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Letter to the Editor

Lichenoflora of Emperor's Road in Biebrza National Park

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Abstract

This is an introductory work of cyclic examination of lichenflora of Biebrza National Park. The area of the Emperor's Road of Biebrza Lower Basin was examined. The presence of 92 species from 17 families was observed. The most numerous representatives were the *Cladoniaceae* family (21 taxons) and *Lecanoraceae* (15 taxons). Epiphytic lichens (59 species) were dominant among 4 ecological groups. The richest epiphytic flora was found in *Populus tremula* (26 species) and *Populus nigra* (12 species). Crust thalluses were the most representative morphological form with 43% of all described species. The examined area revealed 1 species, extinct in the rest of Poland, 12 dying out species, and 16 extinct-threatened species. The area of the Emperor's Road can be qualified to the 7th zone of air purity as species of *Usneaceae* family occur there. Lichen collection was carried out in 2000-02. Taxonomy was based on standard methods used in lichenology. Identification was based on nomenclature by Fałtynowicz . Extinct-threatened species were chosen on the basis of "The Red List" by Cieśliński. The study of the Emperor's Road lichenflora of Biebrza National Park is an introductory record for future comparative studies. It will also enable us to follow changes caused by an increase in anthropopressure and specifically air contamination.

Keywords: Biebrza National Park, Green Lungs of Poland, epiphytic lichens, The Red List of lichens.

Introduction

In 1990-2000 I studied lichenflora in Knyszyn primeval forest [1] and Augustów primeval forest [2]. This paper is an introduction of a cycle of studies on lichenflora in Biebrza National Park. Both primeval forests and Biebrza swamps are the part of the "Green Lungs of Poland," i.e. the region deformed due to anthropopressure only to a small extent [3]. Lichens can show the scale of anthropopressure as they are considered to be the most sensitive bioindicators of changes in air purity and humidity. Epiphytic lichens intake water exclusively from rainfall together with pollution, mainly sulphur dioxide (SO_2). Some species cannot hold such ballast and they die as a result of photosynthesis apparatus inactivation [4, 5]. Therefore, a lichen scale has been established on the basis of indicatory species which exactly determines the environmental contamination grade in a given region. As far as lowland is concerned, the lichen scale according to Bylińska is obligatory [6].

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The Examined Region and Methods

Biebrza National Park was established in 1993. It covers 59 ha and stretches along the Biebrza River valley. The park protects the best-preserved natural peatbog in Europe [7]. The Emperor's Road is located in the Lower Basin of Biebrza Basin. It is a waterway which crosses the area characterized by longitudinal and transversal zonality concerning plant communities and is the unique phenomenon on European scale [8, 9]. Plant distribution is zonal and thus, in a relatively small area, lichens typical for Cladonia coniferous forests and species typical for lowmoor can be found.

Table 1. The epiphytic Lichens of the Emperor's Road in Biebrza National Park.

Species lichens	Species trees												
	Ps	Pt	Pn	Pa	Sa	Sp	Pc	Pav	Qr	Cb	Bp	Ev	Ag
Arthonia dispersa							X						
Buellia disciformis		X			X			X					
Buellia punctata		X			X				X				
Calicium abietinum	X												
Caloplaca cerina		X											
Caloplaca holocarpa													X
Catinaria atropurpurea		X											
Catinaria laureri								X					
Chaenotheca ferruginea													X
Chaenotheca stemonea		X											
Cladonia chlorophaea	X												
Cladonia glauca	X										X		
Cladonia macilenta	X										X		
Cliostomum griffithii		X											
Evernia prunastri													X
Gyalecta truncigena										X			
Hypocenomyce scalaris	X				X								
Hypogymnia physodes	X	X	X	X	X	X	X	X	X	X	X	X	X
Hypotrachyna revoluta			X										
Lecania cyrtella		X								X			X
Lecania dubitans		X											X
Lecania fuscella		X											
Lecanora allophana		X											
Lecanora argentata		X					X	X	X				
Lecanora carpinea		X											
Lecanora chlarotera								X					
Lecanora conizaeoides		X					X	X	X	X	X		
Lecanora hagenii		X		X									
Lecanora intumescens													X
Lecanora piniperda	X											X	
Lecanora rugosella		X											
Lecanora subrugosa		X											
Lecidella elaeochroma								X					
Maronea constans							X						
Melanelia acetabulum			X										
Melanelia subargentifera			X										
Melaspilea gibberulosa		X											
Ochrolechia androgyna													X

Table 1 continues on next page...

Species lichens	Species trees												
	Ps	Pt	Pn	Pa	Sa	Sp	Pc	Pav	Qr	Cb	Bp	Ev	Ag
Parmelia sulcata			X	X		X			X				X
Pertusaria hymenea								X					
Pertusaria leioplaca		X											
Phaeophyscia nigricans		X											
Phaeophyscia orbicularis					X								
Physcia adscendens						X							
Physcia aipolia var. aipolia		X											
Physcia caesia var. ventosa			X										
Physcia dubia					X								
Physcia semipinnata		X											
Physcia stellaris		X											
Physcia tenella			X	X		X							
Physconia grisea		X											
Pseudevernia furfuracea var.scobicina									X				
Ramalina farinacea			X		X								
Ramalina fraxinea			X										
Ramalina pollinaria			X										
Rinodina pyrina							X						
Trapeliopsis flexuosa		X											
Usnea hirta			X										
Xanthoria parietina		X	X	X		X							

Ps – *Pinus sylvestris* , Pt – *Populus tremula* , Pn – *Populus nigra* , Pa – *Populus alba* , Sa – *Salix alba* , Sp – *Salix purpurea* , Pc – *Pyrus communis* , Pav – *Padus avium* , Qr – *Quercus robur* , Cb – *Carpinus betulus* , Bp – *Betula pubescens* , Ev – *Euonymus verrucosa,* Ag – *Alnus glutinosa*

Lichen collection was carried out in 2000-02. Taxonomy was based on standard methods used in lichenology [10]. Botanical keys by Nowak and Tobolewski [11] as well as Kremer [12] were used to determine the species. Identification was based on nomenclature by Fałtynowicz [13]. Extinct-threatened species were chosen on the basis of "The Red List" by Cieśliński [15].

Results

There were 92 species of lichens from 17 families determined in the examined area. *Cladoniaceae* was a dominating family (21 species). Species typical for Cladonia coniferous forests, such as *Cladina rangiferina, Cladina arbuscula*, *Cladina mitis, Cladina partentosa*, and *Cladina islandica* are especially interesting. Among 4 ecological types, epiphytic species prevail (59 taxons, Table 1). The richest epiphytic flora has *Topulus tremula* (poplar – aspen) – 26 taxons and *Populus nigra* (black poplar) – 12 taxons (Tables 1 , 2).

The examined area revealed one lost species, which does not occur in other regions of Poland, 12 dying out species, and 16 extinct-threatened species (Table 3).

Most representative lichens in this region are *Hypogymnia psychodes, Lecanora conizaeoides*, and *Parmelia sulcata* that occupy more than 5 forofites (Fig. 1). Thus, we can count them among eurytypic species of Biebrza National Park.

Discussion

Richness and diversity of lichenflora of the park confirms the pertinence of this area's protection. It has been recommended for consideration by the World's Heritage Object [16]. The presence of 29 species dying out and extinct-threatened due to anthropopressure deserves special attention.

It is an undeniable fact that plants are exponents of environmental purity. Their conditions reflect regular functioning of ecosystems. Plants are the first to

Table 2. Lichens occupying the largest number of forofits.

Species trees	Number of lichens species on trees
Pinus sylvestris	7
Populus tremula	26
Populus nigra	12
Populus alba	5
Salix alba	7
Salix purpurea	5
Pyrus communis	6
Padus avium	8
Quercus robur	6
Carpinus betulus	4
Betula pubescens	4
Euonymus verrucosa	2
Alnus glutinosa	9

signal anthropopressure. Sporozoans, among other lichens, are sensitive to changes in air composition and microclimate changes due to atmospheric pollution. At the end of the 20th century. Arnold initiated studies on this group of organisms [17]. Since that time many researchers have tried to find out what changes occurred in lichen morphology and physiology due to contaminated environment. Visual thallus damage, chlorophyll content decrease, and pheophitin content increase were observed. Significant changes in photosynthesis intensity and less visible in respiration were also shown [5, 16]. Having known lichen floral composition and disappearance rate of certain species, lichen-indicative maps, which showed the size and force of atmospheric contamination, were drawn. Many European countries use an 11-stage scale (0-10) according to Hawksworth and Rose [17]. It is based on the choice of monitoring lichen species that indicate respective mean values of SO_2 concentrations in the air during winter months. However, to use this scale in Poland, we would have to expand it to lichens occurring in our lichenflora. An 8-stage scale (0-7), made by Bylińska [6] and the Environment Aid group (EA), is used in Poland. The scale is divided into 7 zones determined by maximum SO_2 concentrations in the atmospheric air, at which given lichen species still occur. The higher the zone number, the lower SO_2 concentration.

Zone "O" is "a lichen desert." It covers areas of large industrial cities, where SO_2 concentration exceeds 170µ/m^3 of the air. Zone "7" of air purity (SO_2 concentration below 40µg/m^3) is determined by the presence of species of *Usneaceae* family [19]. The most sensitive species of this family is *Usnea hirta* [20]. The taxon was observed in the examined area and it points

Table 3. "The Red list " of lichens.

Symbols	Species lichens	Species number	Percent
Ex	*Maronea constans*	1	1.09%
E	*Buellia disciformis* *Caloplaca cerina* *Catinaria atropurpurea* *Catinaria laureri* *Chaenotheca stemonea* *Gyalecta truncigena* *Hypotrachyna revoluta* *Lecania fuscella* *Melanelia acetabulum* *Melaspilea gibberulosa* *Pertusaria hymenea* *Ramalina fraxinea*	12	13.04%
V	*Arthonia dispersa* *Calicium abietinum* *Cetraria islandica* *Cliostomum griffithii* *Evernia prunastri* *Lacanora intumescens* *Lecanora subrugosa* *Melanelia subargentifera* *Ochrolechia androgyna* *Peltigera canina* *Pertusaria leioplaca* *Physcia aipolia* *Ramalina farinacea* *Ramalina pollinaria* *Usnea hirta* *Xanthoria fallax*	16	17.4%
Common		63	68.5%
	total:	92	100%

Ex- extinct and lost, E- dying out, V- threatened of extinction

to the high class of air purity in Biebrza National Park. The following species of the *Usneaceae* family were also present: *Ramalina farinecea, Ramalina fraxinea*, and *Ramalina pollinaria.*

The study of the Emperor's Road lichenflora of the park is an introductory record for future comparative studies. It will also enable us to follow the changes caused by an increase in anthropopressure and specifically air contamination.

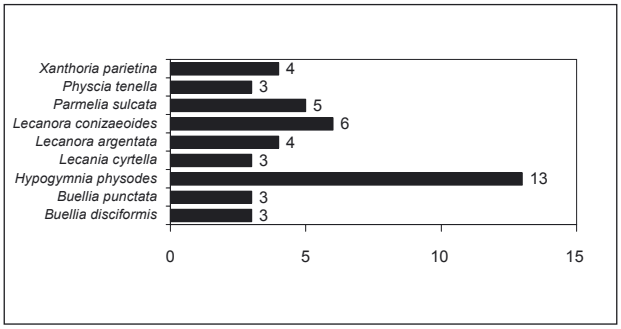

Fig.1. The number of species on particular forofits.

Conclusions

1. *Cladoniaceae* (21 species) and *Lecanoraceae* (15 species) families are the most numerous representatives in the area of Emperor's Road.
2. Epiphytes (59 taxons) are dominant among 4 ecological groups.
3. *Populus tremula* (26 species) and *Populus nigra* (12 species) have the richest lichenflora.
4. There were 12 dying out species and 16 extinct-threatened species observed in the examined area.
5. The analysis of lichenflora species composition of Emperor's Road points to insignificant influence of anthropopression.

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