropic lichens. They

may be regarded as distinguising species of non-forest areas with very poorly polluted air. In the same group, next four species have been involved, such as: *Melanelia subargentifera, Parmelina tiliacea, Ramalina farinacea* and *R. pollinaria*, which on the Polish red list were categorised as VU (Vulnerable), but have not been specified in the red list of NE Poland. Some other taxa that are not threatened in the southeast Poland and within the country are categorised as EN (*Cetraria sepincola*) or VU (*Acrocordia gemmata, Bacidia rubella, Cetraria chlorophylla*) are classified as apolichens; at present, they are more and more often reported from anthropogenic habitats.

The lichen biota of Suwalski Landscape Park is relatively well preserved in comparison with the whole country. However, it is constantly impacted by anthropopression and the most threatened habitat group is an epilithic one (cf. Chapter 3.4.). The greatest threat to epilithic species is destruction of erratics. Large amounts of boulders are utilised as building material and, unfortunately this practice has become more intense from year to year. In addition, the secondary succession of vegetation surrounding boulders is also dangerous for epilithes. Most of erratics are located on pastures. Deterioration of shepherding causes that abandoned pastures quickly overgrow with high plants.

The most valuable, from a lichenologist's point of view, sites in Suwalski Landscape Park are protected as nature reserves.Three greatest accumulations of erratics are located in reserves:„Głazowisko Bachanowo nad Czarną Hańczą",„Głazowisko Łopuchowskie" and „Rutka", while the best preserved tree stands occur around two lakes: Hańcza and Jaczno; that together with their surroundings are also nature reserves, but Jaczno is a planned one.

6. References

Bajkiewicz-Grabowska E. 1985. Stosunki wodne. – In: Święcicka K. (ed.), Województwo suwalskie, studia i materiały. 1: 119-137. Ośrodek Badań Naukowych, Białystok.

Barkman J.J. 1969. Phytosociology and ecology of cryptogamic epiphytes. – Van Gorcum & Comp., Assen, 628 pp.

Bogacki M. 1985. Budowa geologiczna i ukształtowanie powierzchni. – In: Święcicka K. (ed.), Województwo suwalskie, studia i materiały. 1: 11-59. Ośrodek Badań Naukowych, Białystok.

Brown D.H. 1992. Impact of agriculture on bryophytes and lichens. – In: Bates J. W. & Farmer A.M. (eds.), Bryophytes and Lichens in a Changing Environment. Clarendon Press, Oxford, pp. 259-283.

Brown D.H. 1996. Urban, industrial and agricultural effects on lichens. – In: Frankland J.C., Magan N. & Gadd G.M.(eds.), Fungi and environmental change. Cambridge University Press, pp. 257-281.

Brzozowski J. 1995. Pradzieje. – In: Kopciał J. (ed.), Województwo suwalskie: przeszłość, teraźniejszość, perspektywy. Wyd. Hańcza, Suwałki, p. 56-64.

Cieśliński S. 2003a. Atlas rozmieszczenia porostów (Lichenes) w Polsce północno-wschodniej. – Phytocoenosis 15 (N.S.), Suppl. Cartographiae Geobotanicae 15: 1-430.

Cieśliński S. 2003b. Czerwona lista porostów zagrożonych w Północno-Wschodniej Polsce. – Monographiae Botanicae 91: 91-106.

Cieśliński S. & Czyżewska K. 1992. Problemy zagrożenia porostów w Polsce. – Wiadomości Botaniczne 36.1-2: 5-17.

Cieśliński S., Czyżewska K. & Fabiszewski J. 1986. Czerwona lista porostów zagrożonych w Polsce. – In: Zarzycki, K. & Wojewoda, W. (ed.), Czerwona lista roślin zagrożonych w Polsce. PWN, Warszawa: 82-107.

Cieśliński S., Czyżewska K. & Fabiszewski J. 1992. Czerwona lista porostów wymarłych i zagrożonych w Polsce. – In: Zarzycki K., Wojewoda W., Heinrich Z. (ed.). Lista roślin zagrożonych w Polsce (wyd. 2). Instytut Botaniki im. W. Szafera, PAN, Kraków: 57-74.

Cieśliński S., Czyżewska K. & Fabiszewski J. 2003. Czerwona lista porostów wymarłych i zagrożonych w Polsce. – Monographiae Botanicae 91: 13-49.

Cieśliński S. & Fałtynowicz W. 1993. From editors. – In: Cieśliński S. & Fałtynowicz W. (ed.), Atlas of the geographical distribution of lichens in Poland. 1. W. Szafer Institute of Botany, Polish Academy of Sciences, Krakow, p. 7-9.

Cieśliński S. & Tobolewski Z. 1989. Porosty Polski północno-wschodniej. I. – Acta Mycol. 25.1: 57-100.

Czernicka-Chodkowska D. 1977-1983. Głazy narzutowe w Polsce. Katalog. –

Wydawnictwa Geologiczne, Warszawa: I i II (1977), III (1980), IV (1983).
Czyżewska K. 1976. Dissapearance of epiphytic lichens under the influence of antropogenic degenerations of broadleaved forests in the Pilicka Forest complex. – Phytocoenosis 5.3-4: 363-375.
Czyżewska K. & Cieśliński S. 2003. Porosty – wskaźniki niżowych lasów puszczańskich. –Monographiae Botanicae 91: 223-239.
Degórski M. 1984. Porównanie stopnia kontynentalizmu w Polsce określonego metodami klimatologiczną i bioindykacyjną. – Przegląd Geograficzny 56.3-4: 55-71.
Dietrich M. & Scheidegger C. 1996. The importance of sorediate crustose lichens in the epiphytic lichen flora of the Swiss Plateau and the Pre-Alps. – Lichenologist 28.3: 245-256.
Fabiszewski J., Brej T. & Bielecki K. 1983. Fitoindykacja wpływu huty miedzi na środowisko biologiczne. – Prace Wrocławskiego Towarzystwa Naukowego, B 207: 5-109.
Fałtynowicz W. 1981. *Umbilicaria deusta* (L.) Baumg. i *Collema flaccidum* (Ach.) Ach. na Suwalszczyźnie. – Fragm. Flor. Geobot. 27.3: 523-525.
Fałtynowicz W. 1992. The lichens of Western Pomerania. An ecogeographical study. – Polish Bot. Studies 4: 1-183.
Fałtynowicz W. 1994: Propozycja klasyfikacji porostów synantropijnych. Wprowadzenie do dyskusji. – Arboretum Bolestraszyce 2: 21–30.
Fałtynowicz W. 1995. Wykorzystanie porostów do oceny zanieczyszczenia powietrza. Zasady, metody, klucze do oznaczania wybranych gatunków. – Fundacja Centrum Edukacji Ekologicznej Wsi, Krosno, 141 pp.
Fałtynowicz W. 1997a. Zagrożenia porostów i problemy ich ochrony. – Przegląd Przyrodniczy 8.3: 35-46.
Fałtynowicz W. 1997b. The lichen flora on the erratic blocks in the Trójmiejski Landscape Park and Kaszubski Landscape Park (northern Poland) – Monogr. Bot. 81: 54 pp. + 8 pp.
Fałtynowicz W. 1999. *Collema flaccidum* (Ach.) Ach. – In: Cieśliński S. & Fałtynowicz W. (eds.), Atlas of geographical distribution of lichens in Poland 2: 13-17. W. Szafer Institute of Botany, Polish Academy of Sciences, Kraków.
Fałtynowicz W. 2003a. The lichens, lichenicolous and allied fungi of Poland – an annotated checklist. – W. Szafer Institute of Botany, Polish Academy of Sciences, Kraków, 435 pp.
Fałtynowicz W. 2003b. Różnorodność gatunkowa – porosty. – In: Andrzejewski R. & Weigle A. (ed.), Różnorodność biologiczna Polski. Narodowa Fundacja Ochrony Środowiska, Warszawa, p. 29-35.
Fałtynowicz W. 2004. Rekolonizacja przez porosty – optymistyczny trend w stanie środowiska. – In: Kejna M. & Uscka J. (eds.), Zintegrowany Monitoring

Środowiska Przyrodniczego: Funkcjonowanie i monitoring geoekosystemów w warunkach narastającej antropopresji. Biblioteka Monitoringu Środowiska, Wyd. UMK, Toruń, p. 321-325.
Fałtynowicz W. & Tobolewski Z. 1989. The lichenized *Ascomycotina* (*Ascomycetes lichenisati*) of the Kashuby Lake District in northern Poland. – Fragm. Flor. Geobot. 34.3-4: 445-521.
Ferry B.W. & Lodge E. 1996. Distribution and succession of lichens associated with *Prunus spinosa* at Dungeness, England. – Lichenologist 28.2: 129-143.
Halonen P., Hyvarinen M. & Kauppi M. 1991. The epiphytic lichen flora on conifers in relation to climate in the Finnish middle boreal subzone. – Lichenologist 23.1: 61-72.
Hawksworth D.L. & Rose F. 1976. Lichens as pollution monitors. – Edward Arnold Ltd., London, 60 pp.
Herzig R. & Urech M. 1991. Flechten als Bioindikatoren. – Bibliotheca Lichenologica 43: 1-83.
Hillbricht-Ilkowska A. & Wiśniewski R.J. (ed.) 1994. Lakes of the Suwałki Landscape Park. – PAN, Komitet Naukowy "Człowiek i Środowisko", Zeszyty Naukowe 7: 7-281.
Jacobsen P. 1992. Flechten in Schleswig-Holstein: Bestand, Gefährderung und Bedeutung als Bioindikatoren. – Mitteilungen der Arbeitsgemeinschaft Geobotanik in Schleswig-Holstein und Hamburg 42: 1-234.
Jando K. & Kukwa M. 2003. Porosty, grzyby naporostowe i nażywiczne projektowanego rezerwatu „Wiszące torfowiska nad jeziorem Jaczno" oraz terenów przyległych do jeziora Jaczno w Suwalskim Parku Krajobrazowym (Północno-Wschodnia Polska). – Parki nar. Rez. przyr. 22.1: 3-17.
Karczmarz K., Mickiewicz J. & Olech M. 1988. Epilityczna flora głazów narzutowych Pojezierza Suwalsko-Augustowskiego i Wysoczyzny Siedleckiej. – Ochr. Przyr. 46: 121-158.
Kawecka A. 1991. Rośliny chronione, rzadkie i zagrożone w Suwalskim Parku Krajobrazowym i na terenach przyległych. – Parki nar. Rez. przyr. 10.3-4: 93-109.
Kiszka J. 1995. Epifityczne porosty ogrodów podworskich jako wskaźniki ekologicznej jakości środowiska naturalnego. – Arboretum Bolestraszyce 3: 59-71.
Kondracki J. 1972. Polska północno-wschodnia. – PWN, Warszawa, 272 pp.
Kondracki J. 1998. Geografia fizyczna Polski. – PWN, Warszawa.
Kukwa M. & Fałtynowicz W. 2002. Porosty rezerwatu „Głazowisko Bachanowo nad Czarną Hańczą" i przyległego lasu łęgowego w Suwalskim Parku Krajobrazowym. – Parki nar. Rez. przyr. 21.4: 375-384.
Kuusinen M. 1996. Epiphyte flora and diversity on basal trunks of six old-growth forest tree species in southern and middle boreal Finland. – Lichenologist 28.5: 443- 463.

Litterski B. 1999. Pflanzengeographische und ökologische Bewertung der Flechtenflora Mecklenburg-Vorpommerns. – Dissertationes Botanicae (Berlin-Stuttgart) 307: 1-397.
Matuszkiewicz W. 1991. Szata roślinna. – In: Starkel L. (ed.), Geografia Polski. Środowisko przyrodnicze. PWN, Warszawa, s. 445-494.
Mirek Z., Piękoś-Mirkowa H., Zając A. & Zając M. 2003. Flowering plants and pteridophytes of Poland. A checklist. – W. Szafer Institute of Botany, Polish Academy of Sciences, Kraków.
Motiejûnaitë J. 1999. Checklist of lichens and allied fungi of Lithuania. – Botanica Lithuanica 5.3: 251-269.
Motiejûnaitë J. & Fałtynowicz W. 2004. Diversity of lichens and lichenicolous fungi along the planned highway Via Baltica at the Polish-Lithuanian state border. – Acta Soc. Bot. Pol., in press.
Nash T.H. & Wirth V. (eds.) 1988. Lichens, bryophytes and air quality. – Bibliotheca Lichenologica 43: 1-297.
Pisut I. 1993. List of extinct, missing and threatened lichens in Slovakia - the second draft. – Biologia (Bratislava) 48.1: 19-26.
Podbielkowski Z. & Tomaszewicz H. 1977. Roślinność jezior Suwalskiego Parku Krajobrazowego. – Monogr. Bot. 55.
Rozporządzenie Ministra Środowiska w sprawie gatunków dziko występujących grzybów objętych ochroną z dn. 09 lipca 2004 r. – Dz.U. 04.168.1765 z dn. 28 lipca 2004 r.
Siebel H.N., Aptroot A., Dirkse G.M., van Dobben H.F., van Melick H.M.H. & Touw A. 1992. Rode Lijst van in Nederland verdwenen en bedreigde mossen en korstmossen. – Gorteria 18: 1-20.
Sokołowski A.W. 1980. Zbiorowiska leśne północno-wschodniej Polski. – Monogr. Bot. 60: 1-205.
Sokołowski A.W. 1973a. Zbiorowiska leśne Suwalskiego Parku Krajobrazowego. – In: Czeczuga B. (red.), Przyroda Białostocczyzny i jej ochrona. Prace Białostockiego Towarzystwa Naukowego 19: 67-83.
Sokołowski A.W. 1973b. Rośliny naczyniowe Suwalskiego Parku Krajobrazowego. – In: Czeczuga B. (red.), Przyroda Białostocczyzny i jej ochrona. Prace Białostockiego Towarzystwa Naukowego 19: 85-101.
Sokołowski A.W. 1984. Zbiorowiska leśne Suwalskiego Parku Krajobrazowego. – In: Czeczuga B. (ed.), Przyroda Białostocczyzny. Prace Białostockiego Towarzystwa Naukowego 19: 67-83.
Sokołowski A.W. & Kawecka A. 1984. Zbiorowiska murawowe Suwalskiego Parku Krajobrazowego. – Fragm. Flor. Geobot. 30: 287-290.
Sokołowski A.W. & Kot J. 1996. Przyroda województwa suwalskiego. – Wyd. Urząd Wojewódzki w Suwałkach, Suwałki, 176 pp.

Stan środowiska w Polsce. 1998. – Biblioteka Monitoringu Środowiska, Warszawa, 174 pp.
Stopa-Boryczka M. & Martyn D. 1985. Klimat. – In: Stasiak A. (ed.), Województwo suwalskie, studia i materiały. 1: 81-118. Ośrodek Badań Naukowych, Białystok.
Strumiłło A. (ed.) 1999. X lat Wigierskiego Parku Narodowego. – Wyd. Wigierski Park Narodowy, Krzywe koło Suwałk, 230 pp.
Szafer W. 1972. Szata roślinna Polski Niżowej. – In: Szafer W. & Zarzycki K. (eds.), Szata roślinna Polski 2: 17-188. PWN, Warszawa.
Tobolewski Z. 1980. Porosty (*Lichenes*). 6. Atlas of geographical distribution of spore-plants in Poland, ser. III. – PWN, Warszawa-Poznań.
Wawrzoniak J., Małachowska J., Solon J., Fałtynowicz W., Sierota Z., Adamski L., Załęski A., Kolk A. & Lech P. 1999. Forest condition in Poland in 1998. – Chief Inspectorate for Environmental Protection, Warszawa, 44 pp.
Zalewska A. 2000. Ekologia porostów Puszczy Boreckiej i jej obrzeży. Studium bioróżnorodności. – PhD dissertation. Warmia and Mazury University, Olsztyn. Mscr.
Zalewska A., Fałtynowicz W., Krzysztofiak A., Krzysztofiak L. & Picińska-Fałtynowicz J. 2004. Lichens of the Romincka Forest. – In: Zalewska A. & Fałtynowicz W. (eds.), Lichens of the protected areas in the Euroregion Niemen. Suwałki.

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Lichens of Romincka Primeval Forest

Anna Zalewska[1], Wiesław Fałtynowicz[2], Anna Krzysztofiak[3], Lech Krzysztofiak[3], Joanna Picińska-Fałtynowicz[4]

[1] Department of Botany and Nature Protection, Warmia and-Mazury University, pl. Łódzki 1, 10-727 Olsztyn, e-mail: annazalw@moskit.uwm.edu.pl;
[2] Department of Systematics and Phytosociology, Wrocław University, ul. Kanonia 6/8, 50-328 Wrocław, e-mail: wiefalty@biol.uni.wroc.pl;
[3] Wigry National Park, Krzywe 82, 16-400 Suwałki, e-mail: krzysztofiak@itm.com.pl;
[4] Institute of Meteorology and Water Management, Wrocław Branch, Laboratory of Water Quality Research, ul. Parkowa 30, 51-616 Wrocław, e-mail: joannapf@wp.pl.

Introduction

The eldest data on lichens of Romincka Primeval Forest originated from nearly 150 years ago and were published by A. Ohlert (1863, 1870, 1871). He recorded several tens of species from the forest and its neighbourhood but without precise localities of the species. A. Ohlert's information was repeated by G. Lettau (1912, 1919) with correction of some identifications and addition of his own materials. For the next several score years botanists have ommitted this region and a new publication on lichens was issued after 70 years. This was an article of S. Cieśliński and Z. Tobolewski (1989) in which the authors summed up the several years study on lichens from the north-eastern Poland that included also the Polish part of Romincka Primeval Forest. Much information on lichens from the Polish part of the Primeval Forest is contained in the monograph of S. Cieśliński (2003a) published lately. This work comprises numerous new data as well as recapitulation of all earlier works. It also describes for the first time lichens from the Russian part of Romincka Primeval Forest (Krasnyj Les) in which nearly 200 species have been found and among them many lichens very rare within the middle Europe scale.

1. Characteristics of the area

Romincka Primeval Forest covers an area of ca 500 km^2. Administratively, nearly 350 km^2 of the area are located in Russia in Kaliningradski District; the closest town is Gusiew (Gąbin, Gumbinnen). Forests belong to Krasnolesje forest division; Krasnolesje village is the largest settlement in the Russian part of the Primeval Forest. The Polish piece of Romincka Primeval Forest is located in Warmia-Mazury voivodship and in Olecko-Gołdap district. Forests are run by Gołdap forest inspectorate. According to J. Kondracki's (1998) physical-geographical division, Romincka Primeval Forest is a macroregion within Lithuanian Lake District Subprovince and East Baltic Lake District Province.

The surface covered by Romincka Primeval Forest was shaped by the last glaciation, thus a considerable part of it is occupied by morainic plateau elevated up to 116 m alt. in the vicinity of Czistyje Prudy village in Kaliningradski District in Russia till 275.4 m alt. at Pobłędzie lake south-eastwards of Żytkiejmy in Poland. Landscape is relieved by postglacial channels, erosion dissections, melt-out hollows, sandr fields, kame hummocks and other lesser geomorphological forms (Bogacki 1985). Particularly attractive are deep erosion dissections with slopes reaching the height even of 40 metres and usually with small rivers or streams of clean water and swift current running along their floors. On the slopes, in many places old trees grow, mainly oaks, i.e. in the neighbourhood of Radużnoje village, while in rivers and streams, boulders and stones of various size creating substrata for several interesting lichen species can be seen.

Romincka Primeval Forest is located in the Baltic catchment basin. Its area is cut by numerous small streams and rivers and the largest one is Krasnaja (Błędzianka) river, which source is located in the vicinity of Maciejowięta village. Within the Primeval Forest area this river has a length ca 30 km and in many places it runs in distinctly marked postglacial channel of a width even to 700 metres. Northwards of Stańczyki and in the neighbourhood of Radużnoje village there are water gaps narrow to tens of metres and with slopes high up to 40 metres. Błędzianka river, via Pisa and Pregoła rivers, flows into Zalew Wiślany lagoon.

Important elements of hydrographic network are lakes. The largest one is Wisztynieckoje lake located on the frontier between Russia and Lithuania, which covers an area of more than 16 km^2 and is deep to 52 metres. The second large lake is Gołdap situated on the Polish-Russian frontier. Most of the water bodies is located in the Russian part of Romincka Primeval Forest, i.e. Czystoje, Marinowo, Kamyszowoje, Protocznoje and Rybnoje lakes, however, in the southern part, noteworthy are also small lakes: Ostrówek and Rakówko located between Gołdapia and Pluszkiejmy.

Collosal importance for water management of this region have drainage

channels and ditches. The basic drainage network was built as early as the end of the XVIIIth century within the programme of regulation of water system in Prussia ordered by the German Emperor Frederick the Great. Drainage works had been continued during the whole XIXth century till the beginning of the XXth century (cf. Piotrowska 1997, p. 37). Later, particularly in the second half of the XXth century, channel network was destroyed or neglected. As a result, the drainage process of Romincka Primeval Forest, especially in its Russian part had been strongly stopped and this has positively influenced ecosystems.

Considering influence of arctic and continental air masses, and relatively great elevation above sea level, the terrain of Romincka Primeval Forest belongs to the coolest ones in comparison with the remaining lowland regions of both Poland and Kaliningradski District. The vegetation season lasts here 160 days only and is shorter of nearly 1.5 month from the vegetation period in the western Poland. Even in nearby situated Piska Primeval Forest, the vegetation season is already longer in 25 days. Winter is severe and long (twice as long as in the western part of Poland), spring – late and cold, and summer – short and torrid. The period without ground frost involved only 140 days. The average year temperature calculated for the climatic station in Gołdapia is ca +6,1°C, and average temperatures for January and July are respectively: -4,2°C and +16,9°C. Extreme temperatures recorded in this region were: +34,5°C and -35,4°C. Snow cover usually lies for 91 days, but during extremely frosty years it could remain even for 160 days. The average annual precipitation is not much than 600 mm (Dubeninki – 578 mm, Gołdap – 645 mm). West, south-west and south-east winds prevail here. More information on climate of the region can be found in publications of J. Kondracki (1972) and M. Stopa-Boryczka and D. Martyn (1985).

The influence of continental climate is distinctly reflected by flora and fauna as well as by plant communities. It is manifested, among others, by exceptionally great participation of boreal and continental species and also by common presence of spruce in majority of forest communities (Steffen 1932, Polakowski 1963, Szafer 1972, Sokołowski 1980, Degórski 1984, Faliński & Tomaszewicz 1985, Matuszkiewicz 1991, Sokołowski & Kot 1996, Sokołow 2002).

Nature of Romincka Primeval Forest, both biotic and abiotic components, has been strongly transformed owing to man economic activities.Vestiges of man activities within the region originated about 8000 years ago, and as early as Neolithic age, the first settlements had been established. In the early Middle Ages, Jaćwings settled in that region and from that time dated vestiges of fortified cities on some hill-tops. Jaćwings had been exterminated in the XIIIth century, but as early as the beginning of the XIVth century recolonisation of that area by settlers from Poland, Lithuania and Preussen started. Colonisation of Romincka Primeval Forest area was stopped several times owing to wars and repeated after they

had been ceased. The end of settlement process took place in the beginning of the XIXth century (Malinowska-Januszkiewicz 2002). One of the more significant impacts of anthropopression was cutting of parts of forests and areas obtained in such a way were transformed into ploughland or meadows. Simultaneously, in retained forest communities participation of deciduous tree species decreased gradually, whereas the share of coniferous trees preferred by foresters, such as spruce and pine increased. Introducing of coniferous monocultures on large areas created good conditions for development of harmful insects, thus during the last 100 years only, at least five great pest gradations occurred, mainly due to *Lymantra monacha* and *Ips typographus*, in result of which hundreds hectars of forests had been damaged. Enormous transformation happened after the end of the 2nd World War. The territory of the Primeval Forest became nearly depopulated. Only few small settlements retained. Fields and meadows overgrew again by forests or were reforested. In the 50ies of the XXth century, in the Russian part of Romincka Primeval Forest, most of old treestands were cut.

Evidence of the recent dense settlement network is scatterred around the whole Primeval Forest and particularly in its Russian part vestiges of buildings ruines. There are hundreds of them. Most frequently, only foundations overgrown by mosses have retained. Such places have been usually occupied by forests, but almost always at least a few plant species planted by man still exist. Most often there are single old trees that in the past shaded farm buildings, mainly shapely maples *Acer platanoides*, more rarely limes *Tilia cordata*, and in more humid places– willows: *Salix fragilis* and *Salix alba*. Frequent are also bushes of *Lonicera*, in many places grows *Sambucus nigra*, branches of which create substrata for several interesting lichen species. Old settlement sites are usually accompanied by *Syringa vulgaris* and *Viola odorata*. Characteristic element of abandoned sites is also aspen *Populus tremula*. When there was lack of man, light-seed aspens very quickly entered abandoned ploughlands and gardens and during tens of years have grown into shapely trees. Their trunks create very convenient substrata for numerous lichen species.

In spite of significant interference of man lasting for hundreds of years, Romincka Primeval Forest has remained as a place of great natural attractiveness. However, the knowledge of organisms occurring here is far insufficient. It refers especially to the Russian part of the Forest. Nevertheless, several early works of German scientists as well as few of Polish and Russian ones give a picture of vegetation and animal world of this region.

In Romincka Primeval Forest, nearly 1000 vascular plant species grow, many of them being very rare and protected in Poland and also in Kaliningradski District. The most interesting are: *Conioselinum tataricum1*, *Carex magellanica*, *C. pauciflora*, *C. chordorrhiza*, *Aconitum variegatum*, *Polemonium caeruleum*, *Allium ursinum*,

Lunaria rediviva, *Drosera rotundifolia*, *Oxycoccus microcarpus* and *Scheuchzeria palustris*. Postglacial relicts occur here as well, i.e. *Betula humilis*, *Rubus chamaemorus* and *Salix myrtilloides*. Noteworthy are profuse populations of *Matteutia struthiopteris*, and also some orchid species, i.e. *Dactylorhiza fuchsii*, *Listera ovata* and *Epipactis helleborine*.

The nature of Romincka Primeval Forest has been deserved in a relatively good status, because as early as the XIII century it has been protected in a peculiar way. After extermination of Jaćwings, i.e. from the XIIIth till the beginning of the XVIth century the area had been hardly inhabited, and thanks to that forests had not been cut. In the mid- XVI century, the Primeval Forest had been owned by Prussian rulers and was used as hunting ground for kings and princes. Till today, in Radużnoje ruines of a hunting mansion of the Emperor William the II have existed. In the period of the Reich, the territory had been used as a representative hunting ground as before. Near Radużnoje village by Krasnaja river, a hunting mansion was built by Herman Göring, the Prime Minister of the Reich.

Nowadays, the whole Romincka Primeval Forest comes within various forms of protection. The Russian part is involved in „Wisztynieckoj zoological reserve", whereas Wisztynieckoje lake together with Krasnaja river constitute hydrological nature monument of Kaliningradski District (Sokołow 2002). In Poland, the area of the Primeval Forest and its fringe are located within the borders of Romincka Primeval Forest Landscape Park. Moreover, five nature reserves that cover an area of ca 840 ha have been established here. There are: „Struga Żytkiejmska" in which, among others, a site of *Betula humilis* is protected, „Czerwona Struga" established for the protection of *Matteutia struthiopteris*, „Dziki Kąt" which protects natural communities of pine-spruce forests, „Boczki" that most of all protects fertile deciduous forests, i.e. dry-ground forests and „Mechacz Wielki" that comprises a large complex of raised bogs and transitional moors with very rare plant species.

Compared with other regions of the country, Romincka Primeval Forest is characterised by particularly weak air pollution (Stan środowiska… 1998, Wawrzoniak et al. 1999). Lichens are regarded as organisms very sensitive to toxic substances and therefore are commonly used as excellent bioindicators of air pollution (Hawksworth & Rose 1976, Nash & Wirth 1988, Herzig & Urech 1991, Kiszka 1995 et al.). Good quality of air in the studied region causes that the lichen biota is especially rich both qualitatively and quantitatively. The presence of more than 600 species (cf. Cieśliński 2003a) distinguishes positively the north-east Poland on the background of the whole middle European Lowland (cf. i.e. Fałtynowicz 1992, Litterski 1999, Motiejûnaitë 1999).

2. Methods and list of localities

2.1. Methods

Information on the lichen biota of Romincka Primeval Forest has been obtained on the basis of 99 localities (Fig. 1). In the Landscape Park of Romincka Primeval Forest, 66 sites have been chosen, and from 39 of them data were collected by the authors of the present study (in 2003), while the remaining 27 were investigated by S. Cieśliński (2003a) (cf. Chapter 2.2). In the Russian part of the Primeval Forest, lichens were researched on 33 sites by the authors exclusively, in 2004.

Material for the study was collected or registered from all available substrata and habitats. Gathered specimens were identified following routine lichenological methods and deposited in herbaria of Warmia and Mazury University in Olsztyn (OLS) and University of Wrocław (WRSL).

Information on threatened and extinct lichen species in Poland has been derived from "Red List of extinct and threatened lichens in Poland" (Cieśliński et al. 2003), whereas of these from the north-east part of the country – from „Red List of threatened lichens in North Eastern Poland" (Cieśliński 2003b). Assessment of anthropogenic changes of the lichen biota was done according to the publications of W. Fałtynowicz (1994) and S. Cieśliński (2003a).

Frequency of lichen species has been evaluated according to the scale prepared by S. Cieśliński (2003a):

I – species occurs at not more than 19.9% of localities;
II – species occurs at 20 to 39.9% of localities;
III – species occurs at 40 to 59.9% of localities;
IV – species occurs at 60 to 79.9% of localities;
V – species occurs at 80 to100% of localities.

Lichen taxa have been named according to W. Fałtynowicz (2003a). In the list of localities from the Polish part of Romincka Primeval Forest, in square brackets numbers of ATPOL squares are specified (cf. Cieśliński & Fałtynowicz 1993).

2.2. List of localities

A/ Romincka Primeval Forest Landscape Park (Poland):

1. Budzie Małe, 1 km to N, the forest section no. 273, [Af86]; riverside carr, alder carr (acc. Cieśliński 2003a);
2. The forest sections no. 252-253, to S of the reserve "Czerwona Struga", [Af86]; dry-ground forest (acc. Cieśliński 2003a);
3. 2.5 km to N of the reserve "Czerwona Struga", [Af86]; dry-ground forest (acc. Cieśliński 2003a);
4. To N of Budzie Małe forester's lodge, [Af86]; alder carr (acc. Cieśliński 2003a);

5. The forest section no. 16, [Af86]; pine plantings, heathland (acc. Cieśliński 2003a);
6. The reserve "Dziki Kąt", [Af86]; pine-spruce forest (acc. Cieśliński 2003a);
7. South margin of the reserve "Żytkiejmska Struga", [Af86]; mixed coniferous forest, spruce-trees (acc. Cieśliński 2003a);
8. East margin of the reserve "Żytkiejmska Struga", [Af86]; riverside carr (acc. Cieśliński 2003a);
9. The forest sections no. 177-178, [Af86]; forest margins, roadside trees (acc. Cieśliński 2003a);
10. The forest sections no. 316-267, [Af86]; pine-spruce forest (acc. Cieśliński 2003a);
11. The forest section no. 88, [Af85]; dry-ground forest (acc. Cieśliński 2003a);
12. The reserve "Boczki", the forest section no. 86, [Af86]; dry-ground forest (acc. Cieśliński 2003a);
13. The forest section no. 91, [Af85]; dry-ground forest (acc. Cieśliński 2003a);
14. The forest section no. 147, [Af86]; ash carr (acc. Cieśliński 2003a);
15. The forest section no. 299, [Af85]; dry-ground forest (acc. Cieśliński 200a3);
16. The forest section no. 161, [Af85]; dry-ground forest, mixed coniferous forest (acc. Cieśliński 2003a);
17. Surroundings of Hajnówek forester's lodge, [Af85] (acc. Cieśliński 2003a);
18. The reserve "Mechacz Wielki", north part, [Af85]; fresh and marshy coniferous forests (acc. Cieśliński 2003a);
19. The forest section no. 304, [Af85]; pine forest (acc. Cieśliński 2003a);
20. Surroundings of Szyliny forester's lodge [Af84] (acc. Cieśliński 2003a);
21. The forest section no. 164, [Af85]; mixed coniferous forest (acc. Cieśliński 2003a);
22. Galwiecie, 1 km to W, [Af85]; dry-ground forest (acc. Cieśliński 2003a);
23. Gołdap, 2 km to N, [Af84]; roadside trees, forest margin (acc. Cieśliński 2003a);
24. The forest sections no. 258-306, [Af87]; dry-ground forest (acc. Cieśliński 2003a);
25. Dubeninki, 0.5 km to N, [Af86]; along a road and in forest margin (acc. Cieśliński 2003a);
26. Dubeninki, W periphery of the village, [Af85]; roadside trees, a concret bridge (acc. Cieśliński 2003a);
27. The forest sections no. 290-209, [Af85]; dry-ground forest (acc. Cieśliński 2003a);
28. Żytkiejmy, 3.5 km to S, the forest section no. 339f (Żytkiejmy Forest District), [Af87]; 16.09.2003; ruins of farm buildings, trees, concrete, brick;
29. The forest section no. 391 (Żytkiejmy Forest District), [Af87]; along a forest road; 16.09.2003; ruins of farm buildings, trees, stony walls;

30. The forest sections no. 392 (392/393, Żytkiejmy Forest District), [Af87]; 16.09.2003; trees in a well illuminated site;
31. Żytkiejmy, 2 km to S, the forest section no. 230a (Żytkiejmy Forest District), [Af87]; 16.09.2003; a fragment of a dry-ground forest with an old tree stand, forest trees and separately growing trees, concrete;
32. Żytkiejmy, 1.5 km to SW; the forest section no. 176/177 (Żytkiejmy Forest District), [Af87]; an old oak lane along a forest road, a fragment of a dry-ground forest; 16, 17. 09.2003;
33. Along a forest road Żytkiejmy-Bludzie, the forest section no. 118/119 (Żytkiejmy Forest District), [Af86]; 17.09.2003; a birch lane and a wooden feeding rack;
34. The reserve „Żytkiejmska Struga", the forest section no. 60, middle part (Żytkiejmy Forest District), [Af86]; 17.09.2003; trees along a forest road, fragments of riverside and alder carrs, a wooden umbrella roof;
35. The reserve„Żytkiejmska Struga", the forest section no. 63 (Żytkiejmy Forest District), [Af86]; 17.09.2003; transformed spruce-forests on peat with great share of pine;
36. By cross-forest roads on a line of forest sections no. 68/69 (Żytkiejmy Forest District), [Af86]; 17.09.2003;old ash trees;
37. Stańczyki, a viaduct and surroundings, [Af87]; 18.09.2003; concrete, stony poles, transformed forest communities in a valley of Błędzianka river;
38. Błąkały, 300-400 m to N, along an asphalt road: Błąkały-Żytkiejmy, [Af87]; 18.09.2003; roadside trees, timber fences, ruins of farm buildings with stony walls, willow trees by Błędzianka river;
39. The forest section no. 374 (Żytkiejmy Forest District), [Af86]; 19.09.2003; young oak plantings on a habitat of dry-ground forest, single old oak trees along a forest road;
40. The forest section no. 115 (Żytkiejmy Forest District), [Af86]; 19.09. 2003; a margin of pine-spruce plantings, lichen-mossy escarpments along a forest road, roadside poles;
41. The foret section no. 246 k (Żytkiejmy Forest District), ca 1 km to N of Dziki forester's lodge, [Af86]; 19.09.2003; a margin of a forest in Błędzianka river valley, ruins of farm buildings, overgrowing meadows, a group of old poplar trees, fragment of a riverside carr;
42. The forest sections no. 184 and 185 (Żytkiejmy Forest District), [Af86]; 19.09.2003; pine and spruce plantings, a fragment of a dried alder carr;
43. Bludzie, 0.5 km to N, [Af86]; 20.09.2003; ruins of farm buildings, old trees along a ground road;
44. The reserve „Żytkiejmska Struga", the forest sections no. 2 and 12 (Żytkiejmy Forest District), [Af86}, near the state frontier, 20.09.2003; pine and spruce plantings, trees along a forest road, trees in a river valley;

45. Surroundings of a bridge over Błędzianka river, a point of junction of forest sections no. 72, 73, 132, 133 (Żytkiejmy Forest District), [Af86}; 20.09.2003; a scarp and trees along a forest road, a concrete bridge, a fragment of a riverside carr;
46. By Bludzia stream, near a line of forest sections 135/136 (Żytkiejmy Forest District), [Af86]; 20.09.2003; trees along a forest road in an exposed site, fragments of well preserved riverside carr with old alder trees;
47. The forest section no. 76 (Żytkiejmy Forest District), [Af86]; 20.09.2003; a lane of old *Quercus rubra* trees with a trunk circumference of 200-300 cm along a forest road;
48. The nature monument „Group of beeches" in a dry-ground forest, the forest section no. 80 (Żytkiejmy Forest District), [Af85]; 20.09.2003; four old trees with a trunk circimference of 200-300 cm and three younger;
49. Dubeninki, part NW, [Af85]; 21.09.2003; a concrete viaduct of an old railway, stony poles along a ground road, single trees;
50. Budwiecie, S margin, [Af85]; 21.09.2003; roadside trees, forest margin (the forest section no. 385, Gołdap Forest District);
51. At the crossing of the forest section line 383/354 (Gołdap Forest District) and a red tourist track, [Af85]; 21.09.2003; old trees along a forest road, plantings of young poplar trees on a riverside carr habitat;
52. The forest sections no. 408/409 (Gołdap Forest District), [Af85]; 21.09.2003; degenerate tree stands on dry-ground forests habitats, young plantings of oak, birch and spruce trees;
53. Markowo, 1 km to NE; the forest section line 322/323 (Gołdap Forest District), [Af86]; 21.09.2003. an inner-forest gravel-pit, scarps along a forest road, fragments of plantings of oak, spruce and pine trees;
54. At the crossing of the forest section line 281/282 (Gołdap Forest District) and a forest road, by a stream, [Af85]; 21.09.2003; fragments of a riverside carr with old poplar trees;
55. Boczki, 1.5 km to NE, section 285 [Af85]; 21.09.2003. forest communities with *Fraxinus, Quercus* and *Picea* on dry-ground forest habitat; a fragment of alder carr;
56. Boczki forester's lodge, 0,5 km of S, at a road between the villages Boczki and Budwiecie [Af85]; 21.09.2003; a lane of roadside poplars, ruins of farm buildings surrounded by ploughlands;
57. Pluszkiejmy, N margin of a village, at a viaduct of an old railway [Af85]; 22.09.2003; a concrete viaduct, single trees, stones, gravel-pit;
58. Pluszkiejmy, 2 km to N, Czarnówko settlement [Af85]; 22.09.2003; ruins of farm buildings;
59. The forest section line 153/154 [Af85]; 22.09.2003; forest margin, disfigured phytocoenoses of riverside carr and dry-ground-forest, a fragment of spruce planting;

60. Hajnówek forester's lodge, 1 km to NE; the forest section no. 36 [Af85]; 22.09.2003; a fragment of an old tree stand (ca 120 years old) on a dry-ground forest habitat;
61. Hajnówek forester's lodge, 2 km to NW, the forest section no. 43, southwards of Czarna stream [Af85]; 22.09.2003; disfigured dry-ground forests with young tree stands;
62. The line between forest sections no. 45/46 [Af85]; 23.09.2003; a lane of old oaks (*Quercus robur*) and surroundings;
63. Jurkiszki, 2 km to NE, the forest section no. 223 [Af85]; 24.09.2003; an oak lane (*Quercus robur* and few *Q. rubra*) along a road towards the state frontier;
64. The forest sections no. 48 and 51 [Af85]; 24.09.2003; ca 50 years old oak plantings;
65. The forest section no. 51 [Af85]; 24.09.2003; 50 years old oak plantings;
66. The forest section no. 109; ruins of farm buildings [Af85]; 24.09.2003; singly growing trees, concrete, stones.

Localities of *Lobaria pulmonaria* found by Andrzej Ryś, to whom the authors are deeply grateful for rendering his unpublished data, are described in a separate manner.

B/ Wisztynieckoje Protected Area (Russia):

1. Jagodnoje, 3 km to SE, neighbourhood of a touristic base at Wisztynieckoje lake; 21.04.2004; pine plantings on formerly arable grounds, dry-ground forest, ruins of farm buildings.
2. Jagodnoje, 3 km to S, 21.04.2004; trees along an asphalt road, ruins of farm buildings.
3. Jagodnoje, 6 km to S, along a ground road towards Czystoje lake; 21.04.2004; a lane of old ash trees, riverside carr.
4. Neighbourhood of Czystoje lake, 2.5 km to SE far from the locality no. 3, 21.04.2004; ruins of farm buildings; old roadside trees.
5. Jagodnoje, 4.5 km to S, surroundings of a parking at Wisztynieckoje lake; 21.04.2004; ruins of farm buildings, singly growing trees.
6. Uwarowo, 500 m to E; 22.09.2004; ruins of farm buildings, degenerate forest on grounds formerly arable, roadside birches along an asphalt road.
7. Borowikowo, 0.5-1 km to N from the village, along an asphalt road: Uwarowo-Lesistoje; 22.04.2004; pine-spruce plantings on a dry-ground forest habitat, roadside trees.
8. Lesistoje, 0.3-1 km to W, along a ground road: Lesistoje-Pugaczewo; 22.04.2004; a lane of old trees among ploughlands, boulders on a pasture, well preserved dry-ground forests with old oaks and hornbeams.

9. Pugaczewo, 1.5 km to E of Lesistoje; 22.04.2004; well preserved dry-ground forest with old hornbeams and oaks, ruins of farm buildings; roadside trees along a ground road.
10. Pugaczewo, 1.5 km to NE, at an asphalt road: Pugaczewo–Kalinino; 22.04.2004; a viaduct of an old railway line (a boulder wall, concrete), lanes of roadside trees.
11. Lesistoje, 2 km to E, a road towards Wisztynieckoje lake; 22.04.2004; inner-ploughland lane of very old lime trees, ruins of farm buildings; a lane of old oaks along a forest road.
12. Lesistoje, 3.5 km to E towards Wisztynieckoje lake; 22.04.2004; woodland glade with ruins of farm buildings; oaks by a forest road.
13. Pugaczewo, 1 km to SW; 23.04.2004; ruins of farm buildings, remains of an old cemetery, trees along a ground road.
14. 1.5 km to S of a touristic base at Marinowo lake; 23.04.2004; riverside carr and dry-ground forest, gravel-pit.
15. Radużnoje, 3.5 km to NNW, neighbourhood of a crossing of forest roads towards villages Pugaczewo, Krasnolesje and Radużnoje; 23.04.2004; old oaks by a forest road, dry-ground forest on a scarp, riverside carr by Krasnaja river.
16. 4 km to W of the locality no. 15; 23.04.2004; trees along forest ground road; ruins of farm buildings in a young forest on a habitat of dry-ground forest, high escarpment of a valley of Krasnaja river with very old oaks, remains of a wooden bridge over the river.
17. Dmitryjewka, 0.5 km to S, neighbourhood of Tokariewskoje forester's lodge, on a forest margin, 23.04.2004; remains of a park with monumental beeches, ruins of farm buildings; large gravel-pit; trees growing separately along a country road.
18. 3 km to E of the locality 14, a road on the forest section line 29/36; 23.04.2004; tree stand dominated by *Quercus rubra*, on a habitat of dry-ground forest; moist hollow with birch and spruce trees.
19. Surroundings of Wisztynieckoje lake, 1.5 km to E of an asphalt road: Jagodnoje–Uwarowo; 24.04.2004; riverside carr and dry-ground forest.
20. At the shore of Wisztynieckoje lake, 1.7 km to SE of the locality no. 19; 24.04.2004; ruins of farm buildings and singly growing old trees round them.
21. At the shore of Wisztynieckoje lake, 1-1.3 km to SE of the locality no. 20; 24.04.2004;riverside carr, ruins of farm buildings, old roadside willows.
22. 1 km to W of the locality no. 3; 24.04.2004; degenerate dry-ground forest, ruins of railway station.
23. Radużnoje, 2 km to NNW; 25.04.2004; degenerate dry-ground forest on a scarp near Goering's hunting house.
24. Radużnoje; 25.04.2004; dry-ground forest, lanes of roadside trees, ruins of a hunting manor house.

25. Jagodnoje, 4 km to W; 25.04.2004; roadside trees among ploughlands and pastures.
26. Jagodnoje, 1 km to W; 25.04.2004; ruins of farm buildings; gravel-pit, riverside carr.
27. Radużnoje, 3 km to NNE; 26.04.2004; degenerate dry-ground forest with young tree stand.
28. Radużnoje, 2 km to NE; 26.04.2004;dry-ground forest;
29. Pugaczewo, 3 km to W; 26.04.2004; woodland glade with old oaks.
30. Tokariewka, by Krasnaja river; 26.04.2004; a tree lane, riverside carr.
31. Krasnolesje, 1.5 km to NNW; 26.04.2004; a lane of roadside maple trees.
32. Krasnolesje, 2.5 km to SWW; 26.04.2004; woodland glade, single trees, boulders.
33. Krasnolesje, 3.5 km to E, by Krasnaja river; 26.04.2004; riverside carr, dry-ground forest, trees along a forest road

3. Results

3.1. General characteristics of the lichen biota

Until now, within the area of Romincka Primeval Forest 275 lichen species have been recorded, and in the Polish part 241species occur, while in the Russian – 182. This is a large number, but not the final one because some of the collected specimens need further comparative studies. Probably, in the whole Primeval Forest on both sides of the frontier, more than 300 lichen species exist.

From Piska Primeval Forest that covers a greater area, 285 lichen taxa have been known (Cieśliński 2003a). In north-eastern Poland, more lichen species occur only in regions where relatively well preserved forest complexes with great differentiation of microhabitats, substrata and forest communities favour luxuriant development of lichens. Examples of such areas are as follows: Białowieska Primeval Forest, from which 400 species have been reported, Knyszyńska Primeval Forest (365), Augustowska Primeval Forest (363) (Cieśliński 2003a) and also Borecka Primeval Forest (321) (Zalewska 2000). For comparison, in Poland 1554 lichen species have been recorded (Fałtynowicz 2003a), and in the nearby Lithuania – 511 (Motiejûnaitë 1999).

In the greatest number, following genera are represented: *Lecanora* (30 species) and *Cladonia* (26). Relatively many species belong to the following genera: *Pertusaria* (9), *Caloplaca* (8), *Chaenotheca* (8), *Peltigera* (7), and also *Micarea* and *Physcia* (each of them with 6 species).

Most of the species of Romincka Primeval Forest, i.e. 216 (nearly 79% of the whole biota) were given I class of frequency (not more than 19 localities – cf. Chapter 2.1.), and the next 35 (ca 13%) – the II class of frequency (Table 1).

Table 1. Classes of frequency of lichens in Romincka Primeval Forest.

Class of frequency	A number of species in Romincka Primeval Forest		
	Polish part	Russian part	The whole
I	199 (81.2%)	116 (63.7%)	216 (78.5%)
II	21 (8.6%)	31 (17.0%)	35 (12.7%)
III	12 (4.9%)	14 (7.7%)	12 (4.4%)
IV	6 (2.4%)	12 (6.6%)	7 (2.5%)
V	3 (1.2%)	9 (4.9%)	5 (1.8%)

Only 5 taxa, listed below, obtained Vth class of frequency:
Evernia prunastri
Hypogymnia physodes
Lecanora carpinea
Lepraria spp.
Parmelia sulcata

and 7 species were given IVth class of frequency:
Lecanora pulicaris
Lecidella elaeochroma
Melanelia fuliginosa
Pertusaria amara
Phlyctis argena
Platismatia glauca
Ramalina farinacea.

All species mentioned above are included to epiphytic lichens that may be defined as common forest species that grow better in a bit shaded habitats but tolerate full insolation as well. Another feature common for these ordinary in the Primeval Forest species is relatively wide ecological scale that enable them to grow on many tree species. Moreover, most of these lichens may develop on wood, and some of them even on boulders and on soil. For instance, *Parmelia sulcata* grows in Romincka Primeval Forest on bark of *Acer platanoides*, *Alnus glutinosa*, *Betula* spp., *Carpinus betulus*, *Fagus sylvatica*, *Fraxinus excelsior*, *Malus domestica*, *Padus avium*, *Quercus* spp., *Populus* spp, *Prunus*, *Salix*, *Sorbus aucuparia*, *Thuja* spp. and *Tilia cordata*, on branches of shrubs such as: *Corylus avellana*, *Crataegus* spp., *Caragana* sp., *Lonicera xylosteum* and *Sambucus nigra*, on wood, and also on boulders and stones.

Mentioned above 12 lichen taxa recorded most frequently in Romincka Primeval Forest are characterised also by ability to occupy habitats changed by man. One can often find them on roadside trees, on fruit trees in orchards and on wooden frames as well. Their common feature is capacity to produce enormous numbers of diaspores: spores, soredia or isidia which directly influences reproduction success. Most of these species produce soredia. They are as follows: *Evernia prunastri, Hypogymnia physodes, Parmelia sulcata, Pertusaria amara, Phlyctis argena* and *Ramalina farinacea*. Thalli covered by apothetia possess *Lecanora carpinea, L. pulicaris* and *Lecidella elaeochroma*. In Romincka Primeval Forest, apothetia have been often observed also on thalli of *Hypogymnia physodes* and *Parmelia sulcata*; both these species produce fruit bodies very rarely and in favourable habitat conditions only. On the other hand, *Melanelia fuliginosa* and *Platismatia glauca* produce isidia in large quantities.

Certainly more species is widely distributed in the Russian part of Romincka Primeval Forest, i.e. 12 with IVth class of frequency and 9 with Vth class than in the Polish one, where 6 species obtained IVth class of frequency and only 3 Vth class (see Table 1). It results from both larger area and compactness of the forest complex in the Russian part and also from the presence of exceptionally great number of inner-forest abandoned farm buildings that are centres of propagation of many species of a wider ecological scale.

So far, lichenicolous fungi have not been sufficiently recognised in both Poland and Russia. From Poland territory, only 214 species have been known (Fałtynowicz 2003a), whereas from considerably smaller countries such as Belgium and Luxembourg 242 species have been reported (Diederich & Sérusiaux 2000). In Romincka Primeval Forest, 14 species of lichenicolous fungi have been recorded, but surely there may grow much more species of them.

3.2. Lichens of various habitats

Composition of ecological groups and their contribution to local or regional lichen biotas depend on physiography and vegetation diversity. These factors determine kinds of habitats and substrata available for lichens, and also decide about their frequency. In addition, the current structure of a lichen biota is determined by historic and contemporary anthropogenic factors. Apart from urbanised and industrial areas, among pressures that cause a decrease in a number of species in relation to potential capacity of natural habitats, very important is air pollution of "far-away distance" (Hawksworth & Rose 1976, Fabiszewski et al. 1983, Herzig & Urich 1991, Jacobsen 1992). Even low concentration of toxic substances originating from nearer or considerably remote sources may exterminate sensitive lichens, particularly both fruticose and foliose epiphytes.

Transformations caused by forest management impact also very strongly; they induce vanishing of many higro- and skiophilous forest lichen species, mainly crustaceous epiphytes and epixyles. The most common reason is disappearance of suitable niches in consequence of an exchange of deciduous or mixed forest communities into coniferous monocultures, or microclimatic changes caused by clear cuttings within large areas (cf. Czyżewska 1976, Cieśliński & Czyżewska 1992, Fałtynowicz 1997).

Less frequently in literature is emphasized a positive influence of man activities that induces enrichment of local lichen species composition and/or an increase of frequency of some taxa. Enlargement of lichen diversity is an unintended effect of introducing artificial rock substrata by man, for instance concrete frames that may be inhabited by epilithic calciphilous species or creating new habitats for epiphytic, epixylic, epilithic or epigeic forms, with substrata of a character similar to natural ones, e.g. roadside tree lanes, parks, wooden frames, stony forest section

posts, walls built from field stones, and uncovered parts of soil in gravel-pits or on roadside scarps (cf. Fałtynowicz 1994).

In Romincka Primeval Forest as in almost every region of European lowland, the lichen biota reflects natural physiographic factors to some extent only and usually strongly differs from a lichen biota of primeval forests existing here in the past. On the other hand, factors advantageous for lichen development, such as very weak air pollution (cf. Chapter 1), dispersed buildings, complete absence of industry, and a very poor network of roads with bituminous surface exist here.

3.2.1. Epiphytic lichens

The most important factors that influence epiphytic communities are chemical and physical properties of tree bark, mainly the pH, content of mineral components, water capacity, and also microrelief and a way of bark peeling process (cf. Barkman 1969, Halonen et al. 1991, Dietrich & Scheiddeger 1996, Kuusinen 1996 et al.). Some of the features, especially these related to bark structure may change during a phorophyte life, and model following succession stages of epiphytic communities (see eg. Fałtynowicz 1992, Ferry & Lodge 1996). In many regions, natural chemical features of bark are modified by industrial air pollution (cf. Hawksworth & Rose 1976, Herzig & Urich 1991, Jacobsen 1992), but this factor does not play any role in the studied area.

In most regional lichen biotas, the really important components are epiphytes. Similar pattern has been observed in Romincka Primeval Forest, where the number of epiphytic species (181) is the greatest and almost three times larger than the number of species found on rock substrata (77) and on lignum (68).

The greater number of species has been found on oaks (Table 2). In the Primeval Forest, two oak species grow, native *Quercus robur*, which builds own tree stands, and is also a component of fertile deciduous forests, and *Q. rubra*, the north American species, that was planted by German foresters on roadsides. Its more than 100 years old trees can be met particularly in the Polish part of the study area. Both oak species create very favourable conditions for lichen development. Their bark, smooth on young trees and cracked on old specimens secures wide spectrum of microhabitats with differentiated light and humidity conditions. In lower parts of oak trunks, usually few lichen species occur and often grow here only *Phlyctis argena, Evernia prunastri, Hypogymnia physodes* and *Parmelia sulcata*, and also species from the genus *Lepraria*. More rich lichen communities develop in oak crowns. Upper surface of boughes and stout branches is covered by thalli of *Platismatia glauca, Hypogymnia physodes, H. tubulosa, Pseudevernia furfuracea* and of species from the genus *Ramalina*, and quite frequent are also *Usnea filipendula* and *U. subfloridana*. Nitrophilous lichens from the genera *Physcia*, *Phaeophyscia*, *Physconia* and *Xanthoria* grow here abundantly as well.

In Romincka Primeval Forest, exclusively on oaks grow several species very rare within Europe. There are, for example *Calicium viride* and *C. salicinum*. Also *Bryoria fuscescens* has been found on bark of oaks exclusively. That species, widely distributed in the past, became extinct from most of regions of middle Europe and just in the recent years, it slowly recolonises territories, from which vanished tens years ago (Fałtynowicz 2004). It is likely, that this process results from considerable improvement of air qality. On bark of oak in the Russian part of Romincka Primeval Forest, *Scoliciosporum pruinosum* has been recorded, the species new for the whole Russia and very rarely noted in other countries. In Poland, it is known from three sites only (Cieśliński 2003a, Fałtynowicz 2003a). Very rare is also *Catinaria atropurpurea* found nearby Wisztynieckoje lake.

Table 1. The most important tree species in Romincka Primeval Forest and a number of lichen species found on them.

Phorophyte	A number of epiphytic lichen species		
	Russian part	Polish part	Total
Quercus robur et *Q. rubra*	64	58	82
Betula pendula	51	59	72
Acer platanoides	67	36	70
Fraxinus excelsior	49	57	66
Populus tremula	57	42	65
Salix spp.	53	27	54
Tilia cordata	44	32	52
Carpinus betulus	35	22	41
Alnus glutinosa	27	33	40
Corylus avellana	24	18	29
Sorbus aucuparia	11	21	28
Picea abies	11	16	22
Pinus sylvestris	18	9	21
Sambucus nigra	19	7	20

Diverse epiphytic communities develop on bark of *Betula pendula*; as many as 72 lichen species have been indicated here (Table 1). Birch possesses acid bark, poor in nutrients and with small water capacity. These unfavourable properties of bark are compensated considerably by variety of habitats in which birches grow. They occur in deciduous forests as well as in habitats of coniferous forests, in both dry and wet sites, and in unforested areas, while old birch trees are often found along roads.

Relatively few lichen species occur on birches in forests and first of all there are ordinary species such as *Hypogymnia physodes* and *Lecanora conizaeoides*, and also *Lepraria* spp. On well illuminated trunks *Hypocenomyce scalaris* is frequent. Quite often *Usnea filipendula* has been observed on birches. For example, it grows in rather great numbers near Żytkiejmy, along the road to Bludzie village, and also eastwards of Krasnolesje. In the latter locality, exceptionally rare species *Usnea fulvoreagens* has been identified, that in „Red List of extinct and endangered lichens in Poland" (Cieśliński et al. 2003) is classified as critically endangered (CR).

Much more species occur on trunks of birch trees growing in forest margins, among fields and along roads. Their bark is often enriched owing to blowing of dust and also is often hurt with sap trikling from wounds. In such places grow lichens usually occurring on trunks of aspen and maple trees: *Physcia adscendens, Ph. tenella*, *Xanthoria polycarpa*, and sometimes also *Lecanora carpinea* and *L. pulicaris*.

Apart from *Usnea*, another two exceptionally rare lichens have been recorded. The first is *Scoliciosporum sarothamni*, that grows at Wisztynieckoje lake and the nearest other sites of the species are in the north-eastern Poland (Fałtynowicz 2003a). The second species is *Ochrolechia alboflavescens*, found in the reserve „Dziki Kąt", that from Poland is known also from Białowieska Primeval Forest and Sudety mountains only (Cieśliński 2003a).

Slightly fewer species, in comparison with birches, were found on maples (Table 1). Particularly noteworthy have been old roadside maple trees in the Russian part of the Primeval Forest which trunks are often overgrown as the whole by lichens. Attention attracts mass occurrence of *Evernia prunastri*, *Parmelia sulcata, Ramalina farinacea*, *R. fastigiata* and *R. fraxinea*; a length of thalli of the latter species reaches 20 centimetres. Quite frequently occurs *Anaptychia ciliaris*, and also *Physcia adscendens, Ph. tenella*, *Physconia enteroxantha* and *Xanthoria parietina* as well. Exclusively on maples *Caloplaca obscurella* and *Lecanora impudens* were found. In the Polish Romincka Primeval Forest Landscape Park, on old maples *Lobaria pulmonaria* grows. Until quite lately, this species has been regarded as a vanishing one, however the latest investigations of Andrzej Ryś have shown that the status of *Lobaria pulmonaria* populations, especially in north-eastern Poland is quite good.

Interesting communities of crustaceous lichens develop on *Fraxinus excelsior* trees, on which 66 species were indicated. In the Primeval Forest, two very rare

species *Lecidea erythrophaea* and *Arthopyrenia punctiformis* have been found on ashes.

A large number of species have been recorded on *Populus tremula*. In Romincka Primeval Forest, this tree grows mainly in uncovered places, on roadsides, near buildings or in forest margins, and in the Russian part old aspens commonly occur nearby numerous here ruines of post-German settlements. The more interesting species found on aspens are, for example *Catillaria nigroclavata* and *Caloplaca cerina*.

Similar composition of epiphytic communities posses two tree species characteristic for fertile deciduous forests, i.e. *Tilia cordata* and *Carpinus betulus*, on which 52 and 41 species repectively have been identified (Table 1). Mainly crustaceous lichens grow here and among them dominate *Lecanora argentata, L. carpinea, L. pulicaris, Phlyctis argena, Pertusaria amara*, *P. coccodes*, *P. hemisphaerica* and *P. leioplaca*. On hornbeams, several rare and vanishing in this part of Europe lichens were found, among others *Pertusaria hemisphaerica*, *Pyrenula nitida* and *P. nitidella* and also *Thelotrema lepadinum*. These four species are characteristic for well preserved forest communities

Picea abies and *Pinus sylvestris*, which dominate over large areas of Romincka Primeval Forest, have epiphytic communities of mean species composition. It results mainly from bark properties of these trees. It is very acid, poor and of little water capacity, and moreover, it is peeling constantly. Usually only few species, such as *Hypogymnia phusodes*, *Lecanora conizaeoides* and *Hypocenomyce scalaris* occur on spruce and pine trees. Two other taxa, i.e. *Dimerella pineti* and *Micarea prasina* regarded as higrophilous lichens have been observed at the bases of their trunks, even in rather dry conditions.

Noteworthy is that in Romincka Primeval Forest many epiphytic species occur in large quantities. Tree trunks are usually overgrown profusely by lichen thalli. Particular attention should be paid to species belonging to the genera: *Ramalina*, *Anaptychia ciliaris* and *Pleurosticta acetabulum*, that produce numerous, shapely thalli. They are protected by law and are also included to the list of threatened lichens in Poland (cf. Cieśliński et al. 2003).

3.2.2. Epixylic lichens

Epixylic lichen biota of Romincka Primeval Forest is not rich – on this kind of substratum only 68 species have been found and some of them grow there accidentally. Most of the species growing on wood is met so often on other substrata, particularly on tree bark.

Relatively large moisture of both air and substrata in forest communities of Romincka Primeval Forest causes that epixylic lichens grow here in small quantities and give way to stronger in intraspecific competition mosses. Nevertheless,

in such conditions some very interesting species have been found on wood, e.g. *Absconditella lignicola*, *Biatora turgidula*, *Catillaria erysiboides*, *Lecidea botryosa* and *Micarea melaena*.

The very interesting epixylic species have been indicated on wood of dead but still standing trees and there are: *Chaenotheca brachypoda, Ch. chlorella, Ch. xyloxena* and *Lecanora hypopta*. The latter species is known from single sites in Poland only.

Rare and rare usage of wood as a building material do not favour epixylic lichens because it implies decreasing of differentiation of epixylic communities in a range much more greater than a regional one.

3.2.3. Epilithic lichens

In the studied area, most of epilithic species grows on erratics and stones. In lowland, erratics are usually non-calcareous rocks, and are built of granite, gneiss and granite-gneiss (cf. Czernicka-Chodkowska 1977-1983). Physico-chemical parameters of rock substrata such as hardness, acidity and lack of calcium are similar, so factors differentiating epilithic biota are habitat conditions in particular. Rock substrata containing calcium carbonate are mainly of an anthropogenic origin, rarely one can find small shell conglomerates.

At present, in the area of Romincka Primeval Forest there is quite small number of erratics only contrary to the neighbouring Suwalski Landscape Park (see Zalewska et al. 2004). Presumably, in the past, there were considerably larger quantities of them, however they were used as building materials. These ones that have remained are usually located in habitat conditions such as forests, floors of deep erosion dissections or stream beds, which do not favour development of epilithic lichens.

In Romincka Primeval Forest, on rock substrata as many as 77 species have been noted. Most of them were found on anthropogenic rocks. In the Polish part of the Primeval Forest this kind of rock substrata is very frequent and appear in well insolated places and thus creates suitable conditions for development of many calciphilous lichens. In particular, these are numerous old railway viaducts, but also concrete poles and fences, and roofs made of tiles or eternit. In the Russian part, there are considerably less rock substrata available for lichens. Hundreds of ruined buildings in abandoned, overgrown by forests post-German settlements are damaged so strongly that only remnants of their foundations have remained. Lichen species that may be found there are: *Peltigera rufescens*, which thalli develop on mosses and *Myxobilimbia sabuletorum* growing on vertical walls. On the other hand, at well illuminated concrete poles and viaducts in Romincka Primeval Forest Landscape Park, species from the genus *Caloplaca* (*C. decipiens, C. saxicola*, *C. citrina*) dominate, usually accompanied by *Xanthoria parietina*, and more rarely

by *X. elegans*. On this substratum frequently occur *Lecanora albescens, L. dispersa, Candelariella aurella* and *Physcia caesia*. The most interesting species, noted in lowland very rarely is *Placynthium nigrum*, found on the viaduct in Stańczyki. The closest and simultaneously the only localities of this species in north-eastern Poland have been found on concrete frames of weirs of Augustowski Channel (Cieśliński 2003a).

Among natural rock substrata, the most rich in lichens are stony posts sunk along roads tens years ago. They are quite frequent on drive ways towards viaducts, e.g. in Dubieninki and Stańczyki, less frequent along asphalt roads, e.g. between Jagodnoje and Kalinino villages. Most often grow on them photophilous crustaceous lichens such as: *Acarospora fuscata, Candelariella vitellina* and *Lecanora polytropa*, which are frequently accompanied by *Protoparmeliopsis muralis*, whereas *Neofuscelia loxodes* and *Xanthoparmelia conspersa* appear very rarely.

Certainly poorer epilithic communities develop on boulders in forests. Owing to shadowness and considerable both air and substratum humidity, usually mosses prevail on them, while a few skiophilous and higrophilous lichens occur in small quantities. In such places in Romincka Primeval Forest several very rare lichen species occur. Particular attention should be paid to *Collema flaccidum*, that has been found on a boulder in a small stream nearby Krasnolesje. The species has only few sites within the middle European lowland and the closest one is situated near the reserve „Głazowisko Bachanowo nad Czarną Hańczą" in Suwalski Landscape Park (Fałtynowicz 1999, Zalewska et al. 2004). On boulders in a small stream in the neighbourhood of Pugaczewo, two other rare in lowland crustaceous lichens – *Pseudosagedia chlorotica* and *Bacidina inundata*, that need exceptionally high both air and substratum humidity have been recorded.

Among epilithic lichens found in Romincka Primeval Forest, apart from the three mentioned above, rare or very rare in lowland is also, for instance *Rhizocarpon geographicum*, which one locality was found on stones in ruines of foundations nearby Gołdapia. In the vicinity of the reserve „Dziki Kąt" another mountain species– *Umbilicaria polyphylla* occurs on a boulder.

3.2.4. Terricolous lichens

A small number of terricolous species (35) found in Puszcza Romincka Forest results from low local frequency of suitable habitats for this group. Terricolous lichens grow there presumably in dry swards or on eroded gravely roadside scarps; such habitats cover imperceptible areas within the surveyed terrain. In the Polish part of the Primeval Forest 29 species of terricolous lichens have been indicated, while in the Russian part only 9.

More frequent species growing on soil is only *Peltigera didactyla*. Terricolous *Cladonia*, which as many as 26 species have been found, generally grow

on single sites on insolated scarps of forest roads in the Polish part of the Primeval Forest.

Undoubtedly, the most interesting is *Psilolechia clavulifera*, that was found on a low scarp of a forest road eastwards from Gołdap lake. The species is detected exceptionally in lowland and its nearest localities are situated in Białowieski National Park. In a large gravel-pit near Dmitrijewka, *Verrucaria xyloxena* forms an abundant population. In addition, ephemerolichens *Collema limosum* and *Leptogium biatorinum* have been found, each of them on one locality (see Fałtynowicz 1994).

3.3. Protected, rare and interesting species

The nature of Romincka Primeval Forest has been impacted by strong anthropopressure for hundreds of years. Nevertheless, anthropogenic changes/transformations have not been so large as in areas surrounding the Primeval Forest. Most of all, ecological continuity of forests has been preserved. Forest communities, though changed in respect of structure, age and species composition of their tree-stands, have existed in the same sites for hundreds of years. For organisms inhabiting these ecosystems this was the most important and basic condition of survival. Such situation has caused that in the area of the Primeval Forest many species that vanished from neighbouring regions, have still occurred.

In Romincka Primeval Forest as many as 47 species protected by low have been found[22]. Most of them occur in Poland frequently, particularly in the north part of the country and probably in Kaliningradski District as well. However, the need of their protection results from the fact that they are chiefly macrolichens, i.e. species of foliose or fruticose thalli which usually die as the first owing to changing habitat conditions, especially because of air pollution or changes caused by forest management and cutting off roadside trees. Species protected by law and occurring in the Primeval Forest are as follows ([cz] – species partly protected; [x] – species found in the Polish part exclusively, [xx] – species found in the Russian part exclusively):

Anaptychia ciliaris
[x]*Bryoria fuscescens*
[x]*Bryoria implexa*
[cz,x]*Cetraria aculeata*
Cetraria chlorophylla
[cz,x]*Cetraria ericetorum*
[cz,x]*Cetraria islandica*
Cetraria sepincola
[x]*Cetrelia olivetorum*
[cz,x]*Cladonia arbuscula*
[cz,x]*Cladonia ciliata*
Parmelia submontana
Parmeliopsis ambigua
[x]*Peltigera canina*
Peltigera didactyla
[x]*Peltigera neckeri*
[xx]*Peltigera polydactylon*
Peltigera ponojensis
Peltigera praetextata
Platismatia glauca
Pleurosticta acetabulum
Pseudevernia furfuracea

[cz,x]*Cladonia rangiferina*
[cz]*Evernia prunastri*
Hypogymnia tubulosa
Hypotrachyna revoluta
Imshaugia aleurites
[x]*Lobaria pulmonaria*
Melanelia exasperatula
Melanelia elegantula
Melanelia fuliginosa
[x]*Melanelia olivacea*
Melanelia subargentifera
Melanelia subaurifera
Parmelia saxatilis
[xx]*Ramalina calicaris*
Ramalina farinacea
Ramalina fastigiata
Ramalina fraxinea
[x]*Ramalina pollinaria*
[x]*Thelotrema lepadinum*
Umbilicaria polyphylla
Usnea filipendula
[xx]*Usnea fulvoreagens*
Usnea hirta
Usnea subfloridana
Vulpicida pinastri

Noteworthy are three species: *Anaptychia ciliaris*, *Melanelia subargentifera* and *Pleurosticta acetabulum* occurring on roadside and singly growing trees, for which the north-east Poland creates a specific refuge, and they grow here more frequently and abundantly than elsewhere in the country. These species are probably euanthropolichens that came from south Europe and thanks to man have inhabited permanently territories located to the north of Carpathians (cf. Fałtynowicz 1992, 1994). They form here numerous and shapely thalli, often with a diameter up to 20 cm, and *Anaptychia ciliaris* as well as *Pleurosticta acetabulum* usually plentifully produce fruit bodies.

Other valuable species protected by law and growing in Romincka Primeval Forest are as follows:

Bryoria implexa: rare and endangered in Poland (Fałtynowicz 2003a), in larger forest complexes;

Cetrelia olivetorum: in Poland still common only in Białowieska Primeval Forest (Cieśliński 2003a), rare in other areas (Fałtynowicz 2003a);

Hypotrachyna revoluta: quite frequent in north-eastern Poland, very rare in the remaining area of the country (Cieśliński 2003a, Fałtynowicz 2003a);

Lobaria pulmonaria: up to the present regarded as a vanishing species, but lately found on some thousands of trees, mainly in north-eastern Poland (A. Ryś, personal communication);

Parmelia submontana: very rare in Poland, known from a dozen or so localities (Fałtynowicz 1993, 2003a), most of which is situated in the north-eastern part of the country (Cieśliński 2003a. Motiejûnaitë & Fałtynowicz 2004);

Ramalina calicaris: reported from Poland from few sites, but most of them concern data from the XIXth century (Fałtynowicz 2003a);

Thelotrema lepadinum: very rare in well preserved forest complexes;

Umbilicaria polyphylla: rare in lowland, in north Poland known at several localities

(Fałtynowicz 1992, 2003a, Cieśliński 2003a), it spreads on anthropogenic substrata, e.g. on granite posts;

In the described area, other valuable species also occur and among them, the most interesting are:

Absconditella lignicola: probably more frequent species but at present known in Poland from a few sites only (Fałtynowicz 2003a);

Anisomeridium polypori: known from a few localities only, exclusively in the north part of Poland (Fałtynowicz 2003a), maybe overlooked;

Arthonia mediella: dispersed over the whole country (Fałtynowicz 2003a), but more frequent in the north-east Poland only (Cieśliński 2003a);

Bacidia arceutina: rare in Poland (Fałtynowicz 2003a), mainly in well preserved forest complexes;

Buellia aethalea: in great numbers on tiles on abandoned buildings in Budwiecie near Pluszkiejmy; subatlantic species that eastwards from the River has single localities only (Fałtynowicz 1993a, Cieśliński 2003a);

Caloplaca obscurella: in Poland known from few sites in the south part of the country, in lowland has two localities only (Fałtynowicz 2003a); maybe overloocked because of an inconspicuous thallus;

Chaenothecopsis nigra: on algae and on a thallus of *Chaenotheca chlorella*, nearby Pugaczewo (Kaliningradski District), the nearest localities are in the south Poland (Bielczyk 2003, Łubek 2003);

Collema flaccidum: on boulders in a stream not far from Krasnolesje; in this part of Europe has only two existing sites in the north Poland and one in Lithuania (Motiejûnaitë 1999, Fałtynowicz 2003a, Zalewska et al. 2004);

Collema limosum: rarely noted in Poland, mainly in anthropogenic habitats (gravelpits, roadside scarps), undoubtedly more frequent but omitted; the species represents a relatively poorly known group of ephemeroanthropolichens (Fałtynowicz 1994, 2003a, Ceynowa-Giełdon 2001);

Fellhaneropsis vezdae: in Poland known from a few sites (Fałtynowicz 2003a);

*Macentina abscondita***:** in Poland reported from one locality only (Kubiak unpbl. data), regarded as very rare in Europe, but presumably weakly distinguished owing to an inconspicuous thallus;

Lecanora hypopta: very rare in Poland, perhaps weakly distinguished;

Lecanora persimilis: on poplar bark at Wisztynieckoje lake; the closest site, one of the fourth localities in Poland, is in Suwalski Landscape Park (Fałtynowicz 2003a, Zalewska et al. 2004);

Lecanora sambuci: reported from several localities in Poland but for many years has not been found (Fałtynowicz 2003a);

Lecidea botryosa: exceptionally rare in Europe; in Poland known from two localities

only (Fałtynowicz 2003a);

Lecidea erythrophaea: rare, in Poland reported from a dozen or so sites (Fałtynowicz 2003a), perhaps not distinguished;

Leptogium biatorinum: the same as *Collema limosum*;

Leptorhaphis epidermis: in Poland known from Tatry mountains and Silesia Forests only (Fałtynowicz 2003a);

Pachyphiale fagicola: known from few localities in Poland (Fałtynowicz 2003a), presumably overlooked;

Placynthium nigrum: in the north Poland very rare, the nearest and the only localities of the species in the north-eastern Poland have been found on concrete frames of weirs of Augustowski Channel (Cieśliński 2003a);

Protoblastenia rupestris: frequent in mountains and uplands, in Polish lowland known from few sites only (Fałtynowicz 2003a);

Psilolechia clavulifera: very rare, in Poland reported from a few localities (Fałtynowicz 2003a);

Pycnora sorophora: until quite recently very rare species, now it seems to spread (cf. Cieśliński 2003a);

Rinodina efflorescens: exceptionally rare; in Poland known from three sites in the north-eastern part of the country only (Fałtynowicz 2003a);

Scoliciosporum pruinosum: reported from Poland from a few sites (Fałtynowicz 2003a, Zalewska unpbl. data); rarely found within the whole Europe (eg. Scheidegger et al. 1991, Purvis'a et al. 1992, Santesson 1993, Kukwa 2001, Wirth 2001);

Scoliciosporum sarothamni: up to the present, known in Poland from two localities in the north-eastern part of the country only (Kowalewska & Kukwa 2003);

Strangospora ochrophora: in Poland known from few sites (Fałtynowicz 2003a);

Verrucaria xyloxena: the same as *Collema limosum*;

Xanthoria fulva: until now, known in Poland just only from two present-day localities in Romincka and Augustowska Primeval Forests (Cieśliński 2003a), and from two historic sites in Pieniny and Sudety mountains (Fałtynowicz 2003a).

In the studied area, 21 lichen species – bioindicators of lowland old-growth forests in Poland (acc. Czyżewska & Cieśliński 2003) have occurred. They are as follows:

Arthonia vinosa
Bacidia arceutina
Biatora turgidula
Buellia erubescens
Calicium viride
Cetrelia olivetorum
Lobaria pulmonaria
Loxospora elatina
Micarea melaena
Opegrapha viridis
Pertusaria coronata
P. hemisphaerica

Chaenotheca brunneola
Ch. chlorella
Chrysothrix candelaris
Fellhaneropsis vezdae
Hypotrachyna revoluta
P. pupillaris
Pyrenula nitidella
Thelotrema lepadinum
Usnea fulvoreagens

Mentioned above species are stenotopic, mostly epiphytic lichens, which presence depends on occurrence of specific niches that are characteristic for the least disturbed forest environment (Cieśliński 2003a) and they grow mainly in large forest complexes on old trees.

A great number of indicator species testifies to ecological continuity of forests in Romincka Primeval Forest, but the status of populations of lichens from this group distinctly indicates not very convenient microclimatic conditions prevailing inside forest communities Presumably, the reason is transformed structure of tree stands caused by long-lasting forest management. At present, on both sides of the border young, i.e. ca 50 years old production forests that are built up mainly by spruce and pine trees dominate. A part of them has been planted on more fecund habitats and character of ground cover and undergrowth testifies to it. Areas of typical deciduous forests nearing oak-linden-hornbeam forests are significantly smaller and only not large pieces of them are of old tree stands character. Relatively less changed seem to be quite numerous riverside carr communities that accompany tiny forest streams. Fragmentarily retained old dry-ground forests and riverside carrs described above create the only present-day refuge for lichens - bioindicators of well preserved forests that exists in Romincka Primeval Forest but its future awakens justifiable misgivings.

Local populations of many lichen species connected with forests of lesser degree of naturalness are in much more better state, especially of species belonging to the group of taxa characteristic for regenerating production forests, e.g. *Graphis scripta* and some species from the genera *Pertusaria* and *Opegrapha* (acc. Cieśliński 2003b). They occur still quite frequently and sometimes quite numerously, and create the basis for slow rebuilding process of local resources as the age of tree stands of Romincka Primeval Forest extends and long-term reconstruction of their structure progresses.

3.4. A threat to the lichen biota

The main threat to lichens is man economic activity that impacts widely understood alterations of habitat conditions. Factors that negatively influence on lichens (Table 3), operate as a complex and in many cases there is difficult to point out the only one that is responsible for transformation of a lichen biota. It will not be an exaggeration to say that most of the lichen species are more or less threatened;

even these that inhabit artificial rock substrata (concrete, tiles, bricks) have lesser and lesser possibilities to enter new habitats because of changes in both quality of building materials and technologies (Fałtynowicz 2003b).

Table 3. Factors impacting negatively on a lichen biota (acc. Fałtynowicz 2003b).

No.	Factor	Lichen group particularly endangered	Remarks
1	Air pollution	Species from all habitats and substrata	Large impact of trans-border pollution
2	Economic activities in forests	Epiphytic, epixilic and terricolous lichens	Changes of structure and species composition of tree locds, changes of phytoclimat, decrease in a number of old trees, decrease in amount of rotten wood
3	Cutting of old trees growing outside forests	Epiphytic lichens	Refers to roadside trees in particular
4	Agriculture	Mainly epiphytic and epilithic lichens	Impact of fertilisers and insecticides, dust cover
5	Changes of water regime (drainage)	Mainly epiphytes (psychro- and higrophilous)	Local impacts
6	Urbanization	Species from all habitats and substrata	Destroying of all habitats and substrata; local impacts
7	Motorization	Mainly epiphytes	Pollution, extension of road infrastructure
8	Tourism	Mainly epilithic lichens	Devastation of surface of erratics in lowland and of rocks in mountains; local impact
9	Exploitation of natural resources	Species from all habitats and substrata	Opencast mines, gravel-pits, quarries, harvesting of stones and boulders for building industry in lowland; local impact
10	Pollution of streams and rivers	Epilithic species	Vanishing of lichens growing on boulders located in a river/stream current and along their banks; refers to sub-mountain regions and south Poland
11	Collecting	Species from all habitats and substrata	In particular, collecting for scientific purposes

One way to present a threat to organisms is preparing „red lists". Most of European countries have already prepared such lists for lichens. In Poland, three editions of "Red list of threatened lichens" have been published till now (Cieśliński et al. 1986, 1992, 2003). In each of the following editions, generally more and more numbers of species, as well as much more extinct and endangered taxa were given. For example, in 1986, 142 species were regarded as endangered, in 1992 – 180, and in 2003 – as much as 380. Data from 2003 locate Poland among countries with very strongly threatened lichen biota (cf. Pišut 1993, Siebel et al. 1992).

From among all lichens found in Romincka Primeval Forest, 104 species (37.8% of the total) are included on „Red List of extinct and threatened lichens in Poland", and only 64 (23.3%) – on „Red List of threatened lichens in North-Eastern Poland" (Table 4). This disproportion, i.e. nearly a twice smaller number of species threatened in the region than in Poland testifies to good conditons for lichens in this part of the country.

Table 4. Species occurring in Romincka Primeval Forest, included on Polish and regional lists of threatened lichens

Name of species	Category of threat	
	In Poland (acc. Cieśliński et al. 2003)	In the north-eastern Poland (acc. Cieśliński 2003b)
Acrocordia gemmata	VU	-
Anaptychia ciliaris	EN	-
Arthonia dispersa	VU	EN
Arthonia mediella	VU	VU
Arthonia vinosa	NT	VU
Arthothelium ruanum	NT	-
Bacidia arceutina	EN	EN
Bacidia beckhausii	VU	VU
Bacidia rubella	VU	-
Bacidia subincompta	EN	VU
Bacidina arnoldiana	NT	VU
Bacidina assulata	EN	VU
Biatora turgidula	VU	VU
Bryoria fuscescens	VU	-
Bryoria implexa	CR	VU
Buellia erubescens	CR	EN
Calicium glaucellum	VU	VU
Calicium salicinum	VU	-

Name of species	Category of threat	
	In Poland (acc. Cieśliński et al. 2003)	In the north-eastern Poland (acc. Cieśliński 2003b)
Calicium viride	VU	VU
Caloplaca cerina	VU	EN
Caloplaca flavorubescens	EN	CR
Caloplaca obscurella	NT	NT
Caloplaca velana var. *dolomiticola*	–	LC
Catilaria erysiboides	EN	DD
Catillaria nigroclavata	–	LC
Catinaria atropurpurea	EN	VU
Cetraria chlorophylla	VU	–
Cetraria ericetorum	NT	VU
Cetraria islandica	VU	–
Cetraria sepincola	EN	–
Cetrelia olivetorum	EN	EN
Chaenotheca brunneola	EN	VU
Chaenotheca chlorella	CR	EN
Chaenotheca furfuracea	NT	VU
Chaenotheca phaeocephala	EN	EN
Chaenotheca trichialis	NT	–
Chaenotheca xyloxena	VU	EN
Chrysothrix candelaris	CR	–
Cladonia botrytes	EN	–
Cladonia rei	–	DD
Collema flaccidum	EN	DD
Evernia prunastri	NT	–
Fellhaneropsis vezdae	LC	DD
Graphis scripta	NT	–
Haematomma ochroleucum var. *ochroleucum*	DD	–
Hypogymnia tubulosa	NT	–
Hypotrachyna revoluta	EN	EN
Lecania globulosa	VU	–
Lecanora intricata	–	LC
Lecanora intumescens	EN	EN
Lecanora persimilis	DD	–
Lecanora sambuci	DD	RE

Name of species	Category of threat	
	In Poland (acc. Cieśliński et al. 2003)	In the north-eastern Poland (acc. Cieśliński 2003b)
Lecanora subrugosa	LC	VU
Lecidea botryosa	VU	NT
Lecidea erythrophaea	EN	VU
Lecidella flavosorediata	-	DD
Lobaria pulmonaria	EN	EN
Loxospora elatina	EN	-
Melanelia elegantula	VU	-
Melanelia olivacea	CR	CR
Melanelia subargentifera	VU	-
Melanelia subaurifera	-	VU
Micarea botryoides	-	DD
Micarea melaena	NT	-
Micarea misella	-	DD
Micarea nitschkeana	-	DD
Ochrolechia alboflavescens	CR	CR
Ochrolechia androgyna	VU	-
Ochrolechia subviridis	VU	-
Opegrapha rufescens	VU	-
Opegrapha varia	NT	-
Opegrapha viridis	VU	-
Opegrapha vulgata	VU	-
Pachyphiale fagicola	VU	VU
Parmelia submontana	VU	CR
Peltigera canina	VU	-
Peltigera neckeri	NT	DD
Peltigera polydactylon	DD	VU
Peltigera praetextata	VU	-
Pertusaria alpina	CR	CR
Pertusaria coccodes	NT	-
Pertusaria coronata	VU	VU
Pertusaria hemisphaerica	VU	-
Pertusaria leioplaca	NT	-
Pertusaria pertusa	VU	-
Pertusaria pupillaris	NT	-

Name of species	Category of threat	
	In Poland (acc. Cieśliński et al. 2003)	In the north-eastern Poland (acc. Cieśliński 2003b)
Phlyctis agelaea	EN	VU
Physcia aipolia	NT	–
Physconia distorta	EN	–
Physconia perisidiosa	EN	–
Placynthiella dasaea	–	DD
Placynthium nigrum	NT	–
Pleurosticta acetabulum	EN	–
Protoparmelia badia	NT	–
Pseudosagedia chlorotica	–	NT
Psilolechia clavulifera	NT	NT
Pyrenula nitida	VU	–
Pyrenula nitidella	EN	VU
Ramalina calicaris	CR	RE
Ramalina farinacea	VU	–
Ramalina fastigiata	EN	–
Ramalina fraxinea	EN	–
Ramalina pollinaria	VU	–
Rhizocarpon geographicum	–	VU
Schismatomma decolorans	DD	DD
Scoliciosporum pruinosum	DD	–
Strangospora ochrophora	VU	EN
Tephromela atra	NT	–
Thelotrema lepadinum	EN	EN
Umbilicaria polyphylla	LC	EN
Usnea filipendula	VU	–
Usnea filvoreagens	CR	CR
Usnea hirta	VU	–
Usnea subfloridana	EN	–
Vulpicida pinastri	NT	–
Xanthoria fulva	DD	EN
Total: 116	104	64

A number of lichen species classified in particular categories of threat is presented in Table 5. The highest category RE (regionally extinct) has been given to *Lecanora sambuci* and *Ramalina calicaris*. Both these species were reported from

one locality in north-eastern Poland by Ohlert in 1870 and after that date they were not been recorded any more. They are exceptionally rare in the whole Europe. Nowadays, they have few localities in the Russian part of Romincka Primeval Forest.

Table 5. Numbers of lichen species in particular categories of threat (according to the Polish and regional lists of threatened lichens) in Romincka Primeval Forest.

Category of threat	Number of species	
	A	B
RE	-	2
CR	9	6
EN	27	15
VU	35	23
NT	23	4
LC	3	3
DD	7	11

A – according to„Red List of extinct and threatened lichens in Poland" (Cieśliński et al. 2003a); B – according to „Red List of threatened lichens in North-Eastern Poland" (Cieśliński 2003b).

The category CR (Critically Endangered) has been given to ten species and four of them: *Melanelia olivacea*, *Ochrolechia alboflavescens*, *Pertusaria alpina* and *Usnea fulvoreagens* are endangered to the same level in Poland as in the region. *Melanelia olivacea* is frequent in the north Europe, e.g. in Esthonia and Finnland, where commonly grows on birch bark. In Poland it has still occurred in few sites in the north part of the country but is vanishing because of drainage of terrain. *Usnea fulvoreagens* is known from not many localities, most of which are historical ones. In north-eastern Poland it had been reported many times from large forest complexes, but the only present-day localities are situated in : Białowieska and Borecka Primeval Forests (Cieśliński 2003a). In Romincka Primeval Forest, large and shapely thalli of this species develop on birches along a forest road eastwards from Krasnolesje and are accompanied by *Usnea filipendula*. Only in large complexes of well preserved forests, on smooth bark of foliose trees, *Pertusaria alpina* occurs. In north-east Poland, the species is known from Białowieska, Knyszyńska, Augustowska and Romincka Primeval Forests (Cieśliński 2003a). *Ochrolechia alboflavescens* is regarded as exceptionally rare species which in Poland has two historical localities in Tatry and Sudety mountains and two present – in Białowieska Primeval

Forest and in the reserve „Dziki Kąt" in Romincka Primeval Forest (Cieśliński 2003a, Fałtynowicz 2003a).

Very interesting species is *Parmelia submontana*. Some years ago it was known in Poland at a few places (Fałtynowicz 1993), whereas today it has been found more often and in Romincka Primeval Forest it is present on as many as 11 sites, and finds here suitable conditions for development, i.e. produces numerous and shapely thalli and its populations are not endangered.

The four remaining species critically endangered by extinction in Poland, i.e. *Bryoria implexa*, *Buellia erubescens*, *Chaenotheca chlorella* and *Chrysothrix candelaris*, in the north-eastern part of the country possess lower categories of threat, and the latter of them has not been included on the list of threatened species at all. Similarly, from among lichens classified in Poland as EN (Endangered) and VU (Vulnerable), the first ten with the category EN are not included on „Red List of lichens threatened in North-Eastern Poland", while among species with the category VU as many as 24. These data show distinctly how good conditions for development have lichens within the studied area.

Among species that in Romincka Primeval Forest are less threatened than in neigbouring regions, two groups distinguish themselves distinctly. The first one is created by lichens characteristic for well preserved forest complexes and involves species regarded as indicators of lowland primeval forests (see Chapter 3.3). The second group is constituted by lichens most of all occurring in habitats created by man, i.e. on roadside and singly growing trees in well illuminated places. They can be regarded as lichens distinguishing unforested areas with very weakly polluted air; these are almost exclusively macrolichens, e.g. *Anaptychia ciliaris*, *Melanelia subargentifera*, *Physconia distorta*, *Ph. perisidiosa*, *Pleurosticta acetabulum*, *Ramalina farinacea*, *R. fastigiata*, *R. pollinaria* and *R. fraxinea*.

Two epilithic species: *Rhizocarpon geographicum* (VU) and *Umbilicaria polyphylla* (EN), possess high categories of threat in the north-eastern Poland. They are common on rocks in mountains and within the country scale are not threatened.

4. List of species

Data from localities 28-66 in the Polish part of Romincka Primeval Forest and from localities 1-33 in the Russian part have been prepared by authors of this work, while data concerning localities 1-27 in the Polish part have been obtained from Cieśliński (2003) (cf. List of localities in Chapter 2.2.).

Each taxon in the list has been described as follows:

Name of species – substratum – frequency (cf. Chapter 2.1.) – number of localities – list of localities (see Chapter 2.2.).

Absconditella lignicola Vězda & Pišut – On wood. I.
RUS – 1 loc: 3.

Acarospora fuscata (Nyl.) Arnold – On boulders, stones and tiles. I.
PL – 10 loc: 1, 9, 13, 26, 37, 38, 43, 49, 56, 66; RUS – 4 loc: 8, 10, 12, 26.

A. heppii (Naeg. in Hepp) Naeg. in Körb. – On boulders and small stones. I.
PL – 1 loc: 38; RUS – 2 loc: 25, 26.

A. veronensis A. Massal. – On a stone and on a boulder. I.
PL – 1 loc: 58. RUS – 1 loc: 26.

Acrocordia gemmata (Ach.) A. Massal. – On bark of *Acer, Fraxinus*. I.
PL – 1 loc: 1; RUS – 4 loc: 3, 4, 13, 20.

Amandinea punctata (Hoffm.) Coppins & Scheid. – On bark of *Acer, Aesculus, Betula, Populus, Pyrus, Quercus, Salix, Tilia*. II.
PL – 10 loc: 7, 9, 14, 19, 20, 23, 26, 34, 38, 58; RUS – 15 loc: 1, 2, 8-13, 17, 20, 22, 26, 29-31.

Anaptychia ciliaris (L.) Körb. – On bark of *Acer, Fraxinus, Populus, Quercus, Salix, Sambucus*. II.
PL – 9 loc: 9, 14, 17, 20, 25, 26, 38, 56, 58; RUS – 11 loc: 1, 5, 7-10, 17, 20, 25, 30, 31.

Anisomeridium polypori (M.B. Ellis & Everh.) M.E. Barr – On bark of *Acer*. I.
RUS – 2 loc: 9, 20.

Arthonia mediella Nyl. – On bark of *Acer*. I.
PL – 1 loc: 1; RUS – 1 loc: 9.

A. radiata (Pers.) Ach. – On bark of *Carpinus, Corylus, Fraxinus, Quercus, Sorbus*. I.
PL – 11 loc: 9, 12, 14, 27, 31-33, 39, 48, 54, 59; RUS – 7 loc: 3, 14, 18, 19, 22, 24, 27.

A. spadicea Leight. – On bark of *Alnus, Carpinus, Corylus, Fraxinus, Quercus*. I.
PL – 13 loc: 2, 9, 11, 12, 22, 27, 31, 41, 48, 54, 59, 61, 62; RUS – 5 loc: 4, 8, 14, 16, 18.

A. vinosa Leight. – On bark of *Ulmus*. I.
PL – 4 loc: 2, 11, 12, 54.

**Arthopyrenia punctiformis* auct. – On bark of *Acer, Fraxinus*. I.
PL – 1 loc: 13; RUS – 1 loc: 20.
Arthothelium ruanum (A. Massal.) Zwackh – On bark of *Carpinus, Corylus, Fraxinus, Tilia*. I.
PL – 6 loc: 1-3, 9, 12, 14; RUS – 5 loc: 4, 8, 14, 19, 23.
Aspicilia calcarea (L.) Mudd – On concrete. I.
PL – 4 loc: 25, 37, 49, 57.
A. cinerea (L.) Körb. – On boulders. I.
PL – 1 loc: 17.
A. contorta (Hoffm.) Kremp. – On concrete. I.
PL – 1 loc: 37.
A. moenium (Vain.) Thor & Timdal – On concrete. I.
PL – 2 loc: 10, 66.
**Athelia arachnoidea* (Berk.) Jtl. – On thalli of *Candelariella xanthostigma, Lecania globulosa, Lecanora conizaeoides, L. umbrina* and *Placynthiella icmalea*. I.
PL – 1 loc: 52; RUS – 3 loc: 9, 15, 17.
Bacidia arceutina (Ach.) Arnold – On bark. I.
PL – 2 loc: 11, 13.
B. beckhausii Körb. – On bark. I.
PL – 3 loc: 1, 3, 9.
B. rubella (Hoffm.) A. Massal. – On bark of *Acer, Fraxinus, Malus, Populus, Salix*. II.
PL – 9 loc: 1, 13, 14, 23, 26, 30, 38, 43, 60; RUS – 13 loc: 2, 4, 9, 11-13, 16, 19-21, 25, 28, 30.
B. subincompta (Nyl.) Arnold – On bark. I.
PL – 1 loc: 13.
Bacidina arnoldiana (Körb.) V. Wirth & Vězda – On bark of *Carpinus* and *Quercus*. I.
PL – 2 loc: 11, 19; RUS – 2 loc: 1, 7.
B. assulata (Körb.) Vězda – On bark. I.
PL – 1 loc: 11.
B. inundata (Fr.) Vězda – On a boulder and on a stone in a stream. I.
PL – 1 loc: 17; RUS – 1 loc: 14.
B. phacodes (Körb.) Vězda – On bark. I.
PL – 1 loc: 12.
Baeomyces rufus (Huds.) Rebent. –On soil. I.
PL – 2 loc: 10, 59.
Biatora turgidula (Fr.) Nyl. – On wood. I.
PL – 1 loc: 7.
Bryoria fuscescens (Gyeln.) Brodo & D. Hawksw. – On bark of *Quercus*. I.
PL – 4 loc: 19, 20, 23, 39.
B. implexa (Hoffm.) Brodo & D. Hawksw. – On bark. I.
PL – 1 loc: 9.

Bryoria sp. – On bark of *Betula, Quercus, Salix*. I.
RUS – 1 loc: 1, 10, 24.

Buellia aethalea (Ach.) Th. Fr. –On tiles. I.
PL – 1 loc: 56.

B. erubescens Arnold – On bark. I.
PL – 1 loc: 17.

B. griseovirens (Turner & Borrer ex Sm.) Almb. – On bark of *Acer, Alnus, Betula, Caragana, Carpinus, Corylus, Fagus, Fraxinus, Padus, Populus, Quercus, Salix, Sambucus, Sorbus, Tilia*, on wood. III.
PL – 28 loc: 1-4, 7-9, 12, 14, 32-34, 37, 39, 41, 44-48, 50, 52, 53, 55, 59, 61-63; RUS – 25 loc: 2-5, 7-9, 11, 13, 14, 16-21, 23-25, 27-30, 32. 33.

Calicium glaucellum Ach. – On wood, on bark of *Quercus* and *Salix*. I.
PL – 5 loc: 5-8, 17; RUS – 4 loc: 16, 17, 21, 33.

C. salicinum Pers. – On wood and on bark of *Quercus*. I.
PL – 2 loc: 7, 14; RUS – 3 loc: 9, 15, 29.

C. viride Pers. – On bark of *Quercus*. I.
PL – 1 loc: 10; RUS – 3 loc: 15, 17, 29.

Caloplaca cerina (Ehrh. ex Hedw.) Th. Fr. – On bark of *Populus*. I.
PL – 3 loc: 9, 17, 65.

C. citrina (Hoffm.) Th. Fr. – On concrete. I.
PL – 11 loc: 10, 17, 25, 37, 38, 40, 45, 49, 57, 58, 66; RUS – 4 loc: 5, 20, 21, 26.

C. decipiens (Arnold) Blomb. & Forss. – On concrete. I.
PL – 9 loc: 10, 25, 26, 37, 38, 45, 49, 56, 57; RUS – 3 loc: 10, 21, 26.

C. flavorubescens (Huds.) J.R. Laundon – On bark of *Betula, Fraxinus, Populus*. I.
PL – 2 loc: 9, 21.

C. holocarpa (Hoffm.) Wade – On bark of *Betula Crataegus, Populus, Salix, Sambucus*, on wood, on concrete and roadside stones, on dry shoots of *Artemisia*. II.
PL – 11 loc: 10, 23, 25, 34, 37, 38, 41, 45, 49, 56, 58; RUS – 9 loc: 1, 2, 10, 11, 15, 17, 21, 22, 26.

C. obscurella (J. Lahm) Th. Fr. – On bark of *Acer*. I.
RUS – 2 loc: 8, 9.

C. saxicola (Hoffm.) Nordin – On concrete. I.
PL – 9 loc: 10, 17, 26, 37, 38, 49, 56, 57, 66; RUS – 2 loc: 1, 26.

C. velana (A. Massal.) Du Rietz var. *dolomiticola* (Hue) Clauzade & Cl. Roux – On concrete. I.
PL – 1 loc: 21.

Candelaria concolor (Dicks.) Stein – On bark of *Tilia*. I.
PL – 1 loc: 20; RUS – 1 loc: 11.

Candelariella aurella (Hoffm.) Zahlbr. –On stones, concrete, exlusively on bark of *Betula*. I.
PL – 10 loc: 10, 25, 26, 37, 38, 45, 49, 56, 58, 66; RUS – 4 loc: 1, 10, 25, 26.

C. coralliza (Nyl.) H. Magn. – On boulders and stones. I.
PL – 3 loc: 37, 56, 66.
C. reflexa (Nyl.) Lettau – On bark of *Acer, Betula, Corylus, Fraxinus, Populus, Salix, Thuja*. I.
PL – 4 loc: 14, 43, 50, 58; RUS – 12 loc: 2, 5, 8, 9, 12, 17, 20-22, 25, 26, 30.
C. vitellina (Hoffm.) Müll. Arg. – On boulders and stones. I.
PL – 9 loc: 8, 17, 23, 37, 38, 43, 49, 56, 58; RUS – 6 loc: 1, 8, 10, 12, 32, 33.
C. xanthostigma (Ach.) Lettau – On bark of *Acer, Betula, Corylus, Fraxinus, Populus, Quercus, Salix, Tilia*, rarely on wood. II.
PL – 17 loc: 1, 9, 14, 17, 19, 20, 23, 25-27, 37, 38, 41, 43, 52, 56, 58; RUS – 10 loc: 1, 4, 7-10, 13, 16, 20, 31.
Catillaria erysiboides (Nyl.) Th. Fr. – On wood. I.
PL – 1 loc: 6.
Catillaria nigroclavata (Nyl.) Schuler – On bark of *Populus*. I.
RUS – 1 loc: 15.
Catinaria atropurpurea (Schaer.) Vězda & Poelt –On bark of *Quercus*. I.
RUS – 1 loc: 12.
Cetraria aculeata (Schreb.) Ach. –On soil. I.
PL – 1 loc: 9.
C. chlorophylla (Willd.) Vain. – On bark of *Acer, Betula, Picea, Populus, Quercus*, *Tilia,* on wood. II.
PL – 20 loc: 1, 4, 6-9, 17, 19-23, 26, 32-35, 38, 39, 42; RUS – 7 loc: 1, 2, 11, 13, 16, 24, 29.
C. ericetorum Opiz – On soil. I.
PL – 1 loc: 5.
C. islandica (L.) Ach. – On soil. I.
PL – 3 loc: 5, 6, 10.
C. sepincola (Ehrh.) Ach. – On bark of *Alnus, Betula, Populus* and on wood. I.
PL – 5 loc: 5, 8, 18, 34, 50; RUS – 6 loc: 1, 2, 6, 20, 26, 29.
Cetrelia olivetorum (Nyl.) W.L. Culb. & C.F. Culb. – On bark. I.
PL – 1 loc: 7.
Chaenotheca brunneola (Ach.) Müll Arg. – On wood. I.
PL – 1 loc: 6.
Ch. chlorella (Ach.) Müll Arg. – On wood. I.
PL – 2 loc: 9, 11; RUS – 1 loc: 9.
Ch. chrysocephala (Ach.) Th. Fr. – On bark of *Alnus, Betula, Picea, Populus, Quercus, Salix, Tilia*. II.
PL – 20 loc: 1, 2, 4, 6-8, 14, 16, 18, 19, 21, 31, 32, 34, 35, 44, 45, 60, 61, 66; RUS – 10 loc: 4, 5, 15-17, 20-22, 25, 29.
Ch. ferruginea (Turner ex Sm.) Migula – On bark of *Alnus, Betula, Malus,Picea, Quercus*, *Populus, Salix*, on wood. II.

PL – 13 loc: 11, 12, 18, 21, 31, 32, 35, 37, 42, 44, 53, 60, 63; RUS – 10 loc: 3, 4, 5, 9, 16, 19, 21-23, 33.

Ch. furfuracea (L.) Tibell – On roots of *Betula* and *Picea*, on bark of *Alnus* and *Quercus*, and also on wood and on humus. I.
PL – 4 loc: 3, 12, 35, 55; RUS – 4 loc: 3, 14, 17, 33.

Ch. phaeocephala (Turner) Th. Fr. – On wood and on bark of *Tilia*. I.
PL – 2 loc: 32, 66.

Ch. trichialis (Ach.) Th. Fr. – On bark of *Alnus, Padus, Quercus, Salix*, *Tilia,* rarely on wood. I.
PL – 6 loc: 1, 3, 32, 34, 44, 45; RUS – 11 loc: 4, 6, 9, 13, 15, 17, 19, 21, 25, 29, 30.

Ch. xyloxena Nádv. – On wood. I.
PL – 4 loc: 21, 45, 47, 53. RUS – 2 loc: 6, 14.

**Chaenothecopsis nigra* Tibell –On a thallus of *Chaenotheca chlorella* and on *Stichococcus* sp. I.
RUS – 1 loc: 9.

**Chaenothecopsis pusilla* (Flörke) A. Schmidt – On wood. I.
PL – 1 loc: 20.

**Ch.* sp. – On wood. I.
RUS – 2 loc: 14, 16.

Chrysothrix candelaris (L.) J.R. Laundon – On bark of *Alnus, Quercus*. I.
PL – 3 loc: 11, 44, 47; RUS – 2 loc: 16, 23.

Cladonia arbuscula (Wallr.) Flot. em. Ruoss
subsp. *mitis* (Sandst.) Ruoss – On soil of roadside scarps. I.
PL – 6 loc: 7-10, 40, 42.

subsp. *squarrosa* (Wallr.) Ruoss – On soil. I.
PL – 3 loc: 5, 6, 10.

C. botrytes (Hagen) Willd. – On wood. I.
PL – 3 loc: 5, 6, 10.

C. cariosa (Ach.) Spreng. – On soil. I.
PL – 1 loc: 10.

C. cenotea (Ach.) Schaer. – On wood and on bark of *Betula*. II.
PL – 14 loc: 3, 5-10, 14, 18, 23, 27, 39, 42, 45; RUS – 3 loc: 6, 22, 28.

C. cervicornis (Ach.) Flot. subsp. *verticillata* (Hoffm.) Ahti – On soil. I.
PL – 2 loc: 7, 10.

C. chlorophaea (Flörke ex Sommerf.) Spreng. – On soil and on wood, on bark of *Quercus*. II.
PL – 18 loc: 1, 3, 5, 10-13, 15-17, 21, 24, 27, 42, 44, 45, 62, 63.

C. ciliata (Stirt.) Harm. var. *tenuis* (Flk.) Ahti & Lai – On soil of a roadside scarp. I.
PL – 2 loc: 5, 42.

C. coniocraea (Flörke) Vain. – On bark of *Alnus, Betula, Fraxinus, Larix, Picea, Pinus, Populus, Quercus, Salix, Sorbus*, on wood. III.

PL – 43 loc: 1-6, 8, 12-19, 21, 22, 24, 27, 29, 31-34, 39, 40, 42, 44, 48, 51-54, 57-64; RUS – 11 loc: 1, 2, 7, 13, 21-23, 26-28, 33.

C. cornuta (L.) Hoffm. – On soil of roadside scarps, exclusively on bark of *Betula*. I.
PL – 6 loc: 5, 6, 10, 40, 42, 45; RUS – 1 loc: 6.

C. crispata (Ach.) Flot. – On soil of a roadside scarp. I.
PL – 4 loc: 7-9, 40.

C. deformis (L.) Hoffm. – On soil. I.
PL – 2 loc: 6, 18.

C. digitata (L.) Hoffm. – On bark of *Alnus, Betula, Picea, Pinus*, *Quercus*, on wood. II.
PL – 27 loc: 1-6, 8-10, 14, 17, 18, 27, 31, 33, 35, 42, 44, 46, 47, 51-53, 57, 60, 61, 64; RUS – 10 loc: 1, 6, 7, 13, 16, 19, 22, 23, 28, 33.

C. fimbriata (L.) Fr. – On bark of *Alnus, Betula, Fraxinus, Picea, Pinus, Populus, Quercus, Salix*, on soil, wood, concrete and on a boulder. III.
PL – 37 loc: 2-5, 7-10, 13, 14, 17-19, 21-23, 29, 30, 33, 34, 38-46, 52, 53, 55-58, 61, 64; RUS – 20 loc: 1, 3, 4, 6, 7, 10, 13-17, 19, 21, 23, 25, 26, 29, 30, 32, 33.

C. furcata (Huds.) Schrad. – On soil of a roadside scarp and on mosses covering concrete. I.
PL – 6 loc: 5, 6, 10, 40, 42, 45; RUS – 1 loc: 23.

C. glauca Flörke – On bark of *Betula*, on a boulder and on wood. I.
PL – 5 loc: 5-7, 9, 10; RUS – 2 loc.: 2, 32.

C. gracilis (L.) Willd. – On soil of a roadside scarp. I.
PL – 8 loc: 5-7, 9, 10, 40, 42, 45.

C. macilenta Hoffm. – On bark of *Betula, Pinus* and on soil. I.
PL – 6 loc: 5, 6, 10, 33, 39, 41; . RUS – 4 loc.: 2, 7, 21, 24.

C. ochrochlora Flörke – On bark of *Acer, Alnus, Betula, Fraxinus, Picea, Pinus, Populus, Quercus, Salix, Sorbus*, on wood, soil and on a stone. III.
PL – 34 loc: 1, 2, 4, 5, 12, 14, 17, 18, 21, 24, 27-31, 35, 38-46, 48, 51-55, 60, 62, 63; RUS – 20 loc: 1-3, 6, 9, 12-16, 18-24, 27, 28, 33.

C. phyllophora Hoffm. – On soil. I.
PL – 5 loc: 5-7, 10, 40.

C. pleurota (Flörke) Schaer. – On bark of *Betula*. I.
PL – 1 loc: 43.

C. pocillum (Ach.) O.-J. Rich. –On mosses on concrete. I.
PL – 1 loc: 37.

C. pyxidata (L.) Hoffm. – On soil. I.
PL – 2 loc: 2, 15.

C. rangiferina (L.) Weber in Wigg. – On soil of a roadside scarp. I.
PL – 4 loc: 5, 6, 10, 40.

C. rei Schaer. – On soil. I.
PL – 1 loc: 10.

C. squamosa (Scop.) Hoffm. – On soil. I.
PL – 3 loc: 7, 8, 14.

C. subulata (L.) Weber in Wigg. – On soil, exclusively on mosses covering concrete. I.
PL – 11 loc: 5-10, 39, 40, 42, 45, 66; RUS – 4 loc: 17, 23, 26, 29.

**Clypeococcum hypocenomycis* D. Hawksw. – On thalli of *Hypocenomyce scalaris*. I.
PL – 2 loc: 31, 38; RUS – 2 loc.: 2, 6.

Collema flaccidum (Ach.) Ach. – On a boulder in a stream. I.
RUS – 1 loc: 33.

C. limosum (Ach.) Ach. – On soil of a roadside scarp. I.
RUS – 1 loc: 26.

Dimerella pineti (Schrad. ex Ach.) Vězda – On bark of *Alnus, Betula, Carpinus, Corylus, Fraxinus, Picea, Pinus, Quercus, Sorbus*. II.
PL – 17 loc: 9, 22, 27, 31, 34, 35, 39-42, 46, 52, 59-63; RUS – 18 loc.: 1, 3, 4, 6-9, 14-16, 18, 19, 21, 22, 26-28, 33.

Evernia prunastri (L.) Ach. – On bark of *Acer, Alnus, Betula, Carpinus, Fagus, Fraxinus, Malus, Pinus, Populus, Quercus, Salix, Sambucus, Sorbus, Tilia*, on twigs of *Lonicera xylosteum*, rarely on wood. V.
PL – 48 loc: 1, 2, 4, 6-9, 11-17, 19-24, 27, 30-34, 36-39, 41, 43-48, 50, 51, 53-55, 58-60, 62, 63, 66; RUS – 32 loc.: 1-17, 19-33.

Fellhaneropsis vezdae (Coppins & P. James) Sérus. & Coppins – On bark. I.
PL – 1 loc: 16.

Graphis scripta (L.) Ach. – On bark of *Acer, Alnus, Carpinus, Corylus, Fagus, Fraxinus, Quercus, Tilia*. II.
PL – 25 loc: 1-4, 9, 11, 12, 14-16, 21, 22, 27, 31, 32, 39, 46-48, 54, 55, 59-62; RUS – 14 loc.: 4, 8, 9, 14-18, 23, 25, 27, 28, 30, 33.

Haematomma ochroleucum (Neck.) J.R. Laundon – On bark. I.
PL – 7 loc: 2, 8, 9, 11, 12, 14, 18.

Hypocenomyce caradocensis (Leight. ex Nyl.) P. James & Gotth. Schneid. in D. Hawksw., P. James & Coppins – On wood. I.
RUS – 1 loc.: 9 (c.ap.).

H. scalaris (Ach.) Choisy – On bark of *Alnus, Betula, Picea, Pinus, Quercus, Tilia*, on wood, exclusively on a stone. III.
PL – 30 loc: 6, 8, 10, 14, 16, 21, 23, 24, 28, 30-35, 37, 38, 42-45, 50-52, 57, 60-63, 66; RUS – 20 loc: 1-3, 6, 7, 9, 11, 13, 15-17, 19-22, 24, 26, 29, 30, 32.

Hypogymnia physodes (L.) Nyl. – On bark of *Acer, Alnus, Betula, Carpinus, Corylus, Crataegus, Fagus, Fraxinus, Malus, Padus, Picea, Pinus, Populus, Prunus, Quercus, Salix, Sorbus, Tilia*, on wood. V.
PL – 59 loc: 1, 2, 4-10, 12-24, 27, 28, 29(c. ap.), 30-35, 37, 38, 39(c.ap.), 40, 41(c.ap.), 42-48, 50-55, 57-66; RUS – 33 loc.: 1(c.ap.), 2, 3(c.ap.), 4, 5, 6(c.ap.), 7-15, 16(c.ap.), 17-33.

H. tubulosa (Schaer.) Hav. – On bark of *Acer, Alnus, Betula, Carpinus, Fraxinus, Picea, Populus, Quercus, Salix, Tilia*, on wood. II.
PL – 19 loc: 4, 6-8, 20, 24, 29, 32-34, 38, 41, 43, 50, 51, 60, 63, 65, 66; RUS – 18 loc: 1-8, 10, 13, 19-21, 24-27, 32.

Hypotrachyna revoluta (Flörke) Hale – On bark of *Alnus, Carpinus*, *Padus*. I.
PL – 2 loc: 11, 27; RUS – 1 loc: 19.

**Illosporium carneum* Fr. –On a thallus of *Peltigera didactyla*. I.
RUS – 1 loc: 17.

Imshaugia aleurites (Ach.) Fricke Meyer – On bark of *Pinus*. I.
PL – 5 loc: 2, 6, 8, 27, 35; RUS – 1 loc: 19.

Lecania cyrtella (Ach.) Th. Fr. – On bark of *Acer, Populus, Quercus, Salix, Sambucus*, exclusively on dry shoots of *Artemisia*. I.
PL – 2 loc: 38, 57; RUS – 10 loc: 1, 5, 7, 15, 17, 20-22, 25, 32.

L. globulosa (Flörke) van den Boom & Sérus. – On bark of *Acer, Fraxinus, Populus, Quercus, Salix, Tilia*. II.
PL – 17 loc: 1-3, 9, 11-14, 19-24, 27, 30, 44; RUS – 14 loc: 1, 3-5, 7, 9, 12-15, 20, 24, 25, 28.

L. naegelii (Hepp) Diederich & P. Boom – On bark of *Acer, Populus, Quercus, Salix, Sambucus*. I.
PL – 1 loc: 23; RUS – 7 loc: 1, 9, 11-13, 15, 22.

Lecanora albescens (Hoffm.) Flörke – On concrete. I.
PL – 7 loc: 10, 25, 37, 38, 49, 56, 66; RUS – 4 loc: 5, 20, 21, 26.

L. allophana (Ach.) Nyl. – On bark of *Acer*. I.
PL – 3 loc: 17, 20, 25; RUS – 1 loc: 17.

L. argentata (Ach.) Malme – On bark of *Acer, Carpinus, Corylus, Fagus, Fraxinus, Padus, Populus, Quercus, Tilia*. II.
PL – 22 loc: 1-4, 7, 9, 11-16, 21, 25-27, 41, 43, 50, 56, 60, 62; RUS – 12 loc: 1, 3-5, 8, 9, 15-17, 24, 27, 30.

L. carpinea (L.) Vain. – On bark of *Acer, Alnus, Betula, Carpinus, Corylus, Fagus, Fraxinus, Malus, Populus, Pyrus, Quercus, Salix, Sambucus, Sorbus, Tilia*, on twigs of *Lonicera xylosteum*. V.
PL – 32 loc: 1, 2, 4, 9, 15, 17, 20, 23, 25-27, 29, 31-34, 37-39, 41, 43, 46, 49, 51-55, 57, 59, 64, 66; RUS – 28 loc.: 1, 2, 4-26, 28, 29, 31.

L. chlarotera Nyl. – On bark of *Acer, Betula, Caragana, Corylus, Crataegus, Fraxinus, Padus, Populus, Quercus, Salix, Sorbus, Tilia*. III.
PL – 26 loc: 7, 12, 17, 20, 23, 25-27, 29, 31, 32, 34, 37, 38, 42-44, 51-54, 56-59, 65; RUS – 23 loc: 1-13, 17-23, 26, 29, 30.

L. cfr. *compallens* van Herk & Aptroot – On bark of *Populus*. I.
RUS – 1 loc: 1.

L. conizaeoides Nyl. in Crombie – On bark of *Acer, Alnus, Betula, Malus, Picea, Pinus,*

Pyrus, Quercus, Sorbus, Tilia and on wood, exclusively on a boulder. III.
PL – 28 loc: 1, 5, 15, 17, 18, 20, 27, 28, 31-33, 37, 38, 40, 43-45, 50-52, 53, 57-60, 62, 63, 66; RUS – 18 loc: 1-3, 6, 7, 12-16, 18-22, 26, 29, 32.

L. dispersa (Pers.) Sommerf. – On concrete and small limy stones, exclusively on a boulder. I.
PL – 12 loc: 10, 17, 25, 26, 37, 38, 40, 45, 49, 56, 57, 66; RUS – 5 loc.: 1, 5, 10, 20, 26.

L. expallens Ach. – On bark of *Acer, Betula, Carpinus, Corylus, Fagus, Fraxinus, Populus, Quercus, Salix, Sorbus, Thuja, Tilia*. III.
PL – 28 loc: 1-3, 9, 16, 17, 23, 26, 32-34, 36, 38, 39, 41, 43-47, 50-52, 58, 60-63; RUS – 19 loc.: 1, 3-5, 7-11, 13, 16, 17, 20, 21, 23, 28-30, 32.

L. glabrata (Ach.) Malme – On bark of *Carpinus, Fagus, Quercus*. I.
PL – 2 loc: 46, 48; RUS – 1 loc: 18.

L. hagenii (Ach.) Ach. – On bark of *Acer, Betula, Populus, Salix, Sambucus*. I.
PL – 6 loc: 9, 17, 25, 26, 37, 38; RUS – 6 loc: 1, 8, 11, 21, 22, 30.

L. hypopta (Ach.) Vain. – On wood of spruce. I.
RUS – 1 loc: 3.

L. impudens Degel. – On bark of *Acer*. I.
RUS – 1 loc: 8.

L. intricata (Ach.) Ach. – On boulders. I.
PL – 1 loc: 49.

L. intumescens (Rebent.) Rabenh. – On bark of *Carpinus*. I.
PL – 1 loc: 60,

L. persimilis (Th. Fr.) Nyl. – On bark of *Populus*. I.
RUS – 1 loc: 21.

L. polytropa (Ehrh.) Rabenh. – On boulders and stones. I.
PL – 7 loc: 17, 37, 38, 49, 53, 58, 66; RUS – 6 loc.: 1, 8, 14, 22, 25, 32.

L. populicola (DC. in Lam. & DC.) Duby – On bark of *Populus*. I.
PL – 1 loc: 65; RUS – 1 loc: 21.

L. pulicaris (Pers.) Ach. – On bark of *Acer, Alnus, Betula, Carpinus, Corylus, Frangula, Fraxinus, Padus, Pinus, Populus, Prunus, Quercus, Salix, Sorbus, Thuja, Tilia,* on twigs of *Lonicera xylosteum*, rarely on wood. IV.
PL – 38 loc: 1-3, 6, 8-11, 14, 17-20, 24, 25, 27, 33, 34, 37, 39, 40-45, 48, 50-53, 55, 57-60, 64, 66; RUS – 25 loc.: 1, 3, 5, 7, 9, 11-16, 18-29, 32, 33.

L. rugosella (Schrad.) Zahlbr. – On bark of *Populus*. I.
RUS – 1 loc: 1.

L. rupicola (L.) Zahlbr. – On boulders. I.
PL – 3 loc: 26, 37, 49; RUS – 3 loc: 8, 30, 33.

L. saligna (Schrad.) Zahlbr. – On bark of *Acer, Quercus, Salix*, on wood and on a fruit body of *Polyporus*. I.
PL – 11 loc: 1, 7, 16, 20, 21, 23, 25, 38, 45, 55, 58; RUS – 3 loc: 1, 7, 8.

L. sambuci (Pers.) Nyl. – On bark of *Populus*. I.
RUS – 1 loc: 15.
L. subrugosa Nyl. – On bark. I.
PL – 1 loc: 12.
L. symmicta (Ach.) Ach. – On bark of *Betula, Carpinus, Fraxinus, Malus, Picea, Populus, Quercus, Salix, Sambucus*, *Tilia*, on twigs of *Lonicera xylosteum* and on wood. II.
PL – 24 loc: 7-9, 11, 12, 14, 18, 27, 28, 37, 38, 40, 41, 44, 45, 50, 51, 53, 55, 57, 58, 61, 63, 66; RUS – 9 loc.: 1-3, 6, 10, 24, 25, 29, 32.
L. umbrina (Ehrh.) A. Massal. – On bark of *Acer, Populus, Salix*, on dry shoots of *Artemisia*. I.
PL – 1 loc: 17; RUS – 7 loc: 1, 9, 11, 15, 17, 20, 22.
L. varia (Ehrh.) Ach. – On wood and on bark of *Prunus*. I.
PL – 7 loc: 19, 20, 23, 25, 26, 43, 66; RUS – 1 loc: 9.
Lecidea botryosa (Fr.) Th. Fr. – On wood. I.
PL – 1 loc: 6.
L. erythrophaea Flörke ex Sommerf. – On bark of *Fraxinus*. I.
PL – 1 loc: 27.
L. fuscoatra (L.) Ach. – On boulders. I.
PL – 4 loc: 37, 38, 39, 49.
Lecidella elaeochroma (Ach.) Choisy – On bark of *Acer, Betula, Carpinus*, *Corylus, Fagus, Fraxinus, Malus, Populus, Quercus, Salix, Sambucus, Sorbus, Syringa, Tilia*, on twigs of *Lonicera xylosteum*. IV.
PL – 47 loc: 1-4, 7, 9, 11-17, 20-24, 26-29, 31, 32, 34, 37-39, 41, 43, 44, 46-48, 50-54, 56-58, 59-62, 65; RUS – 29 loc.: 1-27, 30, 31.
L. flavosorediata (Vězda) Hertel & Leuckert – On bark of *Acer, Quercus*. I.
RUS – 2 loc.: 7, 8.
L. stigmatea (Ach.) Hertel & Leuckert – On concrete. I.
PL – 6 loc: 25, 26, 37, 38, 49, 57; RUS – 3 loc.: 1, 9, 10.
Lepraria elobata Tønsberg – On bark of *Betula, Carpinus, Corylus, Fraxinus, Picea, Quercus*. I.
PL – 1 loc: 52; RUS – 5 loc.: 3, 4, 7, 8, 19.
L. incana (L.) Ach. – On bark of *Quercus, Tilia*. I.
PL – 1 loc: 16; RUS – 2 loc: 3, 11.
L. lobificans Nyl. – On bark of *Acer, Quercus* and on wood. I.
PL – 7 loc: 1, 4, 11, 13, 20, 22, 27; RUS – 3 loc: 12, 17, 20.
L. vouauxii (Hue) R.C. Harris – On bark and on concrete. I.
PL – 1 loc: 2; RUS – 1 loc.: 20.
L. spp. –On various substrata. V.
RUS – 33. loc.: 1-33.
Leptogium biatorinum (Nyl.) Leight. – On soil. I.

RUS – 1 loc: 11.

**Leptorhaphis epidermis* (Ach. ex Hepp) Th. Fr. – On bark of *Populus*. I.
RUS – 2 loc: 15, 21.

**Licea parasitica* (Zukal) Martin – On unidentified thalli on bark of *Sambucus*. I.
RUS – 1 loc.: 1.

**Lichenoconium erodens* M.S. Christ. & D. Hawksw. in D. Hawksw. – On thalli of *Lecanora conizaeoides* and *L. varia*. I.
RUS – 2 loc: 1, 9.

**L. lecanorae* M.S. Christ. & D. Hawksw. in D. Hawksw. –On a thallus of *Lecanora chlarotera*. I.
RUS – 1 loc: 1.

Lobaria pulmonaria (L.) Hoffm. – On bark of *Acer* and *Fraxinus*. I.
PL – 10 loc: 11; and also forest sections: 27b, 84a, 86a, b, g, 87b, 88a, 143a, 145f, 146a and 199f (unpublished data acc. A. Ryś).

Loxospora elatina (Ach.) A. Massal. – On bark of *Tilia*. I.
PL – 4 loc: 2, 4, 14, 27; RUS – 1 loc: 23.

Macentina abscondita Coppins & Vězda – On bark of *Sambucus*. I.
RUS – 1 loc.: 1.

Melanelia exasperatula (Nyl.) Essl. – On bark of *Acer, Alnus, Betula, Caragana, Corylus, Crataegus, Fraxinus, Malus, Padus, Populus, Prunus, Quercus, Salix, Sambucus, Sorbus, Tilia*, rarely on boulders and on wood. II.
PL – 13 loc: 17, 23, 26, 34, 37, 38, 41, 43, 45, 50, 57, 58, 66; RUS – 17 loc.: 1-3, 7-9, 11-13, 19-21, 24, 26, 29-31.

M. fuliginosa (Fr. ex Duby) Essl. – On bark of *Acer, Alnus, Betula, Caragana, Carpinus, Corylus, Crataegus, Fagus, Fraxinus, Malus, Padus, Populus, Pyrus, Quercus, Salix, Sorbus, Tilia*, rarely on wood, exclusively on boulders lying under trees. IV.
PL – 52 loc: 1-4, 6-9, 11-22, 24, 25, 27, 28, 32, 36, 37, 39, 41, 44-48, 50-55, 58-65; RUS – 27 loc.: 1, 3-9, 11(c.ap.), 13-28, 30, 33.

M. olivacea (L.) Essl. – On bark. I.
PL – 1 loc: 8.

M. subargentifera (Nyl.) Essl. – On bark of *Acer, Fraxinus, Tilia*. I.
PL – 3 loc: 23, 43, 50; RUS – 6 loc.: 5, 8, 11, 12, 30, 31.

M. subaurifera (Nyl.) Essl. – On bark of *Corylus, Fraxinus, Salix*. I.
PL – 1 loc: 59; RUS – 3 loc.: 1, 3, 5.

Micarea botryoides (Nyl.) Coppins in D. Hawksw., P. James & Coppins – On wood. I.
RUS – 1 loc: 14.

M. denigrata (Fr.) Hedl. – On wood. I.
PL – 5 loc: 6, 8, 24, 44, 66; RUS – 1 loc: 14.

M. melaena (Nyl.) Hedl. – On wood. I.
PL – 1 loc: 2.

M. misella (Nyl.) Hedl. – On wood, exclusively on bark of *Quercus*. I.

RUS – 3 loc.: 3, 14, 17.

M. nitschkeana (J. Lahm ex Rabenh.) Harm. – On bark of *Betula, Carpinus, Tilia* and on wood. I.
PL – 1 loc: 52; RUS – 3 loc.: 1, 3, 19.

M. prasina Fr. – On bark of *Alnus, Betula, Carpinus, Corylus, Picea, Pinus, Populus, Quercus, Salix, Sorbus, Tilia*, on wood. I.
PL – 5 loc: 22, 39, 52, 53, 59; RUS – 13 loc.: 1, 3, 7, 8, 12, 14, 18, 19, 21, 23, 27, 28, 33.

Mycoblastus fucatus (Stirt.) Zahlbr. – On bark of *Acer, Alnus, Betula, Carpinus, Corylus, Fraxinus, Populus, Pyrus, Quercus, Sorbus, Tilia*. II.
PL – 13 loc: 16, 27, 32, 37, 39, 41, 44, 52, 53, 55, 58, 59, 63; RUS – 13 loc.: 1, 5, 8, 9, 13, 16, 18-23, 28.

Myxobilimbia sabuletorum (Schreb.) Hafellner – On concrete and on mosses growing on concrete. I.
PL – 2 loc: 31, 66; RUS – 6 loc.: 6, 12, 20-23.

Neofuscelia loxodes (Nyl.) Essl. – On boulders. I.
PL – 2 loc: 7, 37; RUS – 3 loc.: 30, 32. 33.

Ochrolechia alboflavescens (Wulfen) Zahlbr. – On bark of *Betula*. I.
PL – 1 loc: 1.

O. androgyna (Hoffm.) Arnold – On bark of *Betula, Quercus*. I.
PL – 12 loc: 4, 7, 11, 12, 19, 27, 31, 32, 44, 45, 47, 62.

O. microstictoides Räsänen – On bark of *Acer, Alnus*. I.
PL – 9 loc: 1, 6, 7, 14-16, 19, 46, 54; RUS – 1 loc: 8.

O. subviridis (Hoeg) Erichsen – On bark. I.
PL – 1 loc: 10.

O. turneri (Sm. in Sm. & Sowerb.) Hasselrot – On bark. I.
PL – 1 loc: 6.

Opegrapha rufescens Pers. – On bark of *Acer, Quercus*. I.
PL – 7 loc: 2, 9, 12, 14, 16, 21, 62; RUS – 4 loc.: 5, 9, 13, 20.

O. varia Pers. – On bark of *Acer, Fraxinus*. I.
PL – 7 loc: 1, 9, 11-13, 19, 23; RUS – 5 loc.: 3, 9, 13, 20, 25.

O. viridis Pers. – On bark. I.
PL – 3 loc: 11, 13, 14.

O. vulgata Ach. – On bark. I.
PL – 4 loc: 2, 3, 12, 22.

Pachyphiale fagicola (Hepp in Arnold) Zwackh – On bark of *Acer*. I.
PL – 1 loc: 19; RUS – 1 loc: 20.

Parmelia saxatilis (L.) Ach. – On bark of *Betula, Fraxinus*. I.
PL – 4 loc: 7, 14, 30, 43.
On bark of *Quercus*. I. RUS – 1 loc.: 18.

P. submontana Nádv. ex Hale – On bark of *Acer, Carpinus, Fraxinus, Padus, Populus, Quercus*. I.
PL – 6 loc: 29, 30, 31, 34, 52, 59; RUS – 5 loc.: 6, 8, 9, 19, 24.

P. sulcata Taylor – On bark of *Acer, Alnus, Betula, Caragana, Carpinus, Corylus, Crataegus, Fagus, Fraxinus, Malus, Padus, Populus, Prunus, Quercus, Salix, Sambucus, Sorbus, Thuja, Tilia*, on twigs of *Lonicera xylosteum*, on wood, rarely on boulders. V.
PL – 53 loc: 1-4, 6-9, 11-17, 19, 20, 22-28, 30-34, 37-39, 41, 43-48, 50-53, 55-60, 62-66; RUS – 32 loc.: 1, 2, 3(c.ap.), 4, 5(c.ap.), 6, 7, 8(c.ap.), 9(c.ap.), 10(c.ap.), 11, 12(c.ap.), 13-19, 20(c.ap.), 21-24, 25(c.ap.), 26-29, 30(c.ap.), 31, 32.

Parmeliopsis ambigua (Wulfen in Jacq.) Nyl. – On bark of *Alnus, Betula, Populus, Quercus, Tilia*, on wood, exclusively on stones. II.
PL – 24 loc: 4-8, 10, 12, 14, 17, 18, 21, 23, 30-33, 39, 46, 50-53, 57, 60; RUS – 6 loc.: 1, 2, 6, 9, 18, 23.

Peltigera canina (L.) Willd. – On soil. I.
PL – 2 loc: 40, 41.

P. didactyla (With.) J.R. Laundon – On soil and on wood. I.
PL – 13 loc: 5-7, 9, 10, 17, 39-41, 49, 57, 58, 66; RUS – 3 loc.: 12, 17, 25.

P. neckeri Hepp ex Müll. Arg. – On mosses covering boulders. I.
PL – 2 loc: 17, 29.

P. polydactylon (Necker) Hoffm. – On mosses growing on tree trunks. II.
RUS – 9 loc: 2, 3, 12, 15, 16, 18, 21, 25, 33.

P. ponojensis Gyeln. – On soil. I.
PL – 1 loc: 24.

P. praetextata (Flk. ex Sommerf.) Zopf –On mosses growing on wood and boulders and on bark of *Fraxinus, Salix, Tilia, Ulmus*. II.
PL – 13 loc: 1-3, 11, 12, 21, 28, 36, 41, 44, 47, 54, 60; RUS – 7 loc.: 16, 19, 22-24, 27, 28.

P. rufescens (Weiss) Humb. – On soil, rarely on mosses covering concrete. I.
PL – 11 loc: 5, 6, 10, 17, 36, 37, 38, 40, 49, 57, 66; RUS – 6 loc.: 2, 12, 14, 17, 26, 32.

Pertusaria albescens (Huds.) Choisy & Werner in Werner – On bark of *Acer, Betula, Fraxinus, Populus, Quercus*. II.
PL – 20 loc: 9, 12-15, 17, 19-23, 26, 30, 31, 38, 50, 51, 56, 58, 62; RUS – 2 loc.: 9, 13.

P. alpina Hepp ex Ahles – On bark. I.
PL – 1 loc: 14.

P. amara (Ach.) Nyl. – On bark of *Acer*, *Alnus, Betula, Carpinus, Fagus, Fraxinus, Picea, Populus, Quercus, Salix, Sorbus, Tilia*. IV.
PL – 42 loc: 1-4, 6-9, 11-17, 20-22, 26, 27, 30-34, 36, 43, 44, 46-48, 50, 51, 54, 56, 58-64; RUS – 22 loc.: 2, 3, 5-9, 11, 13-19, 22-24, 27, 29, 30, 33.

P. coccodes (Ach.) Nyl. – On bark of *Acer, Betula, Carpinus, Fagus, Quercus, Salix, Tilia*. II.

PL – 20 loc: 1, 2, 4, 7-9, 11-16, 19, 22, 26, 27, 31, 38, 60, 62; RUS – 8 loc.: 3, 5, 13, 16-18, 20, 29.

P. coronata (Ach.) Th. Fr. – On bark. I.
PL – 1 loc: 11.

P. hemisphaerica (Flörke) Erichsen – On bark of *Acer, Alnus, Carpinus, Quercus, Tilia, Ulmus*. I.
PL – 11 loc: 2, 4, 11-13, 14, 16, 17, 21, 60, 62; RUS – 6 loc.: 8, 9, 15, 16, 28, 29.

P. leioplaca DC. in Lam. & DC. – On bark of *Acer, Carpinus, Corylus, Fraxinus, Tilia*. I.
PL – 9 loc: 1-3, 11, 12, 16, 27, 54, 60; RUS – 8 loc.: 3, 8, 9, 14, 16, 17, 27, 28.

P. pertusa (L.) Tuck. – On bark of *Carpinus*. I.
PL – 2 loc: 14, 21; RUS – 1 loc.: 16.

P. pupillaris (Nyl.) Th. Fr. – On bark of *Alnus, Carpinus, Corylus, Fraxinus, Quercus, Tilia*. I.
PL – 4 loc: 4, 14, 18, 21; RUS – 9 loc.: 7, 9, 14, 16, 18, 23, 24, 28, 33.

Phaeophyscia nigricans (Flörke) Moberg – On concrete and on bark of *Acer, Betula* and *Populus*. I.
PL – 5 loc: 9, 10, 25, 49, 65; RUS – 3 loc.: 8, 10, 31.

Ph. orbicularis (Neck.) Moberg – On concrete, boulders and on wood, on bark of *Acer, Betula, Fraxinus, Malus, Populus, Salix, Sambucus, Thuja* and also on dry shoots of *Artemisia*. II.
PL – 21 loc: 9, 10, 14, 17, 19, 20, 23, 25, 26, 31, 37, 38, 40, 43, 45, 49, 50, 56, 57 (c.ap.), 58, 66; RUS – 15 loc.: 1, 2, 5(c.ap.), 8, 10, 11, 13, 17, 20-22, 25(c. ap.), 26, 30, 31.

Phlyctis agelaea (Ach.) Flot. – On bark. I.
PL – 1 loc: 6.

Ph. argena (Ach.) Flot. – On bark of *Acer, Aesculus, Alnus, Betula, Carpinus, Corylus, Crataegus, Fagus, Fraxinus, Malus, Padus, Pinus, Populus, Pyrus, Quercus, Salix, Sambucus, Sorbus, Thuja, Tilia, Ulmus*, on twigs of *Lonicera xylosteum*, exclusively on boulders lying under trees. IV.
PL – 45 loc: 1-4, 7-9, 12-17, 20-32, 34, 36-39, 41-48, 50-64, 66; RUS – 31 loc.: 1-9, 11-30, 32, 33.

Physcia adscendens (Fr.) Olivier – On bark of *Acer, Alnus, Betula, Caragana, Fraxinus, Malus, Populus, Prunus, Quercus, Salix, Sambucus, Sorbus*, on concrete. II.
PL – 17 loc: 10, 17, 20, 25, 31, 34, 37, 38, 41, 43, 45, 49, 50 (c.ap.), 56-58, 65; RUS – 11 loc.: 1, 2, 5, 8, 10, 16, 17, 22, 25, 26, 30.

Ph. aipolia (Ehrh. ex Humb.) Fürnrohr – On bark of *Acer*. I.
PL – 2 loc: 20, 21; RUS – 1 loc.: 8.

Ph. caesia (Hoffm.) Fürnrohr – On concrete, stones, boulders, exclusively on bark of *Betula* and on iron frames. II.
PL – 13 loc: 10, 17, 23, 25, 26, 34, 37, 38, 43, 45, 49 (c.ap.), 57, 66; RUS – 8 loc.: 1, 8-12, 17, 26.

Ph. dubia (Hoffm.) Lettau – On boulders, concrete, on bark of *Caragana, Fraxinus,*

Populus and *Salix*. I.
PL – 8 loc: 17, 26, 37, 38, 41, 49, 50, 65; RUS – 3 loc.: 8, 19, 26.

Ph. stellaris (L.) Nyl. – On bark of *Acer, Fraxinus, Populus, Quercus, Salix, Sorbus*. II.
PL – 8 loc: 17, 25, 26, 38, 41, 53, 57, 65; RUS – 16 loc.: 1, 2, 4, 8, 9, 11, 12, 17, 19, 21, 22, 25, 26, 29, 31, 32.

Ph. tenella (Scop.) DC. in Lam. & DC. – On bark of *Acer, Betula, Caragana, Carpinus, Corylus, Crataegus, Fraxinus, Malus, Populus, Quercus, Salix, Sambucus, Thuja, Tilia*, rarely on concrete and on boulders. III.
PL – 21 loc: 8, 10, 17, 19, 20, 25, 26, 31, 34(c.ap.), 37, 38, 40, 41(c.ap.), 43(c.ap.), 49, 50(c.ap.), 53, 56-58, 65; RUS – 24 loc.: 1-13, 16, 17, 19-22, 24-26, 30-32.

Physconia distorta (With.) J.R. Laundon – On bark of *Acer, Populus*. I.
PL – 2 loc: 17, 25; RUS – 2 loc.: 2, 17.

Ph. enteroxantha (Nyl.) Poelt – On bark of *Acer, Fraxinus, Malus, Populus, Salix, Tilia*, rarely on wood. II.
PL – 13 loc: 9, 14, 15, 17, 20, 23, 25, 26, 38(c.ap.), 41, 43(c.ap.), 56, 58; RUS – 19 loc.: 1, 2, 4, 5, 7, 8(c.ap.), 9, 11(c.ap.), 12, 13, 16, 17, 19-21, 25, 26, 30, 31.

Ph. grisea (Lam.) Poelt – On bark. I.
PL – 1 loc: 16.

Ph. perisidiosa (Erichsen) Moberg – On bark of *Acer, Fraxinus, Quercus*. I.
PL – 7 loc: 9, 14, 17, 20, 25, 56, 58; RUS – 5 loc.: 5, 17, 20, 25, 30.

Placynthiella dasaea (Stirt.) Tønsberg – On soil and on bark of *Betula*. I.
PL – 2 loc: 52, 64.

P. icmalea (Ach.) Coppins & P. James – On wood and on bark of *Betula* and *Picea*. I.
PL – 7 loc: 2, 6, 15, 38, 43, 52, 58; RUS – 4 loc.: 2-4, 17.

P. oligotropha (Vain.) Coppins & P. James – On soil. I.
PL – 2 loc: 3, 39.

P. uliginosa (Schrad.) Coppins & P. James – On bark of *Betula, Pinus*, on wood and on soil. I.
PL – 3 loc: 10, 40, 42; RUS – 4 loc.: 10, 12, 23, 29.

Placynthium nigrum (Huds.) Gray – On concrete. I.
PL – 1 loc: 37.

Platismatia glauca (L.) W.L. Culb. & C.F. Culb. – On bark of *Acer, Alnus, Betula, Carpinus, Fraxinus, Malus, Picea, Pinus, Populus, Prunus, Quercus, Salix, Sorbus, Tilia*, on wood. IV.
PL – 56 loc: 1-8, 11, 13, 15, 17-22, 24, 27, 28, 30-39, 41-47, 50-52, 58, 60, 62-64, 66; RUS – 25 loc.: 1-6, 8, 10, 12-16, 18-24, 28-30, 32, 33.

Pleurosticta acetabulum (Neck.) Elix & Lumbsch – On bark of *Acer, Fraxinus, Populus, Tilia*. I.
PL – 6 loc: 14, 23, 27, 38, 43, 56; RUS – 5 loc.: 5, 7, 10, 20, 31.

Porpidia crustulata (Ach.) Hertel & Knoph – On stones. I.

PL – 4 loc: 10, 32, 57, 58; RUS – 6 loc.: 14, 15, 17, 26, 27, 32.

P. soredizodes (Lamy) Schwab – On stones. I.

PL – 3 loc: 29, 58, 66.

P. tuberculosa (Sm.) Hertel & Knoph – On boulders and stones. I.

PL – 2 loc: 2, 10.

Protoblastenia rupestris (Scop.) J. Steiner – On a boulder. I.

PL – 1 loc: 25.

Protoparmelia badia (Hoffm.) Hafellner – On boulders. I.

RUS – 1 loc.: 8.

Protoparmeliopsis muralis (Schreb.) Choisy – On stones, boulders and on concrete. I.

PL – 11 loc: 17, 23, 25, 26, 29, 37, 38, 49, 56, 57, 66; RUS – 7 loc.: 8-10, 12, 26, 30, 32.

Pseudevernia furfuracea (L.) Zopf – On bark of *Acer, Alnus, Betula, Fraxinus, Picea, Pinus, Quercus, Salix, Tilia*, on wood. III.

PL – 36 loc: 1, 3-10, 15-20, 22, 24, 26, 31-35, 38, 39, 42-45, 47, 50, 51, 55, 58, 63, 65; RUS – 23 loc.: 1-4, 6(c.ap.), 7, 8, 10, 11, 13, 15-19, 21, 23-27, 29, 30.

Pseudosagedia aenea (Wallr.) Hafellner & Kalb – On bark of *Acer, Betula, Carpinus, Corylus, Fraxinus, Sorbus, Tilia*. I.

PL – 7 loc: 28, 29, 31, 44, 51, 55, 59; RUS – 10 loc.: 3, 4, 9, 16, 22, 23, 26, 28, 30, 33.

P. chlorotica (Ach.) Hafellner & Kalb – On a boulder in a stream. I.

RUS – 1loc.: 14.

Psilolechia clavulifera (Nyl.) Coppins – On soil of a roadside scarp. I.

PL – 1 loc: 64.

**Pycnidiella resinae* (Fr. ex Fr.) Höhnel (anamorf **Sarea resinae* (Fr. ex Fr.) Kuntze) – On congealed spruce resin. I.

PL – 2 loc: 30, 42 (anamorph), 44, 59 (anamorph and teleomorph).

Pycnora sorophora (Vain.) Hafellner – On wood. I.

PL – 1 loc: 57.

Pyrenula nitida (Weigel) Ach. – On bark of *Carpinus*. I.

PL – 4 loc: 13, 14, 27, 60.

P. nitidella (Flörke in Schaer.) Müll Arg. – On bark of *Carpinus*. I.

PL – 2 loc: 11, 27.

Ramalina calicaris (L.) Fr. – On bark of *Salix*. I.

RUS – 1 loc.: 1.

R. farinacea (L.) Ach. – On bark of *Acer, Alnus, Betula, Carpinus, Fagus, Fraxinus, Populus, Quercus, Salix, Thuja, Tilia,* on twigs of *Lonicera xylosteum*. IV.

PL – 37 loc: 1, 3, 4, 13, 14, 15, 17, 19, 22, 24, 30-32, 34 (c.ap.), 36-39, 41, 43, 44, 46-48, 51, 52, 54-59, 62-66; RUS – 30 loc.: 1, 2(c.ap), 3(c.ap.), 4-15, 17-21, 23-27, 29-33.

R. fastigiata (Pers.) Ach. – On bark of *Acer, Fraxinus, Populus, Salix, Tilia*. II.

PL – 10 loc: 14, 17, 25, 26, 38, 41, 43, 52, 56, 58; RUS – 14 loc.: 1-3, 5, 7, 8, 11, 17,

19-21, 25, 30, 31.

R. fraxinea (L.) Ach. – On bark of *Acer, Fraxinus, Populus, Salix, Tilia*. II.
PL – 16 loc: 9, 14, 17, 19, 20, 23, 25, 26, 37, 38, 41, 43, 50, 56-58; RUS – 14 loc.: 1, 2, 5, 8, 11, 12, 16, 17, 19-21, 25, 30, 31.

R. pollinaria (Westr.) Ach. – On bark. I.
PL – 13 loc: 2, 4, 8, 9, 12, 14, 15, 17, 19, 20, 21, 25, 26.

Rhizocarpon distinctum Th. Fr. – On boulders. I.
PL – 3 loc: 7, 17, 26.

Rh. geographicum (L.) DC. – On boulders. I.
PL – 1 loc: 66.

Rh. obscuratum (Ach.) A. Massal. – On boulders. I.
PL – 1 loc: 16.

Rh. sp. – On boulders. I.
PL – 5 loc: 37, 38, 49, 56, 66; RUS – 5 loc.: 1, 10, 12, 26, 32.

Rinodina efflorescens Malme – On bark of *Tilia*. I.
RUS – 1 loc.: 23.

R. pyrina (Ach.) Arnold – On bark. I.
PL – 1 loc: 23.

Ropalospora viridis (Tønsberg) Tønsberg – On bark of *Acer, Alnus, Carpinus, Corylus, Fraxinus, Populus, Quercus, Sorbus, Tilia*. II.
PL – 4 loc: 32, 39, 48, 59; RUS – 13 loc.: 6, 14, 16-19, 21, 23-25, 27, 28, 33.

Sarcogyne regularis Körb. – On concrete and small limy stones. I.
PL – 4 loc: 25, 37, 49, 66; RUS – 2 loc.: 25, 26.

Schismatomma decolorans (Turner & Borrer ex Sm.) Clauzade & Vězda in Vězda – On bark. I.
PL – 1 loc: 22.

Scoliciosporum chlorococcum (Graeve ex Stenham.) Vězda – On bark of *Acer, Betula, Carpinus, Quercus, Salix, Sorbus*, on wood. I.
PL – 11 loc: 1, 2, 8, 13, 14, 18, 19, 22, 23, 25, 27; RUS – 5 loc.: 1, 3, 9, 19, 20.

S. pruinosum (P. James) Vězda – On bark of *Quercus*. I.
RUS – 1 loc.: 3.

S. sarothamni (Vain.) Vězda – On bark of *Betula*. I.
RUS – 1 loc.: 1.

S. umbrinum (Ach.) Arnold – On boulders and stones. I.
PL – 3 loc: 7, 17, 37.

Strangospora moriformis (Ach.) B. Stein – On wood. I.
PL – 2 loc: 6, 10.

S. ochrophora ((Nyl.) R.A. Anderson – On bark of *Sambucus*. I.
RUS – 1 loc.: 1.

Tephromela atra (Huds.) Hafellner – On boulders. I.

PL – 3 loc: 11, 37, 43; RUS – 2 loc.: 19, 33.

Thelocarpon laureri (Flot.) Nyl. – On wood and on stones. I.
PL – 3 loc: 19, 34, 53.

Thelomma ocellatum (Körb.) Tibell – On wood. I.
RUS – 1 loc.: 9.

Thelotrema lepadinum (Ach.) Ach. – On bark of *Carpinus*. I.
PL – 2 loc: 27, 60.

Trapelia obtegens (Th. Fr.) Hertel –On stones. I.
PL – 1 loc: 29.

Trapeliopsis flexuosa (Fr.) Coppins & P. James – On bark of *Betula, Pinus, Quercus*, on wood, exclusively on a fruit body of *Fomes*. I.
PL – 13 loc: 1, 2, 5, 6, 10, 17, 19, 38, 39, 43, 45, 50, 57; RUS – 16 loc.: 3, 6, 7, 9, 12-14, 16-19, 21-24, 32.

T. granulosa (Hoffm.) Lumbsch – On wood and on bark of *Betula* and *Picea*. II.
PL – 18 loc: 5-7, 9, 10, 18, 33, 35, 40, 42, 43, 45, 50, 52, 57, 58, 64, 66; RUS – 3 loc.: 1, 3, 7.

**Tremella cladoniae* Diederich & M.S. Christ. – On podetia of *Cladonia* sp. I.
RUS – 1 loc.: 23.

**T. lichenicola* Diederich – On thalli of *Mycoblastus fucatus*. I.
RUS – 2 loc.: 21, 28.

Umbilicaria polyphylla (L.) Baumg. – On boulders. I.
PL – 1 loc: 5.

Usnea filipendula Stirt. – On bark of *Betula, Fraxinus, Quercus*. I.
PL – 11 loc: 2, 3, 6, 7, 9, 19, 33, 42, 45, 47, 63; RUS – 8 loc.: 2, 3, 6, 13, 16, 22, 24, 29.

U. fulvoreagens (Räsänen) Räsänen – On bark of *Betula*. I.
RUS – 1 loc.: 16.

U. hirta (L.) Weber ex F.H. Wigg. – On bark of *Alnus, Betula, Pinus, Prunus, Quercus*. I.
PL – 12 loc: 1, 7-9, 18, 20, 23, 32-34, 43, 45; RUS – 2 loc.: 7, 23.

U. subfloridana Stirt. – On bark of *Betula, Fraxinus, Quercus, Salix*, on wood. I.
PL – 9 loc: 4, 6, 7, 12, 19, 34, 42, 45, 63; RUS – 5 loc.: 2, 3, 16, 24, 29.

Verrucaria muralis Ach. – On concrete. I.
PL – 1 loc: 13.

V. nigrescens Pers. – On concrete. I.
PL – 4 loc: 10, 17, 25, 26.

Verrucaria xyloxena Norman – On soil in a gravel-pit. I.
RUS – 1 loc.: 17.

V. sp. – On concrete and stones. I.
PL – 7 loc: 38, 40, 45, 49, 53, 57, 58; RUS – 7 loc.: 9, 14, 17, 21, 24, 25, 26.

**Vouauxiella lichenicola* (Lindsay) Petr. & Syd. – On apothetia of *Lecanora chlarotera*

and *L. rugosella*. I.
RUS – 2 loc.: 1, 11.

Vulpicida pinastri (Scop.) J.E. Mattsson & M.J. Lai – On bark of *Betula, Fraxinus, Populus, Quercus*, on wood and on a boulder in a forest. II.
PL – 20 loc: 1, 3-5, 8-10, 12, 16, 19, 20, 23, 24, 30, 33, 39, 41, 50-52;. RUS – 2 loc.: 1, 32.

Xanthoparmelia conspersa (Ach.) Hale – On boulders. I.
PL – 5 loc: 5, 7, 26, 37, 66; RUS – 2 loc.: 9, 30.

Xanthoria candelaria (L.) Th. Fr. – On bark of *Betula, Quercus, Tilia*. I.
PL – 5 loc: 20, 26, 38, 43, 58; RUS – 2 loc.: 1, 11.

X. elegans (Link.) Th. Fr. – On concrete. I.
PL – 6 loc: 25, 26, 37, 38, 49, 57; RUS – 1 loc.: 10.

X. fulva (Hoffm.) Poelt & Petutschnig – On bark of *Fraxinus*. I.
PL – 1 loc: 25.

X. parietina (L.) Th. Fr. – On bark of *Acer, Betula, Crataegus, Fraxinus, Malus, Pinus, Populus, Quercus, Salix, Sambucus, Sorbus, Syringa*, *Thuja*, on concrete, boulders, on dry shoots of *Artemisia* and on wood. III.
PL – 29 loc: 1, 9, 10, 14, 17, 19-21, 23, 25-28, 31, 34, 37-39, 41, 43, 45, 49, 50, 53, 56-58, 63, 65; RUS – 25 loc.: 1, 2, 4-7, 10-13, 15-19, 21-23, 25-27, 29-32.

X. polycarpa (Hoffm.) Rieber – On bark of *Acer, Alnus, Betula, Caragana, Corylus, Crataegus, Fraxinus, Malus, Populus, Prunus, Quercus, Salix, Sambucus, Sorbus, Syringa, Thuja, Tilia*, on twigs of *Euonymus europaeus* and *Lonicera xylosteum*, rarely on stones, wood and on dry shoots of *Artemisia campestris*. III.
PL – 25 loc: 5, 7, 20, 23, 25, 26, 31, 32, 34, 37-39, 41-43, 45, 49, 50, 53, 56-58, 63, 64, 66; RUS – 23 loc.: 1, 2, 5, 6, 9, 11, 12, 14-17, 19-22, 24-26, 28-32.

5. Summary

In Romincka Primeval Forest 275 lichen species have been found, and in the Polish part 241 taxa occur, while in the Russian – 182. In the greatest number, following genera are represented: *Lecanora* (30 species) and *Cladonia* (26). The largest number of species (181) has been recorded on tree bark, considerably fewer on rock substrata (77) and on lignum (68). The most diverse lichen communities develop on oaks *Quercus robur* and *Q. rubra* (82 species), birches *Betula pendula* (72), maples *Acer platanoides* (70), on an ash *Fraxinus excelsior* (66) and on poplars *Populus* spp. (65) (Table 2).

In Romincka Primeval Forest, many interesting lichen species occur. Among others, as many as 47 species protected by law have been found. Among them there are rare and vanishing macrolichens such as: *Anaptychia ciliaris, Bryoria implexa, Cetrelia olivetorum, Hypotrachyna revoluta, Lobaria pulmonaria, Parmelia submontana, Ramalina calicaris* and *Usnea fulvoreagens*. Noteworthy are also other very rare species: *Anisomeridium polypori, Caloplaca obscurella, Collema flaccidum, Fellhaneropsis vezdae, Lecanora hypopta, L. persimilis, L. sambuci, Lecidea botryosa, Psilolechia clavulifera, Rinodina efflorescens, Scoliciosporum pruinosum, S. sarothamni* and *Strangophora ochrophora*.

In the studied area, 21 lichen species – bioindicators of lowland old-growth forests in Poland have been recorded. These are stenotopic, mostly epiphytic lichens and their occurrence depend on the presence of specific niches characteristic for the least disturbed forest environment. They grow primarily on old trees in large forest complexes. Such a great number of indicator species testifies to ecological continuity of forests in Romincka Primeval Forest.

From among the whole lichen biota of the Primeval Forest, 104 species (37.8% of the total) are included on „Red List of extinct and threatened lichens in Poland" (Cieśliński et al. 2003), and only 64 (23.3%) – on „Red List of threatened lichens in North-Eastern Poland" (Cieśliński 2003b) (Table 4). This disproportion, i.e. nearly twice a smaller number of species threatened in the region than in Poland testifies to good conditons for lichens in this part of the country.

6. References

Barkman J.J. 1969. Phytosociology and ecology of cryptogamic epiphytes. – Van Gorcum & Comp., Assen, 628 pp.

Bielczyk U. 2003. The lichens and allied fungi of the Polish Western Carpathians. – In: Bielczyk, U. (ed.), The lichens and allied fungi of the Polish Carpathians. W. Szafer Institute of Botany, Polish Academy of Sciences, Kraków, p. 23-232.

Bogacki M. 1985. Budowa geologiczna i ukształtowanie powierzchni. – In: Święcicka K. (ed.), Województwo suwalskie, studia i materiały. 1: 11-59. Ośrodek Badań Naukowych, Białystok.

Ceynowa-Giełdon M. 2001. Kalcyfilne porosty naziemne na Kujawach. – Wyd. Uniwersytetu Mikołaja Kopernika, Toruń, p. 5-44.

Cieśliński S. 2003a. Atlas rozmieszczenia porostów (Lichenes) w Polsce północno-wschodniej. – Phytocoenosis 15 (N.S.), Suppl. Cartographiae Geobotanicae 15: 1-430.

Cieśliński S. 2003b. Czerwona lista porostów zagrożonych w Północno-Wschodniej Polsce. – Monographiae Botanicae 91: 91-106.

Cieśliński S. & Czyżewska K. 1992. Problemy zagrożenia porostów w Polsce. – Wiadomości Botaniczne 36.1-2: 5-17.

Cieśliński S., Czyżewska K. & Fabiszewski J. 1986. Czerwona lista porostów zagrożonych w Polsce. – In: Zarzycki, K. & Wojewoda, W. (ed.), Czerwona lista roślin zagrożonych w Polsce. PWN, Warszawa: 82-107.

Cieśliński S., Czyżewska K. & Fabiszewski J. 1992. Czerwona lista porostów wymarłych i zagrożonych w Polsce. – In: Zarzycki K., Wojewoda W., Heinrich Z. (ed.). Lista roślin zagrożonych w Polsce (wyd. 2). Instytut Botaniki im. W. Szafera, PAN, Kraków: 57-74.

Cieśliński S., Czyżewska K. & Fabiszewski J. 2003. Czerwona lista porostów wymarłych i zagrożonych w Polsce. – Monographiae Botanicae 91: 13-49.

Cieśliński S. & Fałtynowicz W. 1993. From editors. – In: Cieśliński S. & Fałtynowicz W. (ed.), Atlas of the geographical distribution of lichens in Poland. 1. W. Szafer Institute of Botany, Polish Academy of Sciences, Krakow, p. 7-9.

Cieśliński S. & Tobolewski Z. 1989. Porosty Polski północno-wschodniej. I. – Acta Mycologica 25.1: 57-100.

Czernicka-Chodkowska D. 1977-1983. Głazy narzutowe w Polsce. Katalog. – Wydawnictwa Geologiczne, Warszawa: I i II (1977), III (1980), IV (1983).

Czyżewska K. 1976. Dissapearance of epiphytic lichens under the influence of antropogenic degenerations of broadleaved forests in the Pilicka Forest complex. – Phytocoenosis 5.3-4: 363-375.

Czyżewska K. & Cieśliński S. 2003. Porosty – wskaźniki niżowych lasów puszczańskich. –Monographiae Botanicae 91: 223-239.

Degórski M. 1984. Porównanie stopnia kontynentalizmu w Polsce określonego metodami klimatologiczną i bioindykacyjną. – Przegląd Geograficzny 56.3-4: 55-71.

Dietrich M. & Scheidegger C. 1996. The importance of sorediate crustose lichens in the epiphytic lichen flora of the Swiss Plateau and the Pre-Alps. – Lichenologist 28.3: 245-256.

Diederich P. & Sérusiaux E. 2000. The lichens and lichenicolous fungi of Belgium and Luxembourg. An annotated checklist. – Musée National d'Histoire Naturelle, Luxembourg, 207 pp.

Fabiszewski J., Brej T. & Bielecki K. 1983. Fitoindykacja wpływu huty miedzi na środowisko biologiczne. – Prace Wrocławskiego Towarzystwa Naukowego, B 207: 5-109.

Faliński J.B. & Tomaszewicz H. 1985. Roślinność. – In: Stasiak A. (ed.), Województwo suwalskie, studia i materiały. 1: 139-168. Ośrodek Badań Naukowych, Białystok.

Fałtynowicz W. 1992. The lichens of Western Pomerania. An ecogeographical study. – Polish Bot. Studies 4: 1-183.

Fałtynowicz W. 1993. *Parmelia submontana* Njdv. ex Hale. – In: Cieśliński S. & Fałtynowicz W. (eds.), Atlas of geographical distribution of lichens in Poland. 1: 41-45. W. Szafer Institute of Botany, Polish Academy of Science, Kraków.

Fałtynowicz W. 1994: Propozycja klasyfikacji porostów synantropijnych. Wprowadzenie do dyskusji. – Arboretum Bolestraszyce 2: 21–30.

Fałtynowicz W. 1995. Wykorzystanie porostów do oceny zanieczyszczenia powietrza. Zasady, metody, klucze do oznaczania wybranych gatunków. – Fundacja Centrum Edukacji Ekologicznej Wsi, Krosno, 141 pp.

Fałtynowicz W. 1997. Zagrożenia porostów i problemy ich ochrony. – Przegląd Przyrodniczy 8.3: 35-46.

Fałtynowicz W. 1999. *Collema flaccidum* (Ach.) Ach. – In: Cieśliński S. & Fałtynowicz W. (eds.), Atlas of geographical distribution of lichens in Poland 2: 13-17. W. Szafer Institute of Botany, Polish Academy of Sciences, Kraków.

Fałtynowicz W. 2003a. The lichens, lichenicolous and allied fungi of Poland – an annotated checklist. – W. Szafer Institute of Botany, Polish Academy of Sciences, Kraków, 435 pp.

Fałtynowicz W. 2003b. Różnorodność gatunkowa – porosty. – In: Andrzejewski R. & Weigle A. (ed.), Różnorodność biologiczna Polski. Narodowa Fundacja Ochrony Środowiska, Warszawa, p. 29-35.

Fałtynowicz W. 2004. Rekolonizacja przez porosty – optymistyczny trend w stanie środowiska. – In: Kejna M. & Uscka J. (ed.), Zintegrowany Monitoring Środowiska Przyrodniczego: Funkcjonowanie i monitoring geoekosystemów w warunkach narastającej antropopresji. Biblioteka Monitoringu Środowiska, Wyd. UMK, Toruń, p. 321-325.

Ferry B.W. & Lodge E. 1996. Distribution and succession of lichens associated with *Prunus spinosa* at Dungeness, England. – Lichenologist 28.2: 129-143.
Halonen P., Hyvarinen M. & Kauppi M. 1991. The epiphytic lichen flora on conifers in relation to climate in the Finnish middle boreal subzone. – Lichenologist 23.1: 61-72.
Hawksworth D.L. & Rose F. 1976. Lichens as pollution monitors. – Edward Arnold Ltd., London, 60 pp.
Herzig R. & Urich M. 1991. Flechten als Bioindikatoren. – Bibliotheca Lichenologica 43: 1-83.
Jacobsen P. 1992. Flechten in Schleswig-Holstein: Bestand, Gefährderung und Bedeutung als Bioindikatoren. – Mitteilungen der Arbeitsgemeinschaft Geobotanik in Schleswig-Holstein und Hamburg 42: 1-234.
Kiszka J. 1995. Epifityczne porosty ogrodów podworskich jako wskaźniki ekologicznej jakości środowiska naturalnego. – Arboretum Bolestraszyce 3: 59-71.
Kondracki J. 1972. Polska północno-wschodnia. – PWN, Warszawa, 272 pp.
Kondracki J. 1998. Geografia fizyczna Polski. – PWN, Warszawa.
Kowalewska A. & Kukwa M. 2003. Addition to the Polish lichen flora. – Graphis Scripta 14.1: 11–17.
Kukwa M. 2001. New and noteworthy lichenized and lichenicolous fungi to Estonia. – Folia Cryptog. Estonica 38: 25-26.
Kuusinen M. 1996. Epiphyte flora and diversity on basal trunks of six old-growth forest tree species in southern and middle boreal Finland. – Lichenologist 28.5: 443- 463.
Lettau G. 1912. Beiträge zur Lichenenflora von Ost- und Westpreussen. – Festschr. Preus. Bot. Ver. Königsberg 53: 17-91.
Lettau G. 1919. Nachträge zur Lichenenflora von Ost- und Westpreussen. – Schrift. Kgl. Phys.-ökon. Ges. Königsberg 60: 5-21.
Litterski B. 1999. Pflanzengeographische und ökologische Bewertung der Flechtenflora Mecklenburg-Vorpommerns. – Dissertationes Botanicae (Berlin-Stuttgart) 307: 1-397.
Łubek A. 2003. Noteworthy lichen species in Poland collected in the Świętokrzyski National Park. – Acta Mycol. 38.1-2: 137-147.
Malinowska-Januszkiewicz I. 2002. Dziedzictwo kulturowe Puszczy Rominckiej. Historia. – Wyd. Park Krajobrazowy Puszczy Rominckiej, Żytkiejmy.
Matuszkiewicz W. 1991. Szata roślinna. – In: Starkel L. (ed.), Geografia Polski. Środowisko przyrodnicze. PWN, Warszawa, s. 445-494.
Mirek Z., Piękoś-Mirkowa H., Zając A. & Zając M. 2003. Flowering plants and pteridophytes of Poland. A checklist. – W. Szafer Institute of Botany, Polish Academy of Sciences, Kraków.
Motiejûnaitë J. 1999. Checklist of lichens and allied fungi of Lithuania. – Botanica Lithuanica 5.3: 251-269.

Motiejûnaitë J. & Fałtynowicz W. 2004. Diversity of lichens and lichenicolous fungi along the planned highway Via Baltica at the Polish-Lithuanian state border. – Acta Soc. Bot. Pol., in press.
Nash T.H. & Wirth V. (red.) 1988. Lichens, bryophytes and air quality. – Bibliotheca Lichenologica 43: 1-297.
Ohlert A. 1863. Verzeichniss Preussischer Flechten. – Schrift. Kgl. Phys.-ökon. Ges. Königsberg 4: 6-34.
Ohlert A. 1870. Zusammenstellung der Lichenen der Provinz Preussen. – Schrift. Kgl. Phys.-ökon. Ges. Königsberg 11: 1-51.
Ohlert A. 1871. Lichenologische Aphorismen. II. Gruppirung der Lichenen der Provinz Preussen nach Standort und Substrat. – Schrift. Naturf. Ges. Danzig 2.3-4: 1-37.
Piotrowska H. 1997. Podstawowe wiadomości o środowisku przyrodniczym. – In: Piotrowska H. (ed.), Przyroda Słowińskiego Parku Narodowego. Bogucki Wydawnictwo Naukowe, Poznań-Gdańsk, p. 40.
Pisut I. 1993. List of extinct, missing and threatened lichens in Slovakia - the second draft. – Biologia (Bratislava) 48.1: 19-26.
Polakowski B. 1963. Stosunki geobotaniczne Pomorza Wschodniego. – Zeszyty Naukowe Wyższej Szkoły Rolniczej w Olsztynie 15: 3-169.
Purvis O.W., Coppins B.J., Hawksworth D.L., James P.W., Moore D.M. 1992. The lichen flora of Great Britain and Ireland. – Natural History Museum and British Lichen Society, London, 710 pp.
Rozporządzenie Ministra Środowiska w sprawie gatunków dziko występujących grzybów objętych ochroną z dn. 09 lipca 2004 r. – Dz.U. 04.168.1765 z dn. 28 lipca 2004 r.
Santesson R. 1993. The lichens and lichenicolous fungi of Sweden and Norway. – STB-förlaget, Lund, 240 ss.
Scheidegger C., Dietrich M., Frei M., Keller K., Kuhn N. & Wildi E., 1991. Zur Waldflechtenflora des westlichen Aargauer Mittellandes und ihrem Wandel seit 1960. – Mitteilungen Aargauer für Naturforshung Gesselchaft 33: 175-192.
Siebel H.N., Aptroot A., Dirkse G.M., van Dobben H.F., van Melick H.M.H. & Touw A. 1992. Rode Lijst van in Nederland verdwenen en bedreigde mossen en korstmossen. – Gorteria 18: 1-20.
Sokołow A. 2002. Przyroda Regionu Wisztynieckojego. – Wyd. Park Krajobrazowy Puszczy Rominckiej, Żytkiejmy.
Sokołowski A.W. 1980. Zbiorowiska leśne północno-wschodniej Polski. – Monographiae Botanicae 60: 1-205.
Sokołowski A.W. & Kot J. 1996. Przyroda województwa suwalskiego. – Wyd. Urząd Wojewódzki w Suwałkach, Suwałki, 176 ss.
Stan środowiska w Polsce. 1998. – Biblioteka Monitoringu Środowiska, Warszawa, 174 ss.

Steffen H. 1932. Vegetationskunde von Ostpreussen. – Pflanzensoziologie 1: 1-406.
Stopa-Boryczka M. & Martyn D. 1985. Klimat. – In: Stasiak A. (ed.), Województwo suwalskie, studia i materiały. 1: 81-118. Ośrodek Badań Naukowych, Białystok.
Szafer W. 1972. Szata roślinna Polski Niżowej. – In: Szafer W. & Zarzycki K. (ed.), Szata roślinna Polski 2: 17-188. PWN, Warszawa.
Wawrzoniak J., Małachowska J., Solon J., Fałtynowicz W., Sierota Z., Adamski L., Załęski A., Kolk A. & Lech P. 1999. Forest condition in Poland in 1998. – Państwowy Inspektorat Ochrony Środowiska, Warszawa, 44 pp.
Wirth V. 2001. Checklist of the lichens and lichenicolous fungi of Germany. Version 1. January 2001. – http://www.uni-hamburg.de/biologie/ialb/herbar/germa_f2.htm.
Zalewska A. 2000. Ekologia porostów Puszczy Boreckiej i jej obrzeży. Studium bioróżnorodności. – Praca doktorska. Uniwersytet Warmińsko-Mazurski, Olsztyn. Mscr.
Zalewska A., Fałtynowicz W., Krzysztofiak A., Krzysztofiak L. & Picińska-Fałtynowicz J. 2004. Lichens of Suwalski Landscape Park. – In: Zalewska A. & Fałtynowicz W. (eds.), Lichens of the protected areas in the Euroregion Niemen. Suwałki.

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(Footnotes)

[1] - all plants have been named according to Z. Mirek et al. (2003).

[2] Kaliningradski District as the whole Russia does not possess any instructions for protection of lichen species, thus in the presented work the Polish list of lichen species protected by law involved on the decree of species protection of fungi from 9 July 2004 (Dz.U. 04.168.1765 from 28 July 2004) has been applied. Such assumption is correct as Romincka Primeval Forest constitutes a uniform complex and within its whole area is under the same anthropopressure.