

Lichens and lichenicolous fungi of the “Golczewskie Uroczysko” nature reserve (NW Poland)

ANETTA WIECZOREK, KAMILA TYCZKOWSKA

Department of Ecology and Environmental Protection, Institute of Biodiversity, University of Szczecin, ul. Wąska 13, 71-415 Szczecin, Poland; e-mail: anetta.wieczorek@usz.edu.pl

Keywords lichens, nature reserve, Poland, Pomerania

Abstract Lichens of the “Golczewskie Uroczysko” nature reserve were studied in 2007–2008 and 2015–2016. Within the examined area, 68 species of lichens and 5 lichenicolous fungi were observed. Eleven species are included in the red list of threatened lichens in Poland, six as vulnerable (VU) (*Bryoria fuscescens*, *Buellia disciformis*, *Calicium viride*, *Ochrolechia androgyna*, *Pertusaria pertusa* and *Tuckermannopsis chlorophylla*) and five as near threatened (NT) (*Alyxoria varia*, *Chaenotheca furfuracea*, *Evernia prunastri*, *Graphis scripta* and *Hypogymnia tubulosa*).

Porosty rezerwatu „Golczewskie Uroczysko” (NW Polska)

Słowa kluczowe porosty, rezerwat, Polska, Pomorze

Streszczenie Badania prowadzono nad biotą porostów rezerwatu „Golczewskie Uroczysko”. Stwierdzono w sumie 68 gatunków porostów i 5 grzybów naporostowych. Ponad 56% bioty porostów stanowiły gatunki nadrzewne, wśród których występowały taksony rzadkie i zagrożone w skali całego kraju. Blisko połowę wszystkich gatunków stanowiły porosty o plesze skorupiastej. Charakterystyczną cechą lichenobioty badanego rezerwatu jest duży udział gatunków występujących na pojedynczych stanowiskach.

Introduction

The “Golczewskie Uroczysko” nature reserve is located in West Pomerania Province, in Golczewo Commune. It was created in 2004, covers 101.05 ha, and comprises woodlands and peatlands. The reserve includes patches of nearly natural, old coniferous and mixed bog forest, with several-hundred-year-old trees. The dominant trees are oaks (*Quercus* sp.), as their contribution to the tree layer is up to 40%. Also birches (*Betula* sp.) and pine trees (*Pinus sylvestris*) are frequent there. Another valuable characteristic of the landscape are peat deposits in the bog in the central part of the reserve (Zawal, Stępień, 2006).

So far, lichens have not been studied in the reserve. The aim of this study was to present the current biota of lichens and lichenicolous fungi in the reserve.

Material and methods

Field research was conducted in the years 2007–2008 and 2015–2016. The random point method was used, which enabled us to explore the area objectively and evenly. Easily identifiable species of lichens were recorded in the field, while all the others were collected and identified in the laboratory of the Department of Ecology and Environmental Protection of the University of Szczecin. Species names follow Fałtynowicz and Kossowska (2016) and Czyżewska and Kukwa (2009).

The list of species is ordered alphabetically. Types of substrate are given for each species. Names of lichenicolous fungi are marked with asterisks(*). The list of threatened species, with their threat category, is based on the Polish red list (Cieśliński et al., 2006).

Results

As a result of the research at 53 sites, 481 records were collected (herbarium specimens or records in the field) (Figure 1). In total, in the “Golczewskie Uroczysko” nature reserve, 68 species of lichens and 5 lichenicolous fungi were found. The contribution of lichens to the landscape is remarkable, although it varies between habitats.

Epiphytic lichens

The most numerous were epiphytic lichens, which accounted for 56% of the lichen biota of the study area (Figure 2). Among the morphological types of this group of species, crustose lichens were most numerous, accounting for nearly half (23 taxa) of the total number of epiphytic species (Figure 3). The base of tree trunks was most often colonized by *Coenogonium pineti*, *Porina aenea* and *Parmeliopsis ambigua*, while higher parts of tree trunks, by *Hypogymnia physodes*, *Lecanora conizaeoides*, *Parmelia sulcata* and *Phlyctis argena*.

The largest number of species was recorded on bark of *Betula* sp. (32 species) including 6 exclusive species, which were not recorded on other plant hosts (Figure 4). These include *Bryoria fuscescens*, *Calicium viride*, *Cladonia floerkeana*, *C. macilenta*, *Ochrolechia androgyna* and *Usnea dasopoga*.

Bark of *Quercus* sp. ranked second (29 species), and some species were exclusive to this microhabitat: *Alyxoria varia*, *Melanelixia fuliginosa*, *Pseudevernia furfuracea*, and *Tuckermanopsis chlorophylla* (Figure 4). They were supplemented with the rich flora of lichens associated with the bark of *Pinus sylvestris* (23 species), *Acer* sp., and *Fagus sylvatica* (10 species). Most of the taxa are frequent or common in the western part of Polish Pomerania (Fałtynowicz, 1992). Some of the recorded epiphytic species are protected by Polish law and/or threatened in Poland (Cieśliński et al., 2006; Fałtynowicz, Kukwa, 2007) (Table 1). These include 10 exclusively epiphytic species, found on very old trees. The sites of protected and threatened species are scattered all over the reserve.

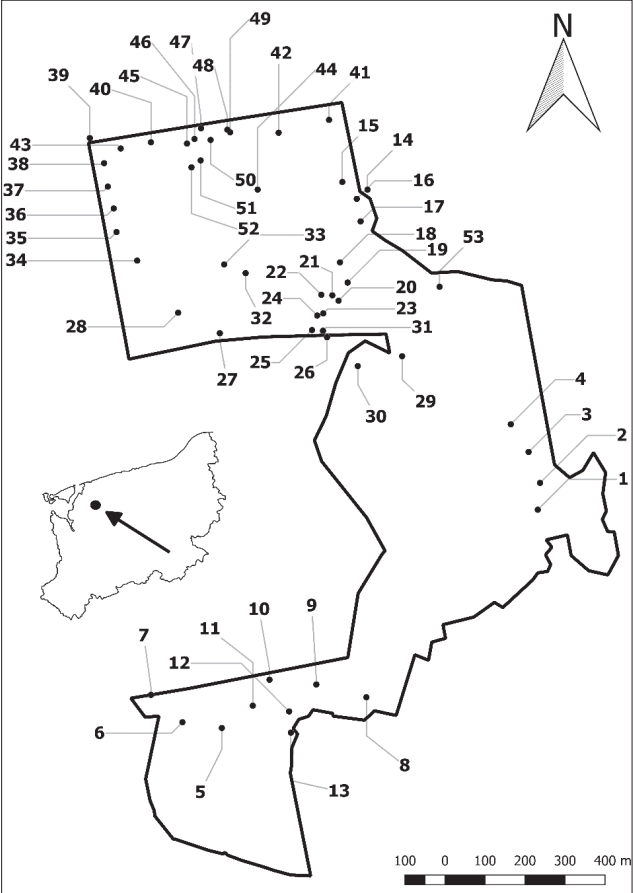


Figure 1. Map of the studied sites

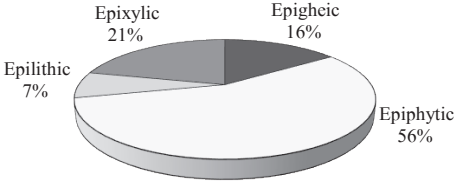


Figure 2. Percentages of lichen species from various ecological groups

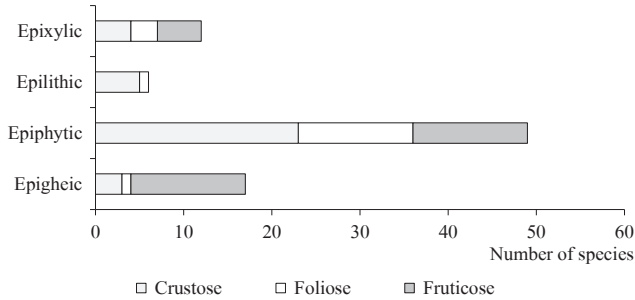


Figure 3. Spatial distribution of lichen species and contributions of morphological forms to each ecological group

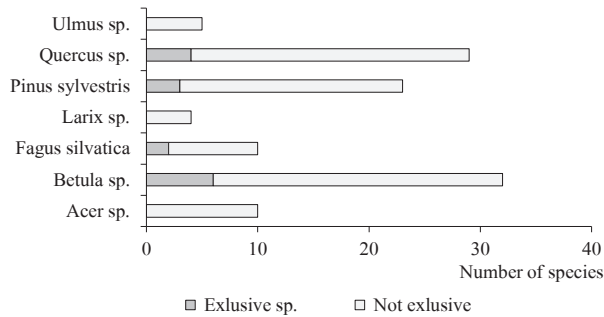


Figure 4. Contribution of exclusive and non-exclusive species in epiphytic groups of lichens

Table 1. Lichen species of the "Golczewskie Uroczysko" nature reserve included in the red list of threatened lichens in Poland, red list of threatened lichens in Pomerelia (Gdańsk Pomerania)

Species	Protection status	Threat category (Cieśliński et al., 2006)	Threat category (Fałtynowicz, Kukwa, 2007)
<i>Alyxoria varia</i>	–	NT	–
<i>Bryoria fuscescens</i>	Partly protected	VU	VU
<i>Buellia disciformis</i>	–	VU	VU
<i>Calicium viride</i>	–	VU	–
<i>Chaenotheca furfuracea</i>	–	NT	–
<i>Evernia prunastri</i>	–	NT	–
<i>Graphis scripta</i>	–	NT	–
<i>Hypogymnia tubulosa</i>	Partly protected	NT	–
<i>Ochrolechia androgyna</i>	–	VU	VU
<i>Pertusaria pertusa</i>	–	VU	–
<i>Tuckermannopsis chlorophylla</i>	Partly protected	VU	VU

Explanations: VU – vulnerable; NT – Near Threatened.

Epixylic lichens

Lichens found on decaying or rotting wood of logs and trunks were classified as epixylic. On such substrates we recorded 18 species, which accounted for 21% of the lichen flora of the study area (Figure 2). They were mostly frequent and common lichens of the genera *Cladonia*, *Micarea*, *Placynthiella*, and *Trapeliopsis*. In moist patches near the bog, young stumps were most often colonized by crustose lichens, such as *Lecanora conizaeoides*, *Micarea denigrata*, *Placynthiella uliginosa*, and *Trapeliopsis flexuosa*. On more strongly decomposed wood, they were succeeded by fruticose lichens, mostly of the genus *Cladonia*. *Hypocenomyce scalaris* and *Lepraria* sp. were also abundant there.

Epigeic lichens

Epigeic lichens accounted for nearly 16% of the total number of species recorded in the “Golczewskie Uroczysko” nature reserve (Figure 2). They were found at the edges of the bog and of forest glades, and were represented most frequently by lichens of the genus *Cladonia*. Less frequently, species associated with thermophilous sandy pine forests were present, such as *Cladonia arbuscula* subsp. *mitis* or *Cladonia uncialis*. Only sporadically we recorded *Bacidia bagliettoana*, and *Peltigera rufescens*.

Epilithic lichens

This group of lichens was represented exclusively by species colonizing anthropogenic substrates, such as concrete poles or walls. In this study it included only 6 taxa, which are common calcicolous lichens: *Flavoplaca citrina*, *Calogaya decipiens*, *Candelariella aurella*, *Myriolecis albescens*, *M. dispersa*, and *Lepraria* sp.

Discussion

Natural bogs and poor fens are ecosystems characterized by a low abundance of lichens. This is due to the high moisture content of the substrate. Lichens in such communities grow mostly on tree bark and at the drier crests of hummocks. However, in the “Golczewskie Uroczysko” nature reserve, its protection succeeded to preserve the natural vegetation and safeguard valuable ecological systems, which constitute a refuge for many threatened and protected species.

In comparison with other nature reserves in northern Poland (Fałtynowicz, 1983, 1996), species diversity in our study area is relatively high. The total number of species (68) is close to that observed in similar study areas. For example, in the “Bagno Biel” nature reserve, protecting peatland covering a 3-fold larger area, as many as 81 species were recorded, while in the “Bagnisko Niedźwiady” nature reserve, which is 4-fold larger, only 52 species. The large number of species in the “Golczewskie Uroczysko” nature reserve, in spite of its smaller area, is linked with the richness of plant hosts. Our study area comprises not only pine forest, which is poor in lichens, but also patches of nearly natural, old forest, with several-hundred-year-old oak trees.

In all the 3 nature reserves, epilithic lichens were the rarest, as suitable natural sites were absent there. Epilithic species were found only sporadically, on concrete electricity poles or small poles marking forest sections.

It can be concluded that the study area is valuable from a lichenological point of view and is an important nature reserve protecting lichen diversity in the western part of Polish Pomerania.

List of species

For each species, the type of substrate on which it is found and numbers sites are given.

Symbols: * = lichenicolous fungus, VU = vulnerable, NT = near threatened; PR = strict or partial protection.

- Alyxoria varia* (Pers.) Ertz & Tehler – [NT], on oak tree bark: 18.
- Amandinea punctata* (Hoffm.) Coppins & Scheid. – on birch, maple, and pine tree bark: 2, 3, 6, 14, 15, 18, 32.
- **Athelia arachnoidea* (Berk.) Jülich – on thallus of *Lecanora conizaeoides* on pine tree bark: 1.
- Bacidia bagliettoana* (A. Massal. & De Not.) Jatta – on soil: 3.
- Bryoria fuscescens* (Gyeln.) Brodo & D. Hawksw. – [VU, PR], on birch tree bark: 32.
- Buellia disciformis* (Fr.) Mudd – [VU], on tree bark: 15, 18, 21, 33.
- B. griseovirens* (Turner & Borrer ex Sm.) Almb. – on birch, and oak tree bark: 15, 18.
- Calicium viride* Pers. – [VU], on birch tree bark: 52.
- Calogaya decipiens* (Hoffm.) Arup, Frödén & Söchting – on concrete posts: 13, 39.
- Candelariella aurella* (Hoffm.) Zahlbr. – on concrete posts: 13, 39.
- Chaenotheca ferruginea* (Turner ex Sm.) Mig. – on pine tree bark: 4, 11, 15, 18, 19.
- C. furfuracea* (L.) Tibell – [NT], on pine, birch, oak, beech, elm tree bark, and wood: 1, 2, 11, 13–16, 18–20, 34, 44, 50, 51, 53.
- Cladonia arbuscula* (Wallr.) Flot. em. Ruoss subsp. *mitis* (Sandst.) Ruoss – on soil on the peat: 4, 29.
- C. chlorophaea* (Flörke ex Sommerf.) Spreng. – on soil on the peat, rarely on tree bark: 6, 21, 42, 51, 52.
- C. coccifera* (L.) Willd. – on soil: 4.
- C. coniocraea* auct. – on soli, wood, and oak, pine, elm, and birch tree bark: 2, 4, 5, 6, 11, 13–18, 21–26, 28, 33, 36–41, 45, 46, 48–53.
- C. cornuta* (L.) Hoffm. – on oak, and birch tree bark: 25, 51.
- C. deformis* (L.) Hoffm. – on soil: 6.
- C. digitata* (L.) Hoffm. – on soil, wood, and elm, birch, pine, and oak tree bark: 1, 4, 5, 13–15, 21, 23–26, 29, 30, 32–38, 40, 46–49, 51.
- C. fimbriata* (L.) Fr. – on soil, and birch tree bark: 2, 6, 21.
- C. floerkeana* (Fr.) Flörke – on birch tree bark, and wood: 2, 24.
- C. furcata* (Huds.) Schrad. – on soil: 2, 4, 8, 9, 29.
- C. glauca* s.l. Flörke – on birch, pine, and oak tree bark, rarely on wood: 4, 6, 14, 39, 45, 51.
- C. macilenta* Hoffm. – on birch tree bark: 2, 6, 15, 17, 21, 22, 25, 26, 32, 38, 47, 49.
- C. ochrochlora* Flörke – on wood: 23.
- C. squamosa* (Scop.) Hoffm. – on soil: 6.
- C. subulata* (L.) Weber – on soil, and pine, oak, and birch tree bark: 4–6, 14, 15, 18–21, 29, 44, 47.
- C. uncialis* (L.) F.H. Wigg. – on soil: 4.
- **Clypeococcum hypocenomycis* D. Hawksw. – on thallus of *Hypocenomyce scalaris* on pine tree bark: 4, 11, 20, 41, 53.
- Coenogonium pineti* (Schrad.) Lücking & Lumbsch – on pine, and birch tree bark: 4, 5, 7, 11–16, 18–23, 27, 29, 30, 33, 40, 43, 45, 50–52.
- Evernia prunastri* (L.) Ach. – [NT], on oak, and elm tree bark, and wood: 14, 30, 43, 44.
- Flavoplaca citrina* (Hoffm.) Arup, Frödén & Söchting. – on concrete posts: 13, 39.

- Graphis scripta* (L.) Ach. – [NT], on beech tree bark: 6, 9.
- Hypocenomyce scalaris* (Ach.) Choisy – on pine tree bark, and wood: 4, 5, 11, 12, 19, 20, 29, 41, 46–48, 52, 53.
- Hypogymnia physodes* (L.) Nyl. – on oak, pine, birch, beech, and maple tree bark, and wood: 3–7, 14, 17, 18, 20–23, 27–33, 35, 36, 38, 39, 41, 43–48, 51, 52.
- H. tubulosa* (Schaer.) Hav. – [NT, PR], on pine tree bark, and wood: 31, 47.
- Lecanora conizaeoides* Nyl. – on pine tree bark: 3–5, 11–13, 15, 16, 19, 20, 29, 41, 46, 47.
- L. expallens* Ach. – on pine, beech, oak tree bark: 3, 5, 7, 14, 17, 18, 20, 23, 28, 34, 44.
- L. pulicaris* (Pers.) Ach. – on beech, oak, and pine tree bark: 5, 8, 9, 13, 27, 30, 39, 43, 45, 50.
- Lecidella elaeochroma* (Ach.) Choisy – on beech, oak, pine, birch, and maple tree bark: 1, 2, 5, 7, 20, 27, 30, 33, 40, 43, 45, 47, 52.
- Lepraria* sp. – on beech, oak, pine, birch, and maple tree bark, and wood: 1–5, 7–19, 24, 25, 28, 35, 42, 43, 45, 49–52.
- **Lichenocodium erodens* M. S. Christ. & D. Hawksw. – on thallus of *Lecanora conizaeoides*: 5, 13, 15, 16, 29, 46, 47.
- **L. lecanorae* (Jaap) D. Hawksw. – on apothecium of *Lecanora conizaeoides*: 3, 4, 12, 13, 19, 47.
- Melanohalea exasperatula* (Nyl.) O. Blanco, A. Crespo, Divakar, Essl., D. Hawksw. & Lumbsch – on oak, and beech tree bark: 18, 27, 33.
- Melanelixia fuliginosa* (Fr. ex Duby) O. Blanco, A. Crespo, Divakar, Essl., D. Hawksw. & Lumbsch – on oak tree bark: 2.
- Micarea denigrata* (Fr.) Hedl. – on wood: 21, 43, 48.
- M. prasina* Fr. – on wood: 5, 14, 31, 48.
- Myriolecis albescens* (Hoffm.) Śliwa, Zhao Xin & Lumbsch – on concrete posts: 39.
- M. dispersa* (Pers.) Śliwa, Zhao Xin & Lumbsch – on concrete posts: 13, 39.
- Ochrolechia androgyna* (Hoffm.) Arnold – [VU], on birch tree bark: 22.
- Parmelia sulcata* Taylor – on birch, and oak tree bark: 2, 6, 15, 17, 18, 21, 22, 24, 27, 30, 32, 33, 38–40, 43–45, 47, 49, 52.
- Parmeliopsis ambigua* (Wulfen) Nyl. – on pine, oak, and birch tree bark: 2, 6, 11, 17, 18, 25, 30, 33, 38, 44, 47.
- Peltigera rufescens* (Weiss) Humb. – on soil: 6.
- Pertusaria albescens* (Huds.) Choisy & Werner – on oak, and beech tree bark: 5, 9, 30.
- P. amara* (Ach.) Nyl. – on oak, and beech tree bark: 3, 5, 9, 30, 39, 44, 50.
- P. pertusa* (Weigel) Tuck. – [VU], on oak, and beech tree bark: 5, 9, 27, 39, 42, 44, 51.
- Phaeophyscia nigricans* (Flörke) Moberg – on birch tree bark, and on concrete post: 3, 39, 46, 49, 52.
- Phlyctis argena* (Ach.) Flot. – on oak, pine, and birch tree bark: 3, 5, 9, 16, 18, 21, 22, 27, 30, 39, 42, 44, 50, 51, 52.
- Physcia tenella* (Scop.) DC. – on wood: 14, 43.
- Placynthiella uliginosa* (Schrad.) Coppins & P. James – on humus: 4, 6, 14, 28, 31, 43.
- Platismatia glauca* (L.) W.L. Culb. & C.F. Culb. – on birch, and oak tree bark: 6, 17, 25, 30, 33, 45.
- Polycauliona polycarpa* (Hoffm.) Frödén, Arup & Søchting – on birch, and pine tree bark: 17, 25, 45.
- Porina aenea* (Wallr.) Zahlbr. – on beech tree bark: 1, 3, 6, 45, 49, 51.
- Pseudevernia furfuracea* (L.) Zopf – on oak tree bark: 39.
- Scoliosporum chlorococcum* (Graeve ex Stenh.) Vězda – on birch, and pine tree bark: 2, 4, 12, 15, 18, 25.
- Trapeliopsis flexuosa* (Fr.) Coppins & P. James – on wood, and pine tree bark: 4–6, 14, 23, 28, 43, 48.

- T. granulosa* (Hoffm.) Lumbsch – on wood: 5, 35, 48, 53.
 **Tremella cladoniae* Diederich & M. S. Christ. – on thallus of *Cladonia coniocraea*: 2, 13, 23, 49.
Tuckermannopsis chlorophylla (Willd.) Hale – [VU, PR], on oak tree bark: 2, 18, 45.
Usnea dasopoga (Ach.) Nyl. – on birch tree bark: 32.
Violella fucata (Stirt.) T. Sprib. – on maple, and oak tree bark: 3, 6, 18, 27, 30, 33, 39, 43, 44, 45, 50.
Xanthoria parietina (L.) Th. Fr. – on wood: 43, 48, 53.
Xyloporia caradocensis (Nyl.) Bendiksby & Timdal – on pine wood: 47.

References

- Cieśliński, S., Czyżewska, K., Fabiszewski, J. (2006). Red list of the lichens in Poland. In: Z. Mirek, K. Zarzycki, W. Wojewoda, Z. Szelaż (eds.), *Red list of plants and fungi in Poland* (pp. 72–89). Kraków: W. Szafer Institute of Botany, Polish Academy of Sciences.
- Czyżewska, K., Kukwa, M. (2009). Lichenicolous Fungi of Poland. A Catalogue and Key to Species. In: Z. Mirek (ed.), *Biodiversity of Poland 11* (pp. 1–133). Kraków: W. Szafer Institute of Botany, Polish Academy of Sciences.
- Fałtynowicz, W. (1983). Porosty Bielawskiego Błota – stan aktualny i zmiany po trzydziestu latach dewastacji torfowiska. *Fragm. Flor. et Geobot.*, 3–4 (29), 415–430.
- Fałtynowicz, W. (1992). The lichens of Western Pomerania (NW Poland) an ecogeographical study. *Polish Bot. Stud.*, 4.
- Fałtynowicz, W. (1996). Porosty rezerwatu “Bagnisko Niedźwiady” i “Bagno Biel”, zasługujących na ochronę torfowisk na Pomorzu Zachodnim. *Parki nar. Rez. Przyr.*, 2 (15), 3–11.
- Fałtynowicz, W., Kukwa, M. (2006). Lista porostów i grzybów naporostowych Pomorza Gdańskiego. *Acta Bot. Cassub., Monogr.*, 2, 1–98.
- Fałtynowicz, W., Kossowska, M. (2016). The lichens of Poland. A fourth checklist. *Acta Bot. Siles., Monogr.*, 8, 3–122.
- Zawal, A., Stępień, E. (2006). Plan ochrony rezerwatu przyrody „Golczewskie Uroczysko”. Wykonany na zlecenie Wojewódzkiego Konserwatora Przyrody w Szczecinie.

Cite as: Wieczorek, A., Tyczkowska, K. (2017). Lichens and lichenicolous fungi of the “Golczewskie Uroczysko” nature reserve (NW Poland). *Acta Biologica*, 24, 141–148. DOI: 10.18276/ab.2017.24-12.