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ORIGINAL RESEARCH PAPER

Notes on the distribution of lichen biota of Podlasie. III. Nowosady village, Podlaskie province (north-eastern Poland)

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Abstract

The present study was undertaken to evaluate the biodiversity of lichen species in Nowosady village and surrounding areas. This work was conducted in 2014 (in August) and biodiversity of lichen species growing on tree bark and bushes, on dead wood (anthropogenic origin), glacial erratics, concrete, mortared walls and other specific substrates like eternit roof slates has been assessed. The lichen species represented morphologically diverse forms: crustose (38%), foliose (38%), fruticose (13%), dimorphous (5%), placodial (3%) and squamulose (3%). They belonged to different ecological types including epiphytes (27 species), epixyles (18) and epilithes (12). Out of 39 species identified in Nowosady village, five are included in the Polish red list of lichens: *Bryoria fuscescens*, *Evernia prunastri*, *Hypogymnia tubulosa*, *Ramalina farinacea* and *Ramalina fraxinea*. Four taxons from the study area are under statutory protection of species. One species, *Ramalina fraxinea* is under full protection and 3 species (*Bryoria fuscescens*, *Evernia prunastri* and *Hypogymnia tubulosa*) are under partial protection.

Keywords
lichens; distribution; Nowosady village; Podlasie; NE Poland

This issue of Acta Mycologica is dedicated to Professor Maria Lisiewska and Professor Anna Bujakiewicz on the occasion of their 80th and 75th birthday, respectively.

Introduction

Nowosady is a small village located at the border between two mesoregions: Białostocka Upland and Narew River Upper Valley. The lichen biota of these geographical areas is poorly known.

So far, the diversity of lichen biota of several Polish cities has been investigated, including Gdańsk, Sopot, Gdynia [1], Olsztyn [2] and Świdnik [3]. The lichen species inhabiting smaller towns on Podlasie, like Drohiczyn [4], Mielnik [5], Boćki [6] and Białowieża [7] have been also described. The diversity of lichen biota of orchards in different towns has been studied in Slovakia, Italy and Poland [8], and in several Polish villages or rural areas, including Warmia Plain [9], Klewinowo [10] and Hermanówka [11]. The main goal of the present study was to evaluate the biodiversity of species in the Nowosady village and its surrounding areas, taking into account their natural environmental conditions.

Study area

Nowosady is a small village in Podlaskie Province located on Północnopodlaska Lowland, at the border of two mezoregions: Narew Upper Valley and Białostocka Upland [12], in the Cg-square of the ATPOL grid square system [13]. The village occupies a hilly upland area with elevations reaching 157.3 m above sea level. The terrain was formed by last middle-Poland glaciation. Geologically, the study area was formed by the ground moraine.

The cover of postglacial deposits reaches 200 m and is composed of mainly sands and gravels. The Nowosady village lies in the area where the influence of the moderate warm and moderate humid continental climates meet. The overlapping of the climates and the relief of this area have considerable effect on the flora of the village studied.

The agricultural landscape of this area is intertwined by the fragments of mixed forests, comprising fresh forests (*Peucedano-Pinetum*) and dry forests (*Cladonio-Pinetum*), sometimes with communities comprising birch or saplings of oaks and herbal layer dominated by field weed species. The age of these forests is estimated to be 20–40 and 40–60 years.

Material and methods

The study was carried out in Nowosady village and in the nearby areas, in August 2014. The lichen biota was analyzed using methods that are generally accepted in lichenology. A result of the field study was the compilation of a floristic list of all lichen species. Materials for the herbarium, deposited at the Herbarium of the Institute of Biology, University of Białystok, were identified on the basis of morphological traits of their thalli, anatomical details and the thallus content of specific substances reacting with chemical reagents inducing color changes. The nomenclature for lichen species was adopted from Diederich et al. [14]; for *Melanohalea* and *Melanelixia* genera from Blanco et al. [15]. Species included in the "Red list of the lichens in Poland" were quoted after Cieśliński et al. [16] and protected species after the regulation of the Minister of the Environment dated October 9, 2014, on the protection of species of fungi (OJ from 2014, item 1408) [17]. Geographic coordinates of study sites of Nowosady village (53°00′09.5″ N / 23°13′00.6″ E – 53°00′21.6″ N / 23°13′45.4″ E) were established by GPS.

Results and discussion

Diversity of lichens

Out of 40 taxons identified in the study area, 39 were identified to the species level. The presented list of lichen species was ordered alphabetically.

Symbols of trees and bushes: trees: Ah – *Aesculus hippocastanum*, Ap – *Acer platanoides*, Bp – *Betula pendula*, Ca – *Corylus avellana*, Pa – *Picea abies*, Ps – *Pinus sylvestris*, Pt – *Populus tremula*, Qr – *Quercus robur*, Ra – *Robinia pseudoaccacia*; Sa – *Salix alba*, Tc – *Tilia cordata*; fruit and ornamental trees: C – *Cerasus* sp., M – *Malus* sp., P – *Prunus* sp., Pav – *Prunus avium*, Py – *Pyrus* sp.; bushes: Rt – *Rhus typhina*, Sv – *Syringa vulgaris*.

Strictly protected species are indicated by "!!", partly protected – by "!" and threatened by: EN – endangered, NT – near threatened, VU – vulnerable.

Bryoria fuscescens (Gyeln.) Brodo & D. Hawksw. – on wooden fence, !, VU;
Buellia punctata (Hoffm.) A. Massal. – on bark of tree (Bp, M), wooden fence;
Caloplaca citrina (Hoffm.) Th. Fr. s.l. – on concrete foundation;
Caloplaca decipiens (Arnold) Blomb. & Forssell – on concrete electric poles and fence;
Candelaria concolor (Dicks.) Stein – on bark of tree (C);

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Candelariella aurella (Hoffm.) Zahlbr. – on concrete electric poles and fence;
Candelariella xanthostigma (Ach.) Lettau – on bark of tree (Bp, P, Qr, Ra, Tc);
Cladonia chlorophaea (Sommerf.) Spreng. s.l. – on wooden fence;
Cladonia fimbriata (L.) Fr. – on bark of tree (Ps, Tc), wooden fence;
Evernia prunastri (L.) Ach. – on bark of tree (C, Qr, Tc), wooden fence, NT;
Hypocenomyce scalaris (Ach.) M. Choisy – on bark of tree (Ps), wooden fence;
Hypogymnia physodes (L.) Nyl. – on bark of tree (Ah, Ap, Bp, C, P, Pa, Ps, Pav Py, Qr, Sv, Rt), wooden fence;
Hypogymnia tubulosa (Schaer.) Hav. – on bark of tree (Qr), !, NT;
Lecanora albescens (Hoffm.) Flörke s.l. – on concrete electric poles and fence;
Lecanora carpinea (L.) Vain. – on bark of tree (P, Qr);
Lecanora chlarotera Nyl. – on bark of tree (P) – on roadside tree;
Lecanora conizaeoides Cromb. – on bark of tree (Ps), wooden fence;
Lecanora dispersa (Pers.) Sommerf. s.l. – on concrete electric poles and fence;
Lecanora muralis (Schreb.) Rabenh. – on erratic boulder, concrete electric poles and on eternit roof slates;
Lecidella stigmatea (Ach.) Hertel & Leuckert – on concrete electric poles;
Lepraria sp. – on bark of tree (Ah, P, Ra);
Melanohalea exasperatula (Nyl.) O. Blanco et al. – on bark of tree (Ah, C, P, Qr), wooden fence;
Melanelixia fuliginosa (Duby) O. Blanco et al. – on wooden fence;
Parmelia sulcata Taylor – on bark of tree (Ah, Ap, Bp, M, P, Qr, Rt, Tc), wooden fence;
Phaeophyscia orbicularis (Neck.) Moberg – on bark of tree (Ah, M, Pt, Sa, Rt, Tc), wooden fence, concrete fence, steel, eternit roof slates;
Phaeophyscia nigricans (Flörke) Moberg – on concrete fence;
Phlyctis argena (Spreng.) Flot. – on bark of tree (Ap, Ca, Qr, Ra, Sa);
Physcia adscendens H. Olivier – on bark of tree (Ah, Ap, M, P, Pt, Py, Rt, Sa), steel;
Physcia caesia (Hoffm.) Fürnr. – on erratic boulder, concrete electric poles and fence, on steel;
Physcia dubia (Hoffm.) Lettau var. ***dubia*** – on bark of tree (Ah, M, P, Tc);
Physcia stellaris (L.) Nyl. – on bark of tree (P, Pav), wooden fence;
Physcia tenella (Scop.) DC. – on bark of tree (M, P, Rt) and on steel;
Physconia enteroxantha (Nyl.) Poelt – on bark of tree (Ah), wooden fence;
Pseudevernia furfuracea (L.) Zopf – on bark of tree (C);
Ramalina farinacea (L.) Ach. – on bark of tree (Tc), !, VU;
Ramalina fraxinea (L.) Ach. – on bark of tree (Qr), wooden fence, !!, EN;
Scoliciosporum chlorococcum (Stenh.) Vězda – on bark of tree (Tc);
Trapeliopsis granulosa (Hoffm.) Lumbsch – on wooden fence;
Xanthoria parietina (L.) Th. Fr. – on bark of tree (Ap, Bp, C, P, Pa, Pt, Pav, Py, M, Pt, Qr, Rt, Sa, Sv), wooden fence, on concrete electric poles and fence, on steel;
Xanthoria polycarpa (Hoffm.) Rieber – on bark of tree (Bp), wooden fence.

The dominant group of lichens comprises species with crustose thalli (38%), which inhabit shaded areas. Some of them colonize smooth tree bark, substrates of anthropogenic origin or soil. Similarly represented are foliose lichens (38%), which prefer more sunny locations. Lichens with dimorphous thalli (5%) live on wooden fences. Numerous are also the species with fruticose thalli (13%), inhabiting tree bark. The percentage of lichens representing other morphological groups (placodial and squamulose) is minor, reaching nearly 6%.

Habitat preferences of lichens

Epiphytes. Out of 40 lichen species found in the study area, 27 are epiphytes colonizing the bark of trees (27 tree species) or shrubs (6 species). Eleven species are the so-called exclusive epiphytes growing on a variety of tree species including: *Q. robur* (9 species), *A. hippocastanum* (8), *T. cordata* (8), *A. platanoides* (6), *B. pendula* (6), *P. sylvestris* (4), *S. alba* (4), *P. tremula* (3), *R. pseudoacacia* (3), *P. abies* (2), *C. avellana* (1), fruit and ornamental trees: *Prunus* sp. (12), *Malus* sp. (7), *Cerasus* sp. (6), *P. avium*

(3), *Pyrus* sp. (3), and bushes – *Rh. typhina* (6), *S. vulgaris* (2). Clearly visible is the large proportion of nitrophilous lichens with large thalli [18], representing the genera: *Physcia* (*P. adscendens*, *P. dubia*, *P. stellaris* and *P. tenella*), *Physconia* (*P. enteroxantha*), *Ramalina* (*R. farinacea*, *R. fraxinea*) or *Xanthoria* (*X. parietina*, *X. polycarpa*). Some rare lichen species were detected on the bark of these trees: *Ramalina farinacea* and *R. fraxinea*. Moreover, several species like: *Candelariella xanthostigma*, *Phaeophyscia enteroxantha*, *Physcia adscendens*, *P. tenella*, *Xanthoria parietina* and *X. polycarpa* represent mesophytic or xerophytic character [19]. Analysis of epiphytic species in Nowosady village has shown, that the number of 27 identified lichen species, is similar to that detected in other small villages in Poland, e.g., 31 taxons found in Klewinowo [10], 26 in Hermanówka [11] and 33 epiphytes from Świdnik town [3]. Similar richness of epiphytes was observed in orchards in Slovakia (52 epiphytic lichen species) and Italy (45). In Polish orchards 32 epiphytes were noted [8]. Lower than in other studies epiphytic species richness found in Poland can be partially explained by diverse geographical location of the study sites. Climatic conditions, especially rainfall, are considered as the most important factors that impact the species diversity. In comparison with other parts of Poland as well as with sites in Italy and Slovakia, Nowosady village is characterized by smallest amount of rainfall [20]. This kind of climatic conditions would negatively influence the growth of lichens. The number of species established in Nowosady is poorer than in Białowieża (94 epiphytes lichen species) [7], Olsztyn (63) [2], Boćki (57) [6], Mielnik (47) [5] and Drohiczyn (43) [4].

Epixylic lichens. The next most abundant ecological group found in the study area (18 species) consisted of lichens thriving on dead wood. Four of them are exclusively epixylic. In Nowosady village and in the surrounding areas, the epixylic lichens are closely associated with anthropogenic wood substrates (pillars, fences, crosses, utility buildings). Matwiejuk [6], for example, has observed 41 taxons from epixylic lichens in Boćki. In other towns and small localities on Podlaskie Province different number of epixylic lichens was observed: 26 species in Mielnik [5], 24 species in Białowieża [7], and only six species in Drohiczyn [4]. Kiercul [10] has observed 26 species representing this type of lichens in Klewinowo and 12 in Hermanówka [11].

Epilithes and lichens of atypical substrates. The epilithic lichen biota was represented by a total of 12 species. Epilithic species grow on natural substrates (glacial erratics, rocks) and anthropogenic surfaces (concrete pillars, mortared walls, tombstones). Exclusively epilithic lichens identified in the study area were *Physcia caesia* and *Lecanora muralis*. Eleven species from this group was also found to colonize artificial substrates (concrete, bricks). They included *Caloplaca citrina*, *C. decipiens*, *Lecanora albescens*, or *Xanthoria parietina*. In the present study these calciphilous lichens accompany nitrophilous species, chiefly from the family Physciaceae.

Total species richness of epilithic lichens found in Nowosady (12 species) appeared comparable to the number of species detected previously in other small villages in Poland: 17 taxons in Klewinowo [10] 9 taxons in Hermanówka [11] and 17 taxons in Polish town – Świdnik. In contrast higher species richness of epilithic lichens was noted in Boćki [6] and Mielnik [5] (38 species) as well as in Drohiczyn [4] and Białowieża [7] (32 and 24 species respectively). An interesting phenomenon of the present study is the tendency for colonization of atypical substrates such as eternit roof slates by lichen species *Lecanora muralis* and *Phaeophyscia orbicularis*. Previously Kiercul [10] has observed 15 taxons colonizing atypical substrates in Klewinowo, and only one lichen *Lecanora muralis* in Hermanówka [11]. Nowosady village has a fairly large number of old buildings and wooden fences which offer comfortable living conditions to lichens preferring and colonizing organic substrates. The limited number of natural habitats in the form of rocks or glacial erratics also causes intensive growth of calciphilous lichens colonizing anthropogenic substrates. Obtained results are expected to contribute to the advance of more lichen oriented protection strategies.

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References

1. Fałtynowicz W, Izydorek I, Budzbon E. The lichen flora as bioindicator of air pollution of Gdańsk, Sopot and Gdynia. Łódź: Polish Botanical Society; 1991. (Monographiae Botanicale; vol 73). http://dx.doi.org/10.5586/mb.1991.001
2. Kubiak D. Lichens of red oak *Quercus rubra* in the forest environment in the Olsztyn Lake District (NE Poland). Acta Mycol. 2006;41(2):319–328. http://dx.doi.org/10.5586/am.2006.033
3. Wójciak H, Korona K. The condition of the biota of lichens in Świdnik. Teka Komisji Ochrony i Kształtowania Środowiska Przyrodniczego. 2008;5:199–207.
4. Matwiejuk A. Lichens of Drohiczyn on the Bug River (Podlasie, Eastern Poland). Rocz AR Pozn Bot Stec. 2009;13:57–62.
5. Matwiejuk A. Lichens of Mielnik on Bug River (Podlasie, eastern Poland). Opole Scientific Society Nature Journal. 2008;41:5–18.
6. Matwiejuk A. Lichens of the Bućki and its surroundings in Podlasie (NE Poland). Opole Scientific Society Nature Journal. 2009;42:49–61.
7. Matwiejuk A. Anthropogenic changes of lichen biota of the Białowieża town (Podlasie, eastern Poland). Rocz AR Pozn Bot Stec. 2011;15:129–138.
8. Zarabska D, Guttova A, Cristofolini F, Giordani P, Lackovicova A. Epiphytic lichens of apple orchards in Poland, Slovakia, and Italy. Acta Mycol. 2009;44(2):151–163. http://dx.doi.org/10.5586/am.2009.013
9. Szymczyk R, Zalewska A. Lichens in the rural landscape of the Warmia Plain. Acta Mycol. 2008;43(2):215–230. http://dx.doi.org/10.5586/am.2008.026
10. Kiercul S. Species diversity of lichens (*Fungi lichenisati*) in Klewinowo village and surrounding areas (NE Poland). Parki Narodowe i Rezerwaty Przyrody. 2013;32(4):77–94.
11. Kiercul S. Species richness of lichens in the Hermanówka village. Chrońmy Przyr Ojcz. 2015;71(2):116–121.
12. Kondracki J. Geografia regionalna Polski. Warszawa: PWN; 2013.
13. Cieśliński S, Fałtynowicz W, editors. Atlas of geographical distribution of lichens in Poland. Cracow: W. Szafer Institute of Botany, Polish Academy of Sciences; 1993. (vol 1).
14. Diederich P, Ries C. Lichens of Belgium, Luxembourg and northern France [Internet]. 2014 [cited 2014 Sept 30]; Available from: http://www.lichenology.info
15. Blanco O, Crespo A, Divakar PK, Esslinger TL, Hawksworth DL, Lumbsch HT. *Melanelixia* and *Melanohalea*, two new genera segregated from *Melanelia* (Parmeliaceae) based on molecular and morphological data. Mycol Res. 2004;108(8):873–884. http://dx.doi.org/10.1017/S0953756204000723
16. Cieśliński S, Czyżewska K, Fabiszewski J. Red list of the lichens in Poland. In: Mirek Z, Zarzycki K, Wojewoda W, Szeląg Z, editors. Red list of plants and fungi in Poland. Cracow: W. Szafer Institute of Botany, Polish Academy of Sciences; 2006. p. 71–90.
17. Regulation of the Minister of the Environment dated October 9, 2014, on the protection of species of fungi (OJ from 2014, item 1408).
18. Wirth V. Zeigerwerte von Flechte. 3. Aufl. Scripta Geobotanica. 2001;18:221–243.
19. Nimis PL, Martellos S. ITALIC – The Information System on Italian Lichens. Version 4.0 [Internet]. 2008 [cited 2015 Feb 17]; Available from: http://dbiodbs.univ.trieste.it
20. Farata R, editor. Atlas klimatu województwa wielkopolskiego. Poznań: IMGW; 2004.

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