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Dedicated to Professor Maria Ławrynowicz on the occasion of the 45th anniversary of her scientific activity

The preservation status of the lichen biota in the designed Special Area of Conservation NATURA 2000 „Middle Łyna River Valley – Smolajny"

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The paper presents the list of 159 taxa, including 151 lichens and 8 saprotrophic or parasitic (lichenicolous) fungi, recorded in the designed Special Area of Conservation NATURA 2000 „Middle Łyna River Valley – Smolajny" (the Forest Division of Wichrowo). The analysed area (2953 ha) covers mostly forest communities, with natural character, associated with the valley of the Łyna river (hillside lime-oak-hornbeam forests, streamside alder-ash forest, riparian black alder forest).

Key words: lichens, lichenized fungi, species diversity, forest

INTRODUCTION

Nature conservation is one of the State Policy aspects defined in the Nature Conservation Act (Dziennik Ustaw 2004) and in the related executive regulations. One of the nature conservation objectives, within the meaning of the aforementioned act, is to preserve the biodiversity of the country. Any measures aimed at active or passive protection of species diversity require comprehensive knowledge of habitat requirements and distribution of species from different taxonomic groups. Furthermore, measures of this kind are a prerequisite for the assessment of potential threats to individual taxa. It is estimated that over 65% of biological resources in Poland are present in forests (Jaroszewicz 2007). Therefore, in view of efficient management of the Polish fauna, flora and fungi resources, the knowledge about nature resources of forest ecosystems appears to be extremely important. The State Forests are obliged by the Forest Act (Ustawa 1991) to initiate, coordinate and conduct periodic assessments of the broadly defined forest resources. In practice, this type of comprehensive assessment is usually not possible due to the lack of professionals adequately trained.

The paper presents the results of lichenological research conducted within the framework of field sessions accompanying the 25th Convention of Polish Lichenologists „Lichens in the geographic, natural and cultural space", which was held on 6-8 September 2011 in Wichrowo Forests (N Poland, the Forest Division of Wichrowo). Due to the limited time of field work, the research focused on the most valuable and representative habitats in the study area, which include the approved or designed Special Areas of Conservation NATURA 2000. Lichens and lichenicolous fungi of Wichrowo Forests have never been investigated, and the geographical location of this forest complex and high heterogeneity of forest plant communities make the site particularly interesting in lichenological terms.

STUDY AREA

Wichrowo Forests (the Forest Division of Wichrowo) cover an area of 17645 ha and consist of two dense parts (complexes) corresponding to two subdivisions: Obręb Łaniewo and Obręb Wichrowo (Fig. 1). Each of them is situated in a different natural forest region: the forest complex of Łaniewo in the Dzielnica Elbląsko-Warmińska district of the Baltic region, whereas the complex of Wichrowo in the Dzielnica Mazursko-Podlaska region in the Pojezierze Mazurskie lakeland (Trampler et al. 1990). According to physical and geographical division proposed by Kondracki (2001), the Forest Division of Wichrowo is located in the area of four mesoregions: Pojezierze Olsztyńskie lakeland, Nizina Sępopolska lowland, Równina Ornecka plain and Wzniesienia Górowskie hills.

The land relief of Wichrowo Forests is very diverse and includes a plateau associated with the Vistulian (Baltic) glaciation. The receding glacier left behind many moraine ramparts of different directions and a dense network of dead-ice depressions transformed into peat bogs. The highest elevation in this area reaches 172 m a.s.l. (Kraszewo wilderness), the lowest one – 36 m a.s.l. (Łaniewo village). The

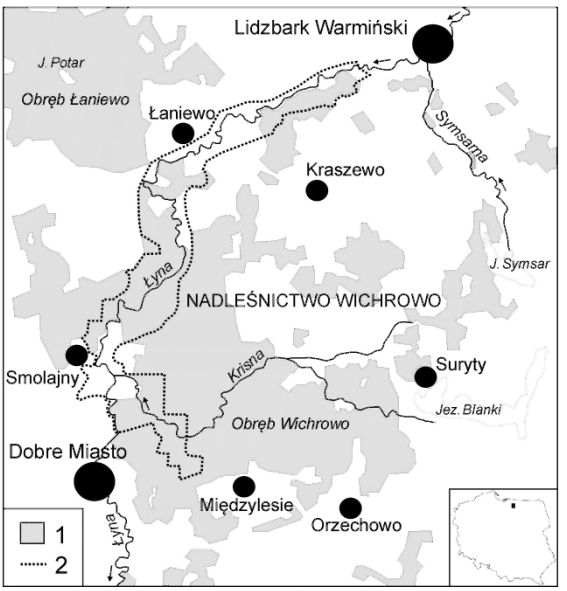

Fig. 1. Location of the analysed area in the Wichrowo Forest (the Forest Division of Wichrowo): 1 – forest areas, 2 – boundary of the designed Special Area of Conservation NATURA 2000 „Middle Łyna River Valley – Smolajny"

Forest Division area is cut through by several rivers flowing in eroded channels, which in some places developed as gorges with a relative altitude above 60 m, and this gives the landscape typical mountain features.

Wichrowo Forests come mostly from afforestation and planting (73.1%), and to a small extent – from natural regeneration (2.61%) or regrowth (3.6%) (Plan Urządzenia 2009). Scots Pine (*Pinus sylvestris*) is the dominant species and it covers 60.3% of the Forest Division, whereas deciduous species cover only 27.6%.

The paper presents the results of the research conducted in the designed Special Area of Conservation (SAC) NATURA 2000 „Middle Łyna River Valley – Smolajny". The idea of creating SAC in Wichrowo Forests came up as a result of nature inventory carried out in the State Forests in 2006 and 2007. The area of „Middle Łyna River Valley – Smolajny" SAC includes 2953.7 ha with the Łyna Valley as a central axis (ca. 30 km of the river gap section between the town of Dobre Miasto and Lidzbark Warmiński) together with the estuary section of the Kirsna river flowing into Łyna (Pakulnicka et al. 2009). Forest cover 79% of the area and they are abundant in plant communities listed in the Habitat Directive, including riparian black alder forest, ash-alder forest, as well as subcontinental and hillside lime-oak-hornbeam forests. The remaining part are open areas with extensively used lowland meadows and many oxbow lakes in different developmental stages.

MATERIAL AND METHODS

The search for species was conducted in September 2011 in two working groups at a total of 30 research sites (Tab. 1). At most sites, a complete inventory of species was made, including all ecological groups of lichens. In few cases, only rare or otherwise interesting species were found. Species identified in the field were listed without collection of herbarium specimens. In other cases – specimens were collected for further detailed taxonomic (anatomical or biochemical) analysis in a laboratory. The collected herbarium material was deposited in the following herbaria: OLTC, SLTC and GPN (Gorce National Park). The species nomenclature follows Fałtynowicz (2003) and Kirk (2013), except the genus *Varicellaria* (Schmitt et al. 2012). Threat categories of lichens were quoted after Cieśliński et al. (2006), and the list of lichens-indicators of lowland old-growth forests − after Czyżewska and Cieśliński (2003).

RESULTS

Altogether 159 species were found in the study area, including 151 lichen species (lichenized fungi) and 8 species of saprotrophic or parasitic (lichenicolous) fungi (Tab. 2). Epiphytes dominate in the biota of lichens. Most of the species were found on oak (79 species), hornbeam (71), maple (60) and linden trees (44). The largest number of species excluded for a given phorophyte was recorded for hornbeam, oak and maple – 12 taxa each. Other ecological groups were represented by much smaller numbers: epixylic lichens – 22 species (including 12 growing exclusively on wood) and epigeic species – only 4 species. The identified lichen biota is represented by 19 taxa legally protected in Poland, including 18 strictly protected species and 1 partially protected species. Threatened lichens (facing a risk of extinction in Poland) are represented by 57 species (Tab. 2). They represent the following threat categories: critically endangered (CR) – 3 species, endangered (EN, high risk of extinction) – 12, vulnerable (VU) – 21, least concerned (LC) – 3, near threatened (NT) – 16, data deficient (DD) – 2. The biota of lichens in the study area is represented by many species that have been previously known from only very few sites in the country, and their distribution, habitat preferences and potential threats are not well researched. The group includes: *Bacidia hemipolia* f. *pallida*, *Biatora chrysantha, B. pontica*, *Biatoridium monasteriense*, *Fellhaneropsis vezdae*, and *Lecanora farinaria*.

DISCUSSION

The number of lichen species reported from the study area is considered to be relatively high. It is higher than the total number of species recorded in important but small refugia of forest lichens in the southern part of the Pojezierze Olsztyńskie lakeland, including the nature reserves of „Dęby Napiwodzkie" (100 species) and Koniuszanka II" (80 species) (Kubiak 2011), but smaller than the number of species reported from the much larger forest nature reserve „Las Warmiński" – ca. 220

Table 1
Major characteristics of the studied sites

No.	Location (forest section; geographical coordinates)	Forest stand type (dominated tree/age)
1	403f; 54°02'04.2"N/20°23'36.9"E	Oak-hornbeam forest (*Q* 92)
2	346l; 54°02'44.5"N/20°24'29.0"E	Old-growth oak forest
3	310h; 54°03'05.7"N/20°26'18.0"E	Lime-oak-hornbeam forest (*Q* 137)
4	366b; 54°02'41.7"/20°24'25.7"E	Lime-oak-hornbeam forest (*Q* 192)
5	366b; 54°02'36.4"N/20°24'15.1"E	Lime-oak-hornbeam forest (*Q* 192)
6	347i; 54°02'44.2"N/20°24'24.3"E	Group of old maple trees
7	346h; 54°02'478"N/20°24'35.5"E	Group of trees at the crossroads
8	346l; 54°02'45.7"N/20°24'45.9"E	Lime-oak-hornbeam old-growth forest, hillside lime-oak-hornbeam forests (*Q* 242)
9	291f; 54°03'40.0"N/20°27'00.2"E	Oak forest (*Q* 132)
10	342c (/343a); 54°03'03.5"N/20°26'07.2"E	Lime-oak-hornbeam forest *(Q* 127)
11	343f; 54°02'57.9"/20°26'02.3"E	Elm-ash forest (*A* 52)
12	314j; 54°03'09.6"N/20°25'34.6"E	Mixed pine-oak forest
13	344d; 54°02'57.8"N/20°25'32.3"E	Degenerated oak-hornbeam forest (dominance of hornbeam)
14	363m; 54°02'30.6"N/20°25'16.2"E	Lime-hornbeam forest (*T* 75)
15	363o; 54°02'30.4"N/20°25'06.8"E	Alder forest (*A* 62)
16	363k; 54°02'30.6"N/20°25'10.2"E	Spruce forest (*Pa* 21)
17	363j; 54°02'37.0"N/20°25'00.5"E	Oak-hornbeam forest (*Q*102)
18	589c; 53°59'43.5"N/20°26'40.0"E	Lime-oak-hornbeam forest (*Q*107)
19	560g; 53°59"59.8"N/20°26"22.3"E	Spruce managed forest (*Q* 52)
20	561a; 54°00"11.0"N/20°26"01.9"E	Mixed spruce-oak forest (*Pa* 97)
21	557h; 54°00'16"N/20°25'43.5"E	Lime-oak-hornbeam forest (*Q* 42)
22	528f; 54°00'255"N/20°25'187"E	Mixed spruce-pine-oak forest (*Ps* 127)
23	560k; 53°59'57"N/20°26'215"E	Lime-oak-hornbeam forest (*Q* 107)
24	589a; 53°59'44"N/20°26'38"E	Spruce-pine forest
25	560j; 53°59'589"N/20°26'255"E	Riparian black alder forest
26	197b; 54°05'59.4"N/20°29'53.9"E	Black alder forest in deep stream valley, surrounded by pine forest (*Ps* 72)
27	196g; 54°06'11.1"N/20°29'57.6"E	Mixed oak-pine forest (*Ps* 102)
28	185c; 54°06'47.5"N/20°30'51.6"E	Ash-alder forest
29	179k; 54°06'54.9"N/20°31'24.0"E	Oak forest (*Q* 99)
30	309h; 54°03'18.5"N/20°26'34.0"E	Lime-oak-hornbeam forest

Abbreviations: *A – Alnus, Ps – Pinus, Pa – Picea Q – Quercus, T – Tilia*

Table 2
List of taxa recorded in the designed Special Area of Conservation NATURA 2000 „Middle Łyna River Valley – Smolajny"

Species	Localities	Substrat	Status of the species
Absconditella lignicola Vězda & Pišút	14	epx	
Acrocordia gemmata (Ach.) A. Massal.	8, 11, 17, 18, 30	*Cb*, *Q*, *Pt*, *Ug*	VU
Agonimia allobata (Stizenb.) P. James	1	*Q*	
Amandinea punctata (Hoffm.) Coppins & Scheid.	2, 4	*Ap*, *Cb*, *Q*	
Anisomeridium polypori (Ellis & Everh.) M.E. Barr	1, 2, 8, 11, 21, 26	*Ap*, *Pt*, *Q*, *S*, *Ug*	
Alyxoria varia (Pers.) Ertz & Tehler	4, 8	*Ap*	NT
Arthonia byssacea (Weigel) Almq.	28	*Fe*	EN
A. didyma Körb.	4	*Cb*	EN

Table 2 – cont.

A. mediella Nyl.	1	*Q*	VU
A. radiata (Pers.) Ach.	1, 3, 9, 10, 14, 27, 30	*Cb*, *Q*, *Sa*	
A. spadicea Leight.	1, 3, 8, 10, 11, 18, 30	*Ap*, *Ag*, *Cb*, *Q*	
A. vinosa Leight.	1, 11	*Ag*, *Cb*, *Q*	NT
Arthothelium ruanum (A. Massal.) Körb.	4, 5, 8, 11, 28	*Cb*, *Fe*, *Tc*	NT
**Arthrorhaphis aeruginosa* R. Sant. & Tønsberg	25	*Cladonia coniocraea*/ *Ag*	
Bacidia arceutina (Ach.) Rehm. & Arnold	4, 16, 21, 23, 30	*Cb*, *Pt*	EN
B. fraxinea Lönnr.	2, 21, 30	*Cb*, *Pt*	DD
B. hemipolia f. *pallida* Czarnota & Coppins	1, 9, 20	*Q*	
B. rubella (Hoffm.) A. Massal.	4, 9, 28, 30	*Ap, Fe, Pt*	VU
B. subincompta (Nyl.) Arnold	1, 2, 4-6, 17, 18	*Ap*, *Cb*, *Q*	EN
**Bacidina chloroticula* (Nyl.) Vězda & Poelt	6	dead thallus of *Parmelia sulcata*/*Ap*	
B. phacodes (Körb.) Vězda	16	*Pt*	
B. sulphurella (Samp.) M. Hauck & V. Wirth	1, 3, 4, 6, 10, 11, 26	*Ag*, *Ap*, *Cb*, *Pa, Q*, epx	
Biatora chrysantha (Zahlbr.) Printzen	12	*Q*	
B. efflorescens (Hedl.) Räsänen	1-6, 8, 18, 27, 29, 30	*Ap*, *Cb*, *Q, Tc*	VU
B. globulosa (Flörke) Fr.	1, 8, 12, 28	*Ap*, *Fe*, *Q*	
B. ocelliformis (Nyl.) Arnold	3	*Cb*	VU
B. pontica Printzen & Tønsberg	5	*Tc*	
Biatoridium monasteriense J. Lahm. ex Körb.	11	*Ug*	NT
Buellia griseovirens (Turner & Borrer ex Sm.) Almb.	1-4, 6, 8-11, 16, 30	*Ap*, *Cb*, *Q*, *Tc*	
Calicium adspersum Pers.	2, 4	*Q*	EN
C. salicinum Pers.	2, 4	*Q*	VU
C. viride Pers.	2, 4, 5, 7	*Ap*, *Q*	VU
Candelariella efflorescens R.C. Harris & W.R. Buck	1	*Q*	
C. xanthostigma (Pers ex Ach.) Lettau	4	*Ap*	
Catillaria nigroclavata (Nyl.) J. Steiner	16	*Pt*	
Chaenotheca chlorella (Ach.) Müll. Arg.	28	*Fe*	CR
Ch. chrysocephala (Ach.) Th.Fr.	1-3, 5, 7-9, 27, 28, 29	*Ap*, *Ps*, *Q*	
Ch. ferruginea (Turner ex Sm.) Mig.	1-5, 8, 9, 11,12, 16, 28, 29	*Ap*, *Cb*, *Pa*, *Ps*, *Q*	
Ch. furfuracea (L.) Tibell	11, 21	*Ag*, *Pa*	NT
Ch. stemonea (Ach.) Müll. Arg.	2-4, 29	*Pa*, *Q*	EN
Ch. trichialis (Ach.) Hellb.	2-5, 26, 28, 29	*Ag, Ap*, *Pa*, *Q*	NT
**Chaenothecopsis savonica* (Räsänen) Tibell	4	*Cb* (exposed dead wood)	
Chrysothrix candelaris (L.) J.R. Laundon	4, 5, 7, 8, 28, 29	*Fe, Q*	SP, CR
Cladonia chlorophaea (Flörke ex Sommerf.) Spreng.	29	*Q*	
C. coniocraea (Flörke) Spreng.	1-5, 6, 9-12, 16, 26, 27, 29	*Ag*, *Bp, Cb*, *Pa*, *Ps*, *Q*, *Tc*, epx, ter	
C. digitata (L.) Hoffm.	4, 11, 27	*Ps*, epx	
C. fimbriata (L.) Fr.	1, 9, 16, 26	*Ps*, *Q*, *Tc, S*	
C. furcata (Huds.) Schrad.	16	ter	
Cliostomum corrugatum (Ach.) Fr.	5	*Q*	CR
C. griffithi (Sm.) Coppins	1	*Q*	VU
**Clypeococcum hypocenomycis* D. Hawksw.	1, 2, 27	*Hypocenomyce scalaris*/*Pa, Ps, Q*	
Coenogonium pineti (Schrad.) Lücking & Lumbsch	1-6, 9, 10, 12, 16, 26, 27, 29, 30	*Ag, Ap*, *Cb*; *Pa*, *Ps*, *Q*, *Tc*, epx	

Table 2 – cont.

Evernia prunastri (L.) Ach.	1-10, 12,16, 28, 29, 30	*Ap*, *Cb*, *Ee*, *Fe*, *Pav*, *Pas*, *P*, *Q*, *Tc*, epx	PP, NT
Fellhanera gyrophorica Sérus., Coppins, Diederich & Scheid.	1, 2, 9, 10, 18, 20, 29, 30	*Cb, Q*	LC
Fellhaneropsis myrtillicola (Erichsen) Sérus. & Coppins	20	*Pa*	
F. vezdae (Coppins & P. James) Sérus. & Coppins	3	*Cb*	LC
Flavoparmelia caperata (L.) Hale	8	*Q*	SP, EN
Fuscidea arboricola Coppins & Tønsberg	1-3, 15, 25	*Ag*, *Cb*, *Q*	
F. pusilla Tønsberg	1, 2, 15, 25, 27	*Ag*, *Cb*, *Ps*, *Q*, *Tc*, epx	
Graphis scripta (L.) Ach. s.l.	1-3, 5, 6, 8-11, 30	*Ap*, *Cb*, *Ca*, *Tc*	NT
Hypocenomyce scalaris (Ach. ex Lijl.) M. Choisy	1, 2, 4, 5, 7, 9, 12, 27	*Cb*, *Pa*, *Ps*, *Q* sp., *Tc*	
Hypogymnia physodes (L.) Nyl.	1-9, 11, 12, 15, 16, 26, 27, 29, 30	*Ag, Ap*, *Cb*, *Ee*, *Pa*, *Ps*, *P*, *Q*, *Tc*, *S*, *Sa*, epx	
**Ilosporiopsis christiansenii* (B. L. Brady & D. Hawksw.) D. Hawksw.	6	*Physcia adscendens*/ *Ap*	
Imshaugia aleurites (Ach.) S.L.F. Mey.	7, 9	*Ps*, *Q*	SP
Lecania cyrtella (Ach.) Th. Fr.	6	*Ap*	
L. naegelii (Hepp) Diederich & van den Boom	6	*Ap*	
Lecanora albella (Pers.) Ach.	4	*Ap*	EN
L. argentata (Ach.) Malme	4-6, 10, 30	*Ap*, *Cb*, *Q*	
L. carpinea (L.) Vain.	1, 2, 5, 8, 16, 28, 30	*Cb*, *Fe*, *Pt*, *Q*	
L. chlarotera Nyl.	1-5, 8-10, 16, 28, 30	*Ap*, *Cb*, *P*, *Q*, *Tc*	
L. compallens Herk & Aptroot	7, 11, 16	*Ag*, *Cb*, *Fe*, *P*, *Q*, *Tc*	
L. conizaeoides Nyl. ex Cromb.	1, 2, 9	*Cb*, *Pa*, *Ps*, *Tc*	
L. expallens Ach.	1-11, 14-16, 26, 27, 28, 29	*Ap*, *Ag*, *Cb*, *Ca*, *Fe*, *Pa*, *Q*, *Ug*, *Sa*, *Tc*	
L. farinaria Borrer	1	*Cb*	
L. glabrata (Ach.) Malme	5, 8, 30	*Cb*	
L. pulicaris (Pers.) Ach.	1, 2, 4, 5, 9, 15, 16	*Ag, Cb*, *Q*, *Tc*	
L. rugosella Zahlbr.	16, 30	*Q, Pt*	
L. sarcopidoides (A. Massal.) Hedl.	24	*Ps*	NT
L. thysanophora R.C. Harris	2, 3, 5, 10, 13, 30	*Cb*, *Q*	
Lecidea nylanderii (Anzi) Th.Fr.	2	*Cb*	
Lecidella elaeochroma (Ach.) M. Choisy	4-6, 8-10, 16, 26, 28, 30	*Ap*, *Cb*, *Fe*, *Q, Pt, S*	
L. flavosoreditata (Vězda) Hertel & Leuckert	4	*Ap*	
L. subviridis Tønsberg	2, 4, 5, 16, 17, 18	*Ag, Cb*, *Tc*	
Lepraria elobata Tønsberg	1-6, 8, 9,12, 13, 16, 26, 27	*Ag, Cb*, *Q*, *Ps*, *Tc*	
L. incana (L.) Ach.	1-14, 16, 26, 27, 28, 29	*Ap*, *Ag*, *Bp, Cb*, *Fe, Pa*, *Ps*, *Q*, *Tc*	
L. jackii Tønsberg	1, 2, 27	*Cb*, *Pa*, *Ps*, *Tc*	
L. lobificans Nyl.	1-13, 26, 28, 29, 30	*Ap*, *Bp, Cb*, *Fe*, *Q*, *Ug*, *Tc, Pt, S*	
L. rigidula (B. de Lesd.) Tønsberg	1, 6, 26, 28	*Ag, Ap*, *Fe*, *Tc*	
L. vouauxii (Hue) R.C. Harris	9	*Ap*	
Lichenomphalia umbellifera (L.) Redhead et al.	19	epx	NT
Melanohalea exasperatula (Nyl.) O. Blanco et al.	2, 6	*Ap*	SP
Melanelixia glabratula (Lamy) Sandler & Arup	1-11, 28, 30	*Ap*, *Cb*, *Pav*, *Q*, *Tc, Pt*	SP
M. subaurifera (Nyl.) O. Blanco et al.	8	*Pav*	SP
Micarea byssacea (Th. Fr.) Czarnota, Guz.-Krzemiń. & Coppins	14, 23	*Pt*, *Tc*	
M. melaena (Nyl.) Hedl.	15	epk	NT

Table 2 – cont.

M. micrococca (Körb.) Gams ex Coppins	4, 8, 15, 16, 21	*Fe, Ps-st C, Pt*, *Q*, epx	
M. misella (Nyl.) Hedl.	22	epx	
M. nitschkeana (J. Lahm. ex Rabenh.) Harm.	16	*Pt*	
M. viridileprosa Coppins & van den Boom	22	*Ps*	
(*)*Microcalicium dissemnatum* (Ach.) Vain.	4	*Q*	
**Monodictis epilepraria* Kukwa & Diederich	1, 8	*Lepraria* sp./*Q* and *Ap*	
Mycobilimbia epixanthoides (Nyl.) Vitik., Ahti, Kuusinen, Lommi & T. Ulvinen	1, 6, 9, 10, 17, 18, 30	*Ap*, *Cb*, *Q*	
**Mycocalicium subtile* (Pers.) Szatala	8	*Q* (exposed dead wood)	
**Nectriopsis rubefaciens* (Ellis & Everh.) M.S. Cole & D. Hawksw.	15	*Parmelia sulcata*/ wood	
Ochrolechia bahusiensis H. Magn.	2, 6-10	*Ap*, *Cb*, *Q*, *Tc*	VU[1]
O. microstictoides Räsänen	2, 5, 8, 30	*Ap*, *Cb*, *Q*, *Tc*	
O. turneri (Sm.) Hasselrot	4, 7-9	*Ap*, epx	
Opegrapha rufescens Pers.	14	*Tc*	VU
O. vermicellifera (Kunze) J.R. Laundon	5, 8	*Cb*, *Tc*	EN
O. vulgata (Ach.) Ach.	18	*Cb*	VU
Pachyphiale fagicola (Arnold) Zwackh	26, 28	*Ap, S*	VU
Parmelia saxatilis (L.) Ach.	4, 6, 8	*Ap*, *Q*	SP
P. sulcata Taylor	1-4, 6, 8, 9, 11, 16, 26, 27, 28, 30	*Ag, Ap*, *Cb*, *Fe*, *Q*, *S*, *Tc*	
Parmeliopsis ambiqua (Wulfen) Nyl.	9	*Ps*	SP
Peltigera didactyla (With.) J.R. Laudon	12	ter	SP
P. hymenina (Ach.) Delise	9	epx	SP, DD
P. praetextata (Flörke ex Sommerf.) Zopf	8, 17, 18	*Ap*, *Q*, epx, ter	SP, VU
Pertusaria albescens (Huds.) M. Choisy & Werner	3-6, 9, 30	*Ap*, *Cb*, *Q*, *Tc*	
P. amara (Ach.) Nyl.	1-3, 5, 7-10, 12, 13, 18, 27, 28, 29	*Ap*, *Cb*, *Fe*, *Q*	
P. coccodes (Ach.) Nyl.	1-4, 6, 8-10, 12, 13, 16, 30	*Ap*, *Cb*, *Q*, *Tc*	NT
P. coronata (Ach.) Th.Fr.	4, 5, 8, 16	*Cb*, *Q, Tc*	VU
P. flavida (DC.) J.R. Laundon	4	*Cb*	EN
P. leioplaca DC.	3-5, 8-10, 14, 30	*Ap*, *Cb*, *Tc*	NT
P. pertusa (L.) Tuck.	3, 10	*Cb*	VU
P. pupillaris (Nyl.) Th.Fr.	18	*Cb*	NT
Phlyctis argena (Ach.) Flot.	1-9, 11-13, 16, 18, 26, 27, 28, 30	*Ag, Ap*, *Cb*, *Ca*, *Fe*, *P*, *Pt, Q*, *S*, *Tc*	
Physcia adscendens (Fr.) H. Olivier	6	*Ap*	
P. tenella (Scop.) DC.	4, 6	*Ap*, *Q*	
Physconia enteroxantha (Nyl.) Poelt	1, 4, 6, 9	*Ap*, *Q*	
P. grisea (Lam.) Poelt		*Ap*	
Placynthiella dasaea (Stirt.) Tønsberg	2, 3	epx	
P. icmalea (Ach.) Coppins & P. James	2, 7, 15	epx	
Platismatia glauca (L.) W.L. Culb. & C.F Culb.	2, 3, 5-9, 11, 26, 27, 29	*Ag, Ap*, *Cb*, *Pa*, *Q*, *Tc*	SP
Porina aenea (Wallr.) Zahlbr.	1-5, 8, 10, 11, 16, 30	*Cb*, *Tc, Q*	
Pseudevernia furfuracea (L.) Zopf	9, 29	*Ee, Ps*	SP
Psilolechia clavulifera (Nyl.) Coppins	12	*Pa* (exposed roots)	NT
Pycnora sorophora (Vain.) Hafellner	9	*Ps*	
Pyrenula nitida (Weigel) Ach.	5, 8	*Cb*	VU
P. nitidella (Flörke ex Schaer.) Müll. Arg.	5, 8, 10	*Cb*, *Fe*	EN

Table 2 – cont.

Ramalina farinacea (L.) Ach.	1-3, 5, 6, 8-10, 12, 16, 28, 29, 30	*Ap*, *Cb*, *Fe*, *P*, *Q*, *Tc*, *Pt*	SP, VU
R. pollinaria (Westr.) Ach.	2, 4	*Ap*, *Cb*, *Q*, *Tc*	SP, VU
Reichlingia leopoldii Diederich & Scheid.	3, 11, 12	*Ag*, *Cb*, *Q*, *Ug*	
Rinodina degeliana Coppins	1	*Q*	
R. efflorescens Malme	1, 2, 4, 6	*Ap, Cb*, *Q*, *Tc*	
Ropalospora viridis (Tønsberg) Tønsberg	2, 3, 5, 8-13, 21, 23, 26, 30	*Ag, Cb*, *Fe*, *Pt*, *Q*, *Tc*	
Scoliciosporum chlorococcum (Graewe ex Stenh.) Vězda	2, 8	*Cb*, epx	
S. sarothamni (Vain.) Vězda	2, 4, 6, 15	*Ag*, *Ap*, *Tc*	
**Taeniolella punctata* M.S. Christ. & D. Hawksw.	8	*Graphis scripta*/*Cb*	
Thelocarpon epibolum Nyl.	15	epx	LC
Trapeliopsis flexuosa (Fr.) Coppins & P. James	3, 7	epx	
T. granulosa (Hoffm.) Lumbsch	2, 4, 9	epx	
Usnea filipendula Stirt.	7, 29	*Q*	SP, VU
U. subfloridana Stirt.	9, 29	*Cb, Q*	SP, EN
Varicellaria hemisphaerica (Florke) Schmitt & Lumbsch	3, 5, 6, 7, 10	*Ap*, *Q*, *Tc*	VU
Violella fucata (Stirt.) T. Sprib.	1, 2, 4-6, 10, 15, 27	*Ap*, *Ag*, *Cb*, *Tc, Sa*	
Vulpicida pinastri (Scop.) J.-E. Mattsson	15	*Ag*	SP, NT
Xanthoria parietina (L.) Beltr.	6	*Ap*	
X. polycarpa (Hoffm.) Rieber	6	*Ap*	
Zwackhia viridis (Ach.) Poetsch & Schied.	2-6, 8-11	*Ap*, *Ag*, *Cb*, *Q*	VU

Abbreviations: * – saprotrophic or parasitic (lichenicolous) fungus; *Ag – Alnus glutinosa*, *Ap – Acer platanoides*, *Bp – Betula pendula*, *Ca – Corylus avellana*, *Cb –Carpinus betulus*, *Ee – Euonymus europaea*, *Fe – Fraxinus excelsior*, *Pa – Picea abies*, *Pav – Padus avium*, *Ps – Pinus sylvestris*, *P – Populus* sp., *Pt – Populus tremula*, *Q – Quercus* sp., *S – Salix* sp., *Sa – Sorbus auccuparia*, *Tc – Tilia cordata*; ter – terricolous, epx – epixylic; SP – strictly protected species, PP – partially protected species; CR – critically endangered, EN – endangered, VU – vulnerable, NT – near threatened, LC – least concern, DD – data deficient; [1] – as *O. androgyna* s.l.

species (Kubiak 2012). So far pine forest habitats with the sites of terricolous lichens and non-forest habitats – e.g., roadside woodlots, have been investigated to a small extent only. Furthermore, the data on lichenicolous fungi should be regarded as a contribution to the knowledge about the group.

It appears that the species diversity of lichens in the most valuable fragments of the study area, including meso- and eutrophic communities of oak-hornbeam forests, riverine forests and alder swamp woods, is well evidenced by the conducted research. Mixed lime-oak-hornbeam forests are one of the most valuable plant communities in terms of lichen biota heterogeneity. Many stenotopic lichens occur at these sites, in particular epiphytes and epixylites (Cieśliński et al. 1995; Czyżewska 2003). Although there are relatively many thematically diverse papers on lime-oak-hornbeam forests, the contribution of lichens in these communities is not thoroughly explored and lichens are basically overlooked in phytosociological studies.

Biodiversity of forest ecosystems largely depends on their natural conditions (Jaroszewicz 2007) and in the case of organisms like lichens, this is a determining factor (Cieśliński, Tobolewski 1988; Cieśliński et al. 1996; Czyżewska, Cieśliński 2003; Kubiak, Sucharzewska 2012). Species that are natural components of forest biocenoses dominate in the lichen biota of the study area. Stenotopic lichens are well

represented – they are less and less frequent outside the area of extensive and well preserved forests. When comparing the species composition of lichens recorded in the Łyna Valley with the results obtained in the strongly deforested, agricultural area of the Równina Warmińska plain (Szymczyk, Zalewska 2008), the number of lichen species growing in Wichrowo Forests is much larger (Równina Warmińska plain – 96 species, the Łyna Valley – 152). There were only 44 lichen species common for both compared areas – mostly widespread, ubiquitous and hemerophilous. Although the number of protected species recorded in the Równina Warmińska plain is similar – 14 species (the Łyna Valley – 19), threatened species were much fewer – 18 species (the Łyna Valley – 57).

The relatively large number of lichens attached to the bark of old oak trees, rare or even very seldom species, threatened with extinction in Poland, is one of the most valuable components of the lichen biota, and as it appears – differential for the studied fragment of Wichrowo Forests. The group includes: *Calicium adspersum*, *C. viride*, *Chrysothrix candelaris*, *Cliostomum corrugatum* i *Microcalicium disseminatum.* In Poland, these taxa are regarded as indicators of lowland old-growth forests (Czyżewska, Cieśliński 2003). A total of 21 species with this status were found in the study area (tab. 2). This number is relatively large compared to previously researched and described, similar refugia of forest lichens (Czyżewska, Cieśliński 2003). Some of the listed species occur in the study area with a relatively high frequency (eg., *Chrysothrix candelaris*, *Fellhanera gyrophorica, Varicellaria hemisphaerica, Zwackhia viridis*) compared to forests outside the nature reserves.

The occurrence of many lichen species in forests is determined by high species and age diversity of forest stands, owing to which individual taxa make use of the evolutionary consolidated ecological amplitude in relation to substrate (tree species), and consequently, may exist at a given site (see Cieśliński 2008). Oak is of particular significance in this respect, because of the longevity and diverse structure of periderm varying with age (Cieśliński 2008; Kubiak, Sucharzewska 2012). A total of 79 species of lichens and saprotrophic fungi were found on the bark of this phorophyte in the study area, which is a relatively large number (Kubiak 2011) and is higher than the number of species recorded on the bark of oak trees in the forest reserves „Dęby Napiwodzkie" and „Koniuszanka II" (71 species) with unique old-growth oak forest (Kubiak 2011). Many authors emphasize the importance of old oak trees for the preservation of species richness epiphytic lichens in forests, both in quantitative and qualitative terms (Cieśliński 2008; Johansson et al. 2009; Kubiak, Zalewska 2009; Kubiak, Sucharzewska 2012).

SUMMARY

As evidenced by the results presented and compared to other forests in Warmia and Masuria not included yet in the nature reserve conservation programme, the analysed fragment of Wichrowo Forests is characterised by above-average lichenological values and deserve protection. Due to the unique geographical location and land relief, the area functions as an ecological corridor and is potentially very valuable in the nature conservation system of the Warmia-Masuria province. Although

after verification, the area was ultimately removed from the list of potential Sites of Community Importance (SCI), its natural values are high and fully deserve detailed exploration and protection. Due to the limited scope of the research conducted, further lichenological research in Wichrowo Forests should be continued, both in other types of forest plant communities and in non-forest habitats directly connected with a forest.

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Streszczenie

Praca przedstawia wyniki badań lichenologicznych przeprowadzonych w dniach 6-8 września 2011 r. w ramach sesji terenowej towarzyszącej 25 Zjazdowi Lichenologów Polskich, który odbywał się w Medynach koło Lidzbarka Warmińskiego. Celem sesji było poznanie zasobów gatunkowych porostów położonych na terenie Lasów Wichrowskich (Nadleśnictwo Wichrowo), istniejących lub projektowanych, Specjalnych Obszarów Ochrony Siedlisk (SOOS) Natura 2000. W tej pracy przedstawiono wyniki inwentaryzacji przeprowadzonej na obszarze zaproponowanego do utworzenia SOOS „Dolina Środkowej Łyny – Smolajny”. Obszar o powierzchni 2953 ha obejmuje głównie zbiorowiska leśne, związane z przełomowym odcinkiem rzeki Łyny (grądy typowe, grądy zboczowe, łęgi, olsy). Na analizowanym terenie znaleziono 159 taksonów, w tym 151 gatunków porostów (grzybów zlichenizowanych) oraz 8 gatunków grzybów saprotroficznych lub pasożytniczych (naporostowych). Biota ta obejmuje 19 taksonów objętych w Polsce ochroną oraz 57 zagrożonych w skali kraju wymarciem. Ponadto, stwierdzono gatunki znane dotychczas w kraju z bardzo nielicznych stanowisk, do których można zaliczyć: *Bacidia hemipolia* f. *pallida*, *Biatora chrysantha, B. pontica*, *Biatoridium monasteriense*, *Fellhaneropsis vezdae*, *Lecanora farinaria.* Na podstawie uzyskanych wyników można stwierdzić, że analizowany fragment Lasów Wichrowskich, na tle innych kompleksów leśnych Warmii i Mazur nie objętych dotychczas ochroną rezerwatową, wykazuje ponadprzeciętne wartości lichenologiczne, które zasługują na ochronę.