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EPIPHYTIC LICHENS OF *QUERCUS ROBUR* IN WIGRY NATIONAL PARK (NE POLAND)

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Abstract. The study covered diversity of lichens on bark of *Quercus robur* in rich deciduous forest *Tilio-Carpinetum* and Scotch pine forest *Serratulo-Pinetum* in Wigry National Park (NE Poland). Ninety eight taxa of lichenized fungi have been recorded, which accounts for over 30% of lichens biota of the Park. Greater diversity of species has been noticed on oaks grown in *Tilio-Carpinetum* phytocenosis. Among the found lichens, 14 are protected by law and 18 are threatened in Poland. Moreover, 10 new species for Wigry National Park lichen biota have been found.

Key words: epiphytic lichens, *Quercus robur*, NE Poland, coniferous and deciduous forests

INTRODUCTION

Lichen biota of Wigry National Park is very rich. So far, 320 species have been recorded, but studies are in progress (Fałtynowicz (ed.) 1994, Fałtynowicz & Krzysztofiak 2010, Fałtynowicz unpubl. data), thus this number will certainly increase. High taxonomic diversity of lichens in the Park results from well-preserved and diverse forest ecosystems, a large number of old trees, presence of numerous stones and boulders, and low air pollution in north-eastern Poland. This part of the country stands out from the other regions. In numerous, vast forest complexes similar number of lichen taxa as in Wigry National Park have been found (Białowieża Forest – 400, Augustów Forest – 363, Knyszyn Forest – 365, Pisz Forest – 285, Borecka Forest – 303; see Cieśliński 2003a).

Epiphytic lichens bibliography is very rich – the older are summarized in Barkman's monography (Barkman 1969); the more contemporary one is listed in comprehensive works of Fos (1998) and Sillett & Antoine (2004). Two volumes of "The Polish

lichenological bibliography" (Fałtynowicz 1983, Fałtynowicz & Śliwa 2017) contain Polish literature. In the vast majority of works on the diversity and ecology of lichens, and in almost all Polish ones, studies have been conducted on the lowest 2 m of trunks – as high as researcher can reach standing on the ground. In Poland, only Łubek (2012) on *Fraxinus excelsior* and Kowalewska (2010) in her unpublished PhD thesis studied lichens of *Betula pendula* on trees in their full height. Scientists reached higher up on the trunks in monitoring studies of roadside oaks in the Netherlands (Herk 2001), where samples were collected up to 5 m height. The same border height were chosen during studies of spruces in the Harz Mountains by Hauck et al. (2000) and Kermit & Gauslaa (2001) in Norway. Only in the past few years, several publications covering topic of vertical distribution of lichens over the entire tree height were published (e.g. Sillett & Antoine 2004, Mikhailova 2007, Nascimbene et al. 2008, Asplund et al. 2010, Norden et al. 2012, Boch et al. 2013, Hovden 2013, Silva & Porto 2013, Pope 2015, Marmor et al. 2015a, b, Essen et al. 2016, Kiebacher et al. 2017). Little attention was paid to branches, however Hauck & Meissner (2002) noticed in the short communication that branches of *Abies balsamea,* which they studied in North America, were richer in lichens than trunks.

Among lowland trees, oaks have exceptionally diverse lichen biota, as indicated by previous studies, e.g. Fałtynowicz (1992), Rutkowski (1995), Rutkowski & Kukwa (2000), and Kubiak (2012).

The aim of current work is to present preliminary list of lichen species grown on *Quercus robur* bark in two common forest ecosystems: *Tilio-Carpinetum* and *Serratulo-Pinetum* in Wigry National Park. The work is a part of a long-term project comprising studies of biodiversity of cryptogams, such as lichens, micro- and macrofungi, bryophytes and algae on oak bark in Wigry National Park.

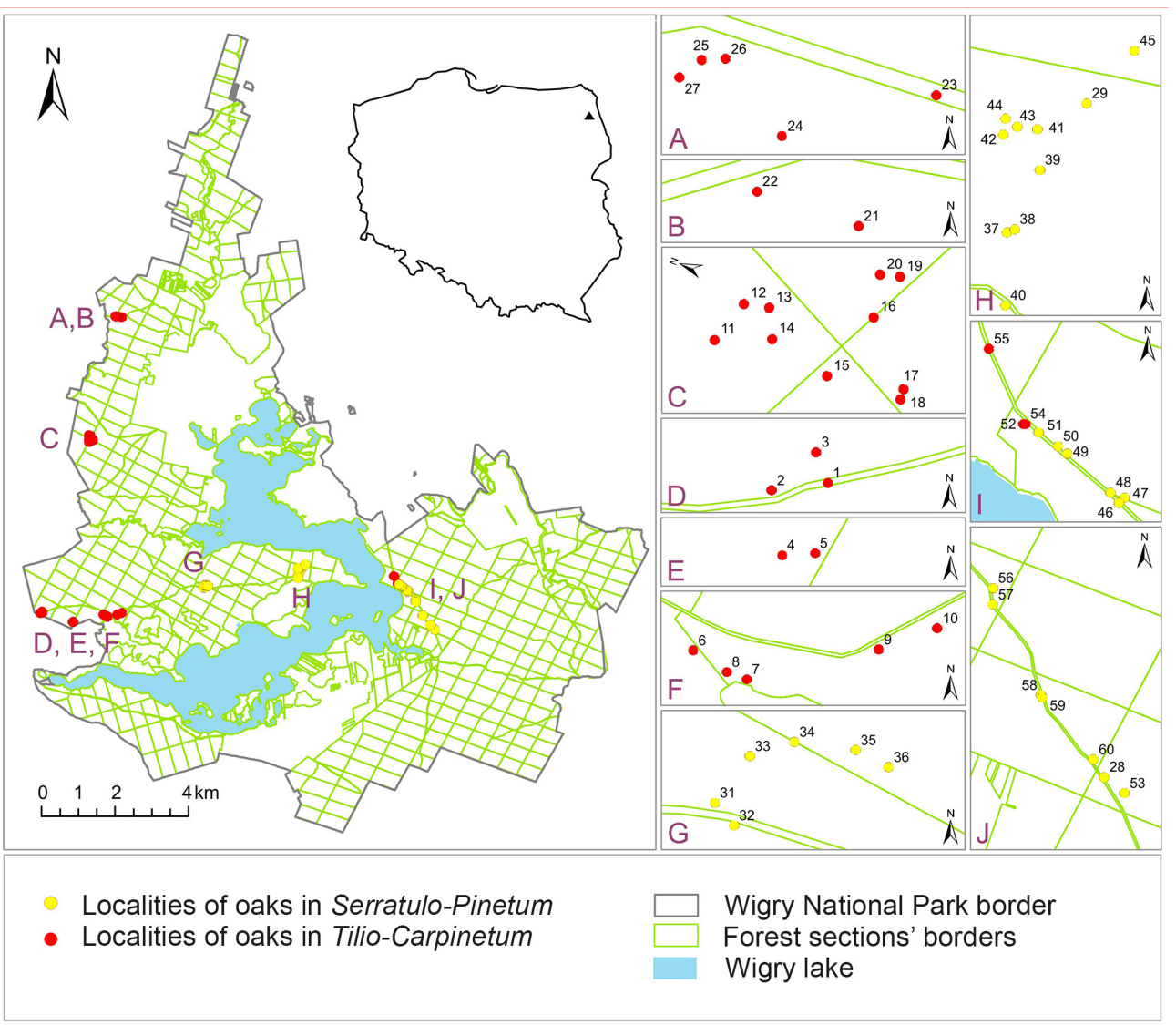

Fig. 1. Distribution of investigated oaks in Wigry National Park

MATERIALS AND METHODS

For the research, 60 specimens of *Quercus robur* were selected randomly in two forest associations: *Tilio-Carpinetum* Tracz. 1962 and *Serratulo-Pinetum* (W. Mat. 1981) J. Mat. 1988, half in each (Fig. 1). Each tree was at least 15 m high, the tallest ones have 30 m; diameter at breast height was at least 30 cm. All trees were healthy, without any visible damages, with straight, not tilted trunks. Data was collected using climbing techniques from trunks, axes (branches > 4 cm in diameter) and twigs (branches < 4 cm in diameter) from all places possible for penetration. Fieldworks were carried out from August to October 2017.

Collected lichens were identified in laboratory using classical methods – stereomicroscope and spot tests. For identification of sterile crustose species, thin layer chromatography in solvent A and C was applied (Orange et al. 2001, Kubiak & Kukwa 2011). The following keys were used for identification: Nowak & Tobolewski (1975), Smith et al. (2009) and Wirth et al. (2013), as well as taxonomic monographies: Tønsberg (1992) and Czarnota (2007). Lichens nomenclature is based on Polish checklist of Fałtynowicz & Kossowska (2016). Threatened categories of lichens in Poland were assigned according to Cieśliński et al. (2006), and in north-eastern Poland according to Cieśliński (2003b). A list of protected species has been prepared on the basis of Regulation of the Minister for Environment in relation to the protection of fungi species (Regulation... 2014).

Herbarium materials have been deposited in the herbaria of University of Wrocław (WRSL) and University of Gdańsk (UGDA).

RESULTS

LIST OF SPECIES

Taxa are listed in alphabetical order in the following layout: Latin name of species; total number of its localities (oak specimens); abbreviation of forest association: numbers of individual oaks (see Fig. 1), ecological remarks and others; protection status; threatened categories in Poland (threatened categories in NE Poland). Remarks about taxon appearance in the country were based on own observations and data of Fałtynowicz (2003).

Abbreviations: *Serr-Pin* – *Serratulo-Pinetum*; *Til-Cp* – *Tilio-Carpinetum*; SP – strict protection; PP – partial protection; NT – near threatened; VU – vulnerable; EN – endangered; CR – critically endangered; (–) species not endangered in NE Poland.

Amandinea punctata (Hoffm.) Coppins & Scheid. – 2; *Til-Cp*: 3, 17; common nitrophilous and coniophilous lichen.

Anisomeridium polypori (M.B. Ellis & Everh.) M.E. Barr – 1; *Serr-Pin*: 32, not often recorded in N part of the country, probably overlooked.

Arthonia radiata (Pers.) Ach. – 1; *Til-Cp*: 10; characteristic for deciduous forests, common in the country.

Arthonia spadicea Leight. – 22; *Til-Cp*: 3, 7, 8, 11, 12, 14–16, 19–23, 26, 27; *Serr-Pin*: 31, 34, 37, 39, 42, 45, 56; characteristic for deciduous forests with high air humidity, common in the country.

Athalia pyracea (Ach.) Arup, Frödén & Søchting – 1; *Til-Cp*: 17; common in Poland, mostly on trees and shrubs with fertile bark and pH close to neutral.

Bacidina sulphurella (Samp.) M. Hauck & V. Wirth – 1; *Serr-Pin*: 42; probably common in the country, but overlooked during field studies.

Biatora efflorescens (Hedl.) Erichsen – 1; *Til-Cp*: 32; up to the present, known from few and dispersed localities in the country. VU(–).

Biatora globulosa (Flörke) Fr. – 4; *Til-Cp*: 9, 13, 14, 17; characteristic for deciduous forests, common in the country.

Bryoria sp. – 1; *Til-Cp*: 1; the whole genus comprises rare and endangered species, which are present on Polish Red List with high threat categories; SP.

Buellia griseovirens (Turner & Borrer ex Sm.) Almb. – 10; *Til-Cp*: 9, 12, 17–19, *Serr-Pin*: 29, 32, 37, 38, 43; characteristic for deciduous forests, common in the country.

Calicium adspersum Pers. – 1; *Til-Cp*: 6; rare in the country, mostly on deciduous trees, especially present on oaks; EN(VU).

Calicium salicinum Pers. – 3; *Til-Cp*: 3, 6, 9; as the species above; VU(–).

Calicium viride Pers. – 1; *Til-Cp*: 6; common, especially in the north of the country, mostly on deciduous trees, especially often on oaks; VU(VU).

Candelariella efflorescens R.C. Harris & W.R. Buck – 1; *Serr-Pin*: 40; species recently described, and for this reason known in Poland only from few localities.

Candelariella xanthostigma (Ach.) Lettau – 1; *Til-Cp*: 9; common in Poland, growing on trees and shrubs with fertile bark and pH close to neutral.

Cetraria sepincola (Ehrh.) Ach. – 1; *Serr-Pin*: 43; growing mostly on thin, dead birch twigs, populations of the species reduce in the last years; SP; EN(–).

Chaenotheca chrysocephala (Ach.) Th. Fr. – 4; *Til-Cp*: 1, 3, 6, 16; characteristic for deciduous forests, common in the country.

Chaenotheca ferruginea (Turner ex Sm.) Mig. – 3; *Til-Cp*: 1, 12, 13; common in the country, growing on both deciduous and coniferous trees.

Chaenotheca stemonea (Ach.) Müll. Arg. – 2; *Til-Cp*: 13, 16; very rare in the country, growing mostly on wood, less frequently on tree bark; EN(EN).

Chaenotheca trichialis (Ach.) Th. Fr. – 1; *Til-Cp*: 17; characteristic for deciduous forests, common in the country; NT(–).

Chrysothrix candelaris (L.) J.R. Laundon – 4; *Til-Cp*: 1, 6–8, 24; rare in the south and central part of Poland where is definitely threatened; in the north of the country more frequent and abundant, weakly threatened; SP; CR(–).

Cladonia chlorophaea (Flörke ex Sommerf.) Spreng. – 2; *Til-Cp*: 4, 5; common ubiquistic lichen.

Cladonia coniocraea auct. – 53; *Til-Cp*: 1–9, 11–23, 25–27, 52, 55, *Serr-Pin*: 28, 29, 31–39, 41–51, 53, 56–60; common ubiquistic lichen.

Cladonia digitata (L.) Hoffm. – 3; *Til-Cp*: 6, 11, 13; common humusophilous lichen, especially often on trunk base and on wood.

Cladonia fimbriata (L.) Fr. – 20; *Til-Cp*: 4, 5, 9, 13, 14, 17, 18, 22, *Serr-Pin*: 29, 31, 32, 34, 35, 38, 42, 44, 50, 51, 53, 58, 60; common ubiquistic lichen.

Cladonia macilenta Hoffm. – 2; *Til-Cp*: 5, 22; common ubiquistic lichen.

Coenogonium pineti (Schrad.) Lücking & Lumbsch – 16; *Til-Cp*: 8, 11, 12, 15, 17, 19–22; 23, *Serr-Pin*: 33, 36–38, 41, 43; common in the country, but often overlooked due to a hardly visible thallus and very small apothecia.

Evernia prunastri (L.) Ach. – 39; *Til-Cp*: 1–7, 9–20, 22, 26, *Ser-Pin*: 28, 31–35, 37–40, 42–44, 47, 53, 58–60, common in the north of Poland, in recent years its number of localities and abundance clearly increased; NT(–).

Fuscidea arboricola Coppins & Tønsberg – 1; *Serr-Pin*: 33; quite rarely noted on deciduous trees in forests with high air humidity in the north of the country.

Fuscidea pusilla Tønsberg – 8; *Til-Cp*: 9, 16, *Serr-Pin*: 28, 33, 37, 39, 43, 59; often on deciduous tree bark in forests.

Hypocenomyce scalaris (Ach.) Choisy – 8; *Til-Cp*: 1–3, 6, 7, 9, 10–13; thermophilous and photophilous lichen common in the country, often occurs en masse, especially on acid bark of coniferous trees.

Hypogymnia physodes (L.) Nyl. – 45; *Til-Cp*: 1–7, 9–20, 22, 23, 25, 27, 54; *Serr-Pin*: 28, 29, 31–45, 47, 48, 50, 52, 53, 57–60; the most common foliose lichen in the country, especially on trees with acid bark.

Hypogymnia tubulosa (Schaer.) Hav. – 32; *Til-Cp*: 1–5, 9–11, 13–20, *Serr-Pin*: 28, 31–37, 39, 42–45, 53, 58–60; often in the country, in recent years its number of localities and abundance clearly increased; PP; NT(–).

Lecanora argentata (Ach.) Malme (incl. *L. subrugosa* Nyl.) – 3; *Til-Cp*: 1, 5, 15; common in the country, mostly on deciduous trees in forests.

Lecanora carpinea (L.) Vain. – 18; *Til-Cp*: 1–5, 9–11, 15, 17–20, *Serr-Pin*: 28, 37, 39, 48, 53; common in the country, especially on bark of aspen, poplars and willows.

Lecanora chlarotera Nyl. – 25; *Til-Cp*: 1, 3–5, 9, 10, 13, 15–20, *Serr-Pin*: 28, 33, 34, 37, 39–41, 43, 48, 51, 53, 57, 59; common in the country.

Lecanora compallens van Herk & Aptroot – 1; *Til-Cp*: 8; known from few localities in the north of the country, probably overlooked.

Lecanora conizaeoides Nyl. – 5; *Til-Cp*: 2, 15, *Serr-Pin*: 28, 48, 53; until recently the most abundant and frequent European lichen, exceptionally resistant to air pollution; currently in regress, much less often noted.

Lecanora expallens Ach. – 25; *Til-Cp*: 1–3, 5–7, 9, 12, 13, 16, 17, 20–22, 24–27, *Serr-Pin*: 34, 37, 40, 44, 45, 51, 60; epiphyte characteristic for forest trees, often in the country.

Lecanora populicola (DC.) Duby – 2; *Til-Cp*: 17, 18; rare, mostly connected with poplars bark.

Lecanora pulicaris (Pers.) Ach. – 12; *Til-Cp*: 2, 4, 5, 9, 13, 14, 17, 18, *Serr-Pin*: 28, 33, 40, 42; one of the most frequent epiphyte; on deciduous and coniferous tree bark and wood.

Lecanora saligna (Schrad.) Zahlbr. – 4; *Til-Cp*: 1, 4, 5, 9; common species of eutrophic habitats, equally often on bark of deciduous trees and on wood.

Lecanora symmicta (Ach.) Ach. – 3; *Serr-Pin*: 28, 31, 53; common in the country.

Lecidea nylanderi (Anzi) Th. Fr. – 4; *Til-Cp*: 9, 54, *Serr-Pin*: 37, 40; common in the country.

Lecidella elaeochroma (Ach.) Choisy – 13; *Til-Cp*: 4, 9–11, 14, 15, 17–20, *Serr-Pin*: 28, 59, 60; mostly on fertile bark of deciduous trees, especially on aspen and willows; common in the country.

Lepraria elobata Tønsberg – 31; *Til-Cp*: 2, 4, 9, 10, 12, 17, 19–23, 27, *Serr-Pin*: 28, 29, 31, 33–45, 48, 50, 51, 59; common in forests.

Lepraria finkii (B. de Lesd. ex Hue) R.C. Harris – 19; *Til-Cp*: 8, 13, 15, 16, 19, 21, 23–25, 27, *Serr-Pin*: 28, 32, 36, 41, 42, 51, 52, 56, 60; common in Poland in forests with high air humidity.

Lepraria incana (L.) Ach. – 36; *Til-Cp*: 1–4, 6, 8, 9, 12, 13, 15–17, 20, 22–25, 27, *Serr-Pin*: 28, 29, 31–35, 37–45, 58–60; common in Poland, in forests and open spaces.

Lepraria jackii Tønsberg – 13; *Til-Cp*: 1, 4, 9, 20, *Serr-Pin*: 29, 31, 33–37, 39, 45; forest epiphytic species common in the country.

Lepraria rigidula (B. de Lesd.) Tønsberg – 13; *Til-Cp*: 1, 9, 19, 20, *Serr-Pin*: 28, 32, 38, 39, 42, 43, 50, 51, 53; rarely noted in the country.

Melanelixia glabratula (Lamy) O. Blanco & al. – 45; *Til-Cp*: 1–5, 7–24, 26, 52, 54, *Serr-Pin*: 28, 29, 31–34, 37–45, 49, 51, 53, 56, 60; in recent years its number of localities and abundance clearly increased.

Melanelixia subaurifera (Nyl.) O. Blanco & al. – 25; *Til-Cp*: 1–5, 9, 10, 13–15, 17–20, *Serr-Pin*: 28, 31,

32, 37, 39, 41–44, 53, 59, 60; characteristic for deciduous forests with high air humidity, often in the country, but frequently confused with the species above; PP.

Melanohalea exasperatula (Nyl.) O. Blanco & al. – 26; *Til-Cp*: 1–5, 9–15, 17–19, *Serr-Pin*: 28, 29, 31, 34, 37, 39, 40, 42, 43, 53, 59, 60; mostly on fertile bark of deciduous trees; in forests, especially frequent on the upper side of axes and twigs; common.

Micarea micrococca (Körb.) Gams ex Coppins – 6; *Til-Cp*: 4, 22, *Serr-Pin*: 33, 36, 37, 60; common higrophilous species, often not distinguished from *M. prasina*.

Micarea prasina Fr. – 31; *Til-Cp*: 1, 2, 4, 5, 7, 9–12, 14–17, 19, 20, 23, 52, *Serr-Pin*: 28, 31, 33–39, 42, 43, 45, 58, 59; common higrophilous species.

Ochrolechia bahusiensis H. Magn. – 1; *Til-Cp*: 9; often in the country, known from many localities.

Opegrapha niveoatra (Borrer) J.R. Laundon – 1; *Serr-Pin*: 42; often in the country, on bark of deciduous trees in forests; VU(–).

Parmelia saxatilis (L.) Ach. – 1; *Til-Cp*: 7; quite rare in lowlands, on tree bark and boulders; more frequent in the mountains, mostly on rocks.

Parmelia sulcata Taylor – 53; *Til-Cp*: 1–27, 52, 54, *Serr-Pin*: 28, 29, 31–45, 47, 48, 50, 51, 53, 57–60; one of the most common foliose lichen in the country, avoids acid bark of coniferous trees.

Parmeliopsis ambigua (Wulfen) Nyl. – 2; *Til-Cp*: 5, 9, common in the country, especially on bark of coniferous trees and wood.

Peltigera praetextata (Flörke) Zopf – 1; *Serr-Pin*: 51; quite rare in the country, characteristic for fertile deciduous forests, often growing on tree bark at the base of trunks or on epiphytic bryophytes; SP; VU(–).

Pertusaria albescens (Huds.) Choisy & Werner – 1; *Til-Cp*: 14; common in the country, characteristic for bark of deciduous trees.

Pertusaria amara (Ach.) Nyl. – 26; *Til-Cp*: 1, 3, 5–7, 9–13, 15, 17, 20–27, *Serr-Pin*: 32–35, 59, 60; common in the country, characteristic for bark of deciduous trees.

Pertusaria coccodes (Ach.) Nyl. – 6; *Til-Cp*: 7, 9, 17, 19, 22, 27; often, characteristic for bark of deciduous trees, especially of oaks and beeches; NT(–).

Phaeophyscia nigricans (Flörke) Moberg – 1; *Til-Cp*: 17; common nitrophilous lichen, equally often, growing on limestone rocks or concrete and tree bark, especially of poplars and willows.

Phaeophyscia orbicularis (Neck.) Moberg – 3; *Til-Cp*: 17, 18, *Serr-Pin*: 53; as the species above.

Phlyctis argena (Ach.) Flot. – 53; *Til-Cp*: 1–26, 52, 54, 55, *Serr-Pin*: 28, 29, 31–51, 53, 56, 58–60; common in the country, characteristic for bark of deciduous trees.

Physcia adscendens (Fr.) H. Olivier – 26; *Til-Cp*: 1–5, 9–11, 13–15, 17–20, *Serr-Pin*: 28, 29, 31, 34, 37, 39, 40, 42, 44, 48, 53, 59, 60; common nitrophilous lichen, equally often, growing on limestone rocks and tree bark.

Physcia aipolia (Ehrh. ex Humb.) Fürnrohr subsp. *aipolia* – 3; *Til-Cp*: 17, 19, 20; quite rare nitrophilous lichen, growing especially on poplars and willows; NT(–).

Physcia dubia (Hoffm.) Lettau – 1; *Til-Cp*: 1; common nitrophilous lichen, equally often, growing on limestone rocks and tree bark, especially of poplars and willows.

Physcia stellaris (L.) Nyl. subsp. *stellaris* – 9; *Til-Cp*: 3, 9–11, 15, 17–20, *Serr-Pin*: 28; common nitrophilous lichen, growing on deciduous trees with fertile bark.

Physcia tenella (Scop.) DC. – 35; *Til-Cp*: 1, 2, 4, 5, 9–11, 13–15, 17–20; *Serr-Pin*: 28, 29, 31–34, 36–45, 48, 53, 58, 59, 60; common nitrophilous lichen, equally often, growing on limestone rocks and tree bark.

Physconia distorta (With.) J.R. Laundon – 1; *Til-Cp*: 17; rare nitrophilous lichen, growing on deciduous trees bark; EN(–).

Physconia enteroxantha (Nyl.) Poelt – 4; *Til-Cp*: 17–19, *Serr-Pin*: 53; common nitrophilous lichen, growing on deciduous trees bark.

Physconia grisea (Lam.) Poelt – 1; *Til-Cp*: 17; common nitrophilous lichen, growing on deciduous trees bark.

Placynthiella dasaea (Stirt.) Tønsberg – 6; *Til-Cp*: 4, 12, 18, *Serr-Pin*: 37, 39, 44; common, growing mainly on wood, but also on deciduous trees bark and on soil.

Placynthiella icmalea (Ach.) Coppins & P. James – 5; *Til-Cp*: 4, 5, 10, 18, *Serr-Pin*: 45, common, growing mainly on wood, but also on deciduous trees bark and on soil.

Placynthiella uliginosa (Schrad.) Coppins & P. James – 1; *Til-Cp*: 4; common, growing mainly on soil, but also on deciduous trees bark and on wood.

Platismatia glauca (L.) W.L. Culb. & C.F. Culb. – 38; *Til-Cp*: 1–7, 9–20, 23, 25 27, 52, *Serr-Pin*: 28, 31–40, 42–44, 53, 58, 60; in recent years its number of localities and abundance significantly increased.

Polycauliona polycarpa (Hoffm.) Frödén, Arup & Søchting – 18; *Til-Cp*: 1, 2, 4, 5, 9, 15, 17–20, *Serr-Pin*: 28, 37, 40, 43, 44, 53, 59, 60; common nitrophilous lichen, growing on deciduous trees bark.

Porina aenea (Wallr.) Zahlbr. – 1; *Til-Cp*: 13; common higrophilous lichen.

Pseudevernia furfuracea (L.) Zopf – 23; *Til-Cp*: 1, 3–5, 7, 9–11, 12, 15, 17–20, *Serr-Pin*: 28, 31, 35–37, 40, 42, 53, 58, 60; acidophilous species common in the country.

Ramalina farinacea (L.) Ach. – 35; *Til-Cp*: 1, 2, 4, 5, 7–14, 16–22, 24–26, *Serr-Pin*: 28, 29, 31–33, 36,

39, 43–45, 53, 58–60; common in the north part of the country, in the other regions quite rare; PP; VU(–).

Ramalina fastigiata (Pers.) Ach. – 2; *Til-Cp*: 17, 19; quite often in the north part of the country, in the other regions very rare; SP; EN(–).

Ramalina fraxinea (L.) Ach. – 2; *Til-Cp*: 17, 20; often in the north part of the country, in the other regions very rare; SP; EN(–).

Ramalina pollinaria (Westr.) Ach. – 1; *Til-Cp*: 8; often in the north-eastern part of the country, in the other regions rare. PP; VU(–).

Rinodina degeliana Coppins – 1; *Til-Cp*: 9; species recently described, and for this reason known in the country only from few localities.

Ropalospora viridis (Tønsberg) Tønsberg – 3; *Til-Cp*: 5, *Serr-Pin*: 33, 42; often on deciduous trees bark in forests.

Scoliciosporum chlorococcum (Graeve ex Stenh.) Vězda – 3; *Til-Cp*: 1, 5, *Serr-Pin*: 53; common nitrophilous species, growing on bark of different trees and on wood.

Trapeliopsis flexuosa (Fr.) Coppins & P. James – 2; *Til-Cp*: 17, *Serr-Pin*: 39; common on wood, less often on tree bark.

Trapeliopsis granulosa (Hoffm.) Lumbsch – 6; *Til-Cp*: 5–7; *Serr-Pin*: 31, 36, 58; common on soil and wood, less often on tree bark.

Tuckermanopsis chlorophylla (Willd.) Hale – 13; *Til-Cp*: 2, 9, 15, 17–19, *Serr-Pin*: 28, 29, 31, 35, 37, 43, 60; often in the north part of the country, in the other regions very rare; PP; VU(–).

Usnea dasopoga (Ach.) Röhl. – 4; *Til-Cp*: 9, 10, *Serr-Pin*: 28, 60; often again in the north part of the country, in the other regions very rare; PP; VU(–).

Usnea hirta (L.) Weber ex F.H. Wigg. – 2; *Til-Cp*: 2, *Serr-Pin*: 40, common in the north part of the country, in the other regions rare; PP; VU(–).

Usnea subfloridana Stirt. – 2: *Til-Cp*: 16, *Serr-Pin*: 42; often in the north part of the country, in the other regions; SP; EN(–).

Violella fucata (Stirt.) T. Sprib. – 3; *Serr-Pin*: 37, 38, 40; common in the forests in the whole country.

Vulpicida pinastri (Scop.) J.-E. Mattsson & M.J. Lai – 1; *Serr-Pin*: 31; common in the country, but occurs in the form of small, not numerous thalli; PP; NT(–).

Xanthoria parietina (L.) Th. Fr. – 23; *Til-Cp*: 1–5, 9–11, 13–15, 17–20, *Serr-Pin*: 28, 40, 42–44, 53, 59, 60; common nitrophilous lichen, on tree bark and rocks.

CHARACTERISTIC OF LICHEN BIOTA

Ninety eight taxa (97 species and 1 taxon in the range of genus) were found on all investigated oaks. It accounts for 30% of all lichens known from Wigry National Park (Fałtynowicz unpubl. data). Common species are *Cladonia coniocraea, Hypogymnia physodes, Melanelixia glabratula, Parmelia sulcata* and *Phlyctis argena*. Very often noted were *Evernia prunastri, Lepraria incana* and *Plastismatia glauca*. The last species were encountered only in tree canopies. Significantly more species were found in deciduous forest

Table 1. Protected, endangered and other interesting taxa (only species with VU, EN and CR categories are included)

Name of taxon	Form of protection	Categories of endanger in Poland (in region)	Remarks
Biatora efflorescens	–	VU(–)	
Bryoria sp.	all taxa protected	all taxa on Red List	
Calicium adspersum	–	EN(VU)	
Calicium salicinum	–	VU(–)	
Calicium viride	–	VU(VU)	
Cetraria sepincola	–	EN(–)	
Chaenotheca stemonea	–	EN(EN)	
Chrysothrix candelaris	–	CR(–)	
Hypogymnia tubulosa	PP	–	
Melanelixia subaurifera	PP	–	
Peltigera praetextata	SP	VU(–)	
Ramalina farinacea	PP	VU(–)	
Ramalina fastigiata	SP	EN(–)	
Ramalina fraxinea	SP	EN(–)	
Ramalina pollinaria	PP	VU(–)	
Rinodina degeliana	–	–	rare in Poland (?)
Tuckermanopsis chlorophylla	PP	VU(–)	
Usnea dasopoga	PP	VU(–)	
Usnea hirta	PP	VU(–)	
Usnea subfloridana	SP	EN(–)	
Vulpicida pinastri	PP	–	

Abbreviations: SP – strict protection; PP – partial protection; VU – vulnerable; EN – endangered; CR – critically endangered.

Tilio-Carpinetum (86), than in coniferous forest *Serratulo-Pinetum* (57). Likewise, the highest taxa number on one tree (40) was noted in *Tilio-Carpinetum* association. More frequently, numerous species grew on the oaks in deciduous forest, e.g. *Evernia prunastri, Melanelixia glabratula, Ramalina farinacea, Pertusaria amara, Xanthoria parietina, Lecidella elaeochroma, Lecanora carpinea* and *L. chlarotera*. Besides few exclusive species, e.g. *Cladonia coniocraea* and *C. fimbriata*, the oaks in coniferous forest were far less rich in lichen species. The dissimilarity probably arises from significantly different diversity of epiphytic lichens in both associations – deciduous forests are far more rich in epiphytic species; epiphytes species composition were more rich on the other trees and shrubs growing in proximity of the investigated oaks in *Tilio-Carpinetum* association (see eg. Cieśliński et al. 1995). Unquestionable impact on that difference have phytoclimatic conditions – inside coniferous forests humidity conditions are less beneficial for lichens, temperature and insolation are higher than in *Tilio-Carpinetum* association. It results with smaller number of taxa inhabiting trees and thus, smaller number of diaspores available.

High number of taxa protected by law (14 species) and threatened (18) were found on the investigated oaks (Table 1). However, it is worth noted, that it does not reflect their real degree of threat in the Park. The most of them, even those with EN and CR categories in the country, are not even on regional Red List (compare Table 1). North-eastern Poland is the least polluted area of the country. Thus, state of preservation of many species is at least satisfactory. Basing on our own, long-term studies of lichens in this part of the country, we state that none of the species present in Table 1 is in real danger. Among found species only one – *Rinodina degeliana* – is very rare in Poland indeed (probably overlooked – see Kubiak 2010).

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