ACTA MYCOLOGICA
Vol. 37 (1/2): 77–92
2002

The Budzisk nature reserve as a biocentre of lichen diversity in the Knyszyńska Large Forest (NE Poland)

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Czyżewska K., Cieśliński S., Motiejūnaitė J., Kolanko K.: *The Budzisk nature reserve as a biocentre of lichen diversity in the Knyszyńska Large Forest (NE Poland)*. Acta Mycol. 37 (1/2) 77–92:, 2002.

Budzisk nature reserve belongs to an old-growth forest in Knyszyńska Large Forest complex. During the present study, 185 taxa of lichens, lichenicolous and saprobic fungi were recorded in the reserve. Seventy seven taxa of them are red-listed in Poland and NE Poland or are indicators of an old-growth forest. Consequently, the Budzisk reserve can be considered to be a biocentre of a diversity of lichens, especially those characteristic of old-growth forests in NE Poland. During the study, the following rare and noteworthy species of lichens and allied fungi were found: *Absconditella lignicola*, *Acrocordia cavata*, *Biatora ocelliformis*, *Fellhanera gyrophorica*, *Fellhaneropsis vezdae*, *Micarea hedlundii*, **Mycocalicium subtile*, *Pertusaria pupillaris*, **Phaeopyxis punctum*, and **Stenocybe pullatula*. They have been reported for the Knyszyńska Large Forest for the first time.

Key words: lichenized fungi (lichens); lichenicolous fungi; threatened lichens; old-growth forest indicators; biocentre of lichen diversity

INTRODUCTION

According to the National Ecological Network, EECONET POLSKA, the Puszcza Knyszyńska Landscape Park is a node region of European significance, and the Budzisk nature reserve is a biological centre rich in valuable species.

Physical and geographical conditions of the territory are diversified. The area is characterized by various old forest communities with many features of an old-growth forest: typical and moist fertile oak-linden-hornbeam forest *Tilio-Carpinetum calamagrostietosum*, *T.-C. typicum* and *T.-C. stachyetosum sylvaticae*, maple-linden forest

Aceri-Tilietum, streamside alder-ash forest *Circaeo-Alnetum*, black alder bog forest *Ribo nigri-Alnetum*, pine-oak mixed forest *Serratulo-Pinetum*, moist oak-spruce forest *Querco-Piceetum*, spruce bog forest *Sphagno girgensohnii-Piceetum* and non-forest vegetation (Wierzba 1999). Large springy areas are characteristic of the reserve. There are numerous springs whose united waters make up the Migawka forest stream, which flows into the Sokołda river.

Lichenological investigations of the reserve have so far been only fragmentary, including studies published by Bystrek and Anisimowicz (1981), Cieśliński (1995), and Bystrek and Kolanko (2000); see also Czyżewska et al. (in press).

STUDY AREA, MATERIAL AND METHODS

Budzisk nature reserve was first founded in 1970 in the area of 14.46 ha. Its current borders were determined in 1987 (328.51 ha area; see Fig. 1). The aim of reserve is to protect both old forest stands typical of a hardwood forest and its accompanying vegetation of bogs, grasslands and springy areas.

Budzisk reserve is situated in the central part of Knyszyńska Large Forest (1288 km^2 area) in the Puszcza Knyszyńska Landscape Park, near the small towns of Czarna Białostocka and Sokółka in NE Poland. The northern part of the nature reserve belongs to the Czarna Białostocka forest district (forest units No-s 94, 95, 107–109, 124, 124A, 139, 140), while its southern part belongs to the Supraśl forest district (forest units No-s 1, 2, 5–8) (Fig. 1).

Field investigations of lichens, lichenicolous and saprobic fungi were carried out using method of floristical relévе in 14 sites (Fig. 1) in 1999. Sites are numbered (53° 16'44"N and 23°22'50"E): 1 – forest unit No. 109i, in *Aceri-Tilietum*, ATPOL grid squ-

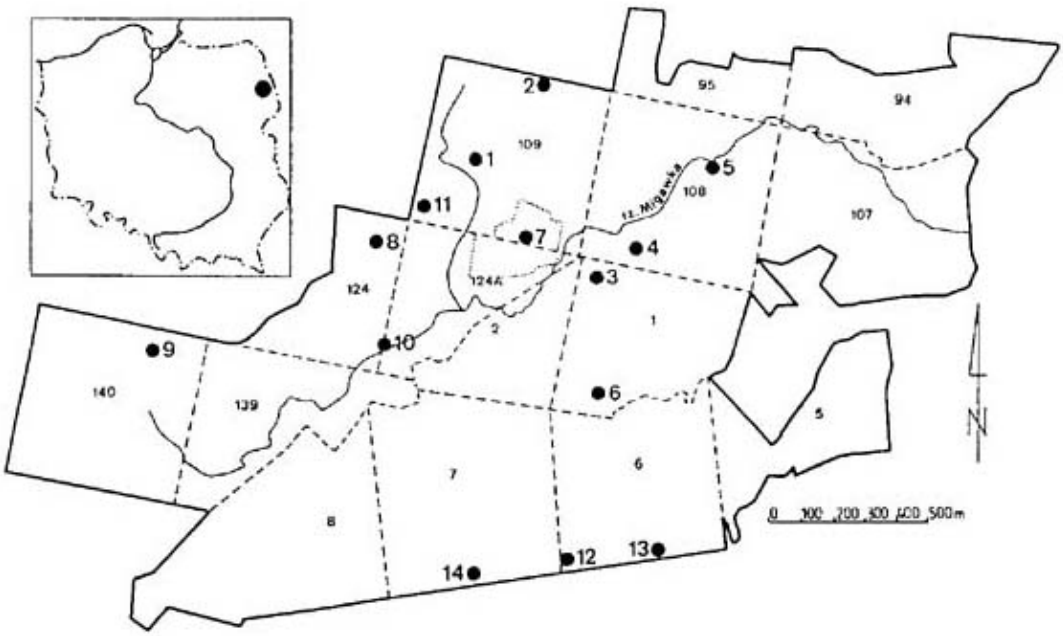


Fig. 1. Investigated sites in the Budzisk nature reserve

are Bg92; 2 – forest unit No. 109d, b in *Tilio-Carpinetum calamagrostietosum*, Bg92; 3 – forest unit No. 1f, in *Aceri-Tilietum*, Bg92; 4 – forest unit No. 108i, in *Ribo nigri-Alnetum*, Bg92; 5 – forest unit No. 108d, in *Ribo nigri-Alnetum*, Bg92; 6 – forest unit No. 1a, in *Ribo nigri-Alnetum*, Bg92; 7 – Budzisk glad, including a forester`s lodge, an orchard, a wooden fence and erratic blocks, Bg92; 8 – forest unit No. 124a, in *Aceri-Tilietum*, Bg92; 9 – forest unit No. 140c, in *Tilio-Carpinetum calamagrostietosum*, Bg92; 10 – forest unit No-s 124c/124Aa, in *Tilio-Carpinetum stachyetosum sylvaticae* and *Circaeo-Alnetum*, Bg92; 11 – forest unit No. 109i, g, h, in *Aceri-Tilietum*, Bg92; 12 – forest unit No. 6l, in *Tilio-Carpinetum typicum*, Cg02; 13 – forest unit No. 6k, in *Querco-Piceetum* and *Sphagno girgensohnii-Piceetum*, Cg02; 14 – forest unit No. 7o, in *Aceri-Tilietum*, Cg02.

The collections are deposited in the BILAS (Vilnius), KTC (Kielce) and LOD (Łódź) herbaria. The nomenclature follows Scholz (2000), while *Fellhanera* and *Fellhaneropsis* names are cited after Sérusiaux (1996) and Sérusiaux et al. (2001), *Pronectria* and *Libertiella* – after Hawksworth and Miądlikowska (1997).

The alphabetical order was accepted in the list of lichens and allied fungi. For each species habitat, the site number and the herbarium abbreviation are indicated.

Abbreviations: * - lichenicolous fungus; (*) - facultative lichenicolous fungus; ° - saprobic fungus.

LIST OF SPECIES

Absconditella lignicola Vězda et Pišút (1984) – on a decaying log. Sites 1, 3, 10. LOD.

Acrocordia cavata (Ach.) R.C. Harris (1974) – on a trunk of *Populus tremula*. Site 2. BILAS, LOD.

Amandinea punctata (Hoffm.) Coppins et Scheid. (1993) – on the wooden fence surrouding the forester`s lodge. Site 7. KTC.

Anaptychia ciliaris (L.) Körb. ex A. Massal. (1853) – on branches of *P. tremula*. Site 4. KTC.

Arthonia byssacea (Weigel) Almq. (1880) – on trunks of *Fraxinus excelsior*, *Quercus robur*, and *Ulmus glabra*. Sites 1, 3, 11. KTC, LOD.

A. radiata (Pers.) Ach. (1808) – on trunk of *F. excelsior*. Site 6. KTC.

A. spadicea Leight. (1854) – on trunks of *Tilia cordata*, *Carpinus betulus*, *F. excelsior*, *Corylus avellana*, and *Pinus sylvestris*, on upper part of submerged roots of *Alnus glutinosa*, on bark of decaying stump of a deciduous trees. Sites 1-4, 6, 8, 10, 11. BILAS, KTC, LOD.

Arthothelium ruanum (A. Massal.) Körb. (1861) – on trunks of *C. betulus*, *F. excelsior*, and *Salix* sp. Sites 1, 2, 5, 6, 8, 10, 11. BILAS, KTC.

Aspicilia gibbosa (Ach.) Körb. (1855) – on erratic blocks. Site 7. KTC.

Bacidia arceutina (Ach.) Arnold (1869) – on trunks of *C. betulus* and *F. excelsior*. Site 1. BILAS, KTC.

B. bagliettoana (A. Massal. et De Not.) Jatta (1900) – on mosses growing on a roadside escarpment. Site 12. LOD.

B. beckhausii Körb. (1860) – on trunk of *F. excelsior*. Site 5. KTC.

B. laurocerasi (Delise ex Duby) Zahlbr. (1926) – on a trunk of *C. betulus*. Site 1. BILAS, LOD.

B. rubella (Hoffm.) A. Massal. (1852) – on trunks of *Acer platanoides* and *C. betulus*. Sites 8, 11. BILAS, KTC.

B. subincompta (Nyl.) Arnold (1870) – on trunks of *C. betulus*, *F. excelsior*, and *U. glabra*. Sites 1, 6, 8, 11. BILAS, KTC, LOD.

Bacidina arnoldiana (Körb.) V. Wirth et Vězda (1994) – on a decaying log, on a trunk of *U. glabra*. Sites 1, 11. BILAS, KTC.

Biatora efflorescens (Hedl.) Räsänen (1935) – on a trunk of *C. betulus*. Site 1. BILAS.

Biatora ocelliformis (Nyl.) Arnold (1870) – on a trunk of *C. betulus*. Sites 1, 8. BILAS, KTC, LOD.

"*Biatora*" sp. – on a trunk of *F. excelsior*, 11. BILAS.

Thallus sterile, smooth to verrucose, thin to medium thick, greenish grey. Soralia punctiform, green, not confluent. No secondary substances detected by TLC. Grows on various deciduous trees in shady situations.

Known from Poland, Lithuania and Estonia (Motiejūnaitė, personal collections) in Central Eastern and Northern Europe.

Bryoria implexa (Hoffm.) Brodo et D. Hawksw. (1977) – on a trunk of *Q. robur*. Site 9. KTC.

Buellia griseovirens (Turner et Borrer ex Sm.) Almb. (1952) – on trunks of *C. betulus*, *F. excelsior*, *Sorbus aucuparia*, *P. tremula*, *Picea abies*, and *A. platanoides*, on wood of a deciduous tree. Sites 1, 2, 4-7, 10-12. KTC, LOD.

Calicium abietinum Pers. (1797) – on decaying wood. Site 9. KTC.

C. glaucellum Ach. (1803) – on decaying wood. Site 9. KTC, LOD.

C. salicinum Pers. (1794) – on trunks of *Q. robur* and *F. excelsior*. Sites 2, 11. BILAS, LOD.

C. viride Pers. (1794) – on trunks of *A. platanoides*, *Q. robur*, and *F. excelsior*. Sites 2, 3, 11. BILAS, KTC.

Caloplaca holocarpa (Hoffm. ex Ach.) Wade (1965) – on a wooden fence near forester's lodge, on a cement post in a glade. Site 7. KTC, LOD.

Candelariella aurella (Hoffm.) Zahlbr. (1928) – on a cement post. Site 7. KTC.

C. reflexa (Nyl.) Lettau (1912) – on a wooden fence. Site 7. KTC.

C. xanthostigma (Ach.) Lettau (1912) – on a wooden fence. Site 7. KTC, LOD.

Cetraria sepincola (Ehrh.) Ach. (1803) – on a wooden fence, on twigs of *Q. robur*. Sites 7, 12. KTC.

Cetrelia cetrarioides (Delise ex Duby) W.L. Culb. et C.F. Culb. (1968) – on the bark of *C. betulus*. Site 1. LOD.

C. olivetorum (Nyl.) W.L. Culb. et C.F. Culb. (1968) – on mossy wood, on a trunk of *C. betulus*. Sites 1, 4. KTC.

Chaenotheca brachypoda (Ach.) Tibell (1987) – on trunks of *A. platanoides*, *F. excelsior*, and *Q. robur*. Sites 2, 3. BILAS, LOD.

Ch. chlorella (Ach.) Müll. Arg. (1862) – on wood in the hollow of *T. cordata* trunk. Sites 1, 11. BILAS, LOD.

Ch. chrysocephala (Turner ex Ach.) Th. Fr. (1860) – on trunks of *P. abies* and *A. glutinosa*. Sites 1, 2, 10. BILAS, KTC, LOD.

Ch. ferruginea (Turner et Borrer) Mig. (1930) – on a trunk of *P. abies*, on decaying wood. Sites 1, 2, 5, 8, 9. KTC, LOD.

Ch. furfuracea (L.) Tibell (1984) – on decaying twigs. Site 10. LOD.

Ch. stemonea (Ach.) Müll. Arg. (1862) – on decaying wood. Site 1. KTC.
Ch. trichialis (Ach.) Th. Fr. (1860) – on a trunk of *A. glutinosa* and *U. glabra*, on decaying wood. Sites 1-3, 11. BILAS, LOD.
Ch. xyloxena Nádv. (1934) – on wood of *T. cordata* and on decaying pine stumps. Sites 9, 11, 14. BILAS, LOD.
(*)*Chaenothecopsis pusilla* (Ach.) A.F.W. Schmidt (1970) – on decaying wood, on the bark of *A. glutinosa*. Sites 9, 14. KTC.
Chrysothrix candelaris (L.) J.R. Laundon (1981) – on trunks of *A. glutinosa*, *F. excelsior,* and *Q. robur*. Sites 2, 3, 11. BILAS, LOD.
Cladonia cariosa (Ach.) Spreng. (1827) – on soil of a sunny roadside escarpment. Site 12. LOD.
Cl. cenotea (Ach.) Schaer. (1823) – on decaying tree trunk, on the bases of *Betula pendula* and *Q. robur*. Sites 10, 13. LOD.
C. cervicornis (Ach.) Flot. ssp. *verticillata* (Hoffm.) Ahti (1980) – on soil of a roadside escarpment. Site 12.
C. chlorophaea (Flörke ex Sommerf.) Spreng. (1827) – on soil, on wood, and on trunks of *P. abies*, *F. excelsior,* and *Q. robur*. Sites 1-3, 5, 9, 10, 12-14.
C. coniocraea (Flörke) Spreng. (1827) – on a decaying log, on stumps, on trunks of deciduous and coniferous trees. Sites 1-6, 8-14. BILAS.
C. cornuta (L.) Hoffm. (1791) – on soil of a roadside escarpment. Site 12. KTC.
C. crispata (Ach.) Flot. (1887) – on soil. Site 12. LOD.
C. digitata (L.) Hoffm. (1796) – on trunk bases of *P. abies* and *P. sylvestris*, on wood. Sites 1, 9, 10. BILAS.
C. fimbriata (L.) Fr. (1831) – on decaying stumps and logs, on soil. Sites 5, 7, 10, 12.
C. furcata (Huds.) Schrad. ssp. *furcata* (1794) – on soil of a roadside escarpment. Site 12.
C. gracilis (L.) Willd. (1787) – on soil of a roadside escarpment. Site 12.
C. macilenta Hoffm. (1796) – on decaying wood of stumps and logs. Sites 1, 9,10.
C. ochrochlora Flörke (1828) – on decaying tree stump and a log of *P. abies*. Sites 1, 10, 11. BILAS, LOD.
C. parasitica (Hoffm.) Hoffm. (1796) – on a decaying stump. Site 2. LOD.
C. phyllophora Hoffm. (1796) – on soil of a roadside escarpment. Site 12.
C. rangiformis Hoffm. (1796) – on soil of a roadside escarpment. Site 12. LOD.
C. subulata (L.) Weber ex F.H. Wigg. (1780) – on soil of a roadside escarpment. Site 12. LOD.
Dimerella pineti (Ach.) Vězda (1975) – on bark of decaying stumps of deciduous trees, on trunk bases of *A. glutinosa*, *C. betulus*, *P. sylvestris,* and *P. tremula*, on mosses. Sites 1-3, 6, 8-11, 13. BILAS, KTC, LOD.
Evernia prunastri (L.) Ach. (1810) – on trunks of *Q. robur*, *C. betulus*, *F. excelsior,* and *A. glutinosa*, on decaying wood. Sites 1-3, 7, 9, 11-13. KTC, LOD.
Fellhanera gyrophorica Sérus., Coppins, Diederich et Scheid. (2001) – on the mossy bark of *Q. robur*. Sites 1, 9. BILAS, LOD.
Confined to hardwood trees in old hardwood or hardwood-spruce forests. In Central Eastern and Northern Europe, it is known from Poland (Czyżewska et al. 2001 - Białowieża Large Forest; Sérusiaux et al. 2001 – Suwałki District, Bo-

recka Forest, leg. A. Zalewska), Lithuania (Sérusiaux et al. 2001, Motiejunaite 2000) and Estonia (Motiejunaite, Prigodina-Lukošiene, in press).

Fellhaneropsis vezdae (Coppins et P. James) Sérus. et Coppins (1996) – on a fallen decaying log, on the bark of pine stump, on a decaying root of *P. abies*. Sites 1, 3, 10. LOD.

Graphis scripta (L.) Ach. (1809) – on trunks of *C. betulus*, *T. cordata*, *F. excelsior*, *Q. robur*, *A. glutinosa*, *P. tremula*, *P. sylvestris*, *S. aucuparia*, and *C. avellana*, Sites 1-6, 8, 10-12, 14. KTC, LOD.

Haematomma ochroleucum (Neck.) J.R. Laundon var. *ochroleucum* (1970) – on a trunk of *C. betulus*. Site 1. KTC, BILAS.

Hypocenomyce scalaris (Ach. ex Lilj.) M. Choisy (1951) – on trunks of *P. sylvestris*, *P. abies* and *Q. robur*, on fallen wood. Sites 5, 7, 9-14.

Hypogymnia physodes (L.) Nyl. (1896) – on trunks of deciduous and coniferous trees or shrubs, on wood of logs and stumps. Sites 1-3, 5-14.

H. tubulosa (Schaer.) Hav. (1918) – on twigs of *Q. robur*. Site 12. KTC.

Hypotrachyna revoluta (Flörke) Hale (1975) – on a trunk of *F. excelsior* in shady situation. Site 5. KTC.

**Illosporium carneum* Fr. (1829) – on a thallus of *Peltigera didactyla* var. *didactyla* growing on soil in an overgrowing gravel pit. Site 12. BILAS, LOD.

Lecania cyrtella (Ach.) Th. Fr. (1871) – on a trunk of *Pyrus communis* in an orchard near the forester's lodge. Site 7. KTC, LOD.

L. globulosa (Flörke) P. Boom et Sérus. (1999) – on trunks of *F. excelsior*, *A. platanoides*, and *U. glabra*. Sites 2, 3, 5, 8, 11. BILAS, KTC.

Lecanora albella (Pers.) Ach. (1810) – on a trunk of *A. glutinosa*. Site 12. KTC.

L. allophana Nyl. (1872) – on a trunk of *F. excelsior*. Sites 7, 11.

L. argentata (Ach.) Malme (1897) – on trunks of *F. excelsior*, *A. glutinosa*, *Q. robur*, *T. cordata*, and *S. aucuparia*. Sites 2, 3, 11-13. KTC, LOD.

L. carpinea (L.) Vain. (1888) – on trunks of *C. betulus*, *T. cordata*, *Q. robur* and *A. glutinosa*, on wood. Sites 1, 2, 7, 8, 12.

L. chlarotera Nyl. (1872) – on trunks of *F. excelsior*, *C. betulus*, *T. cordata*, and *A. glutinosa*. Sites 2, 6, 8, 11, 12.

L. conizaeoides Nyl. ex Crombie (1885) – on trunks of *T. cordata* and *B. pendula*, on wood. Sites 1-3, 5, 8, 9, 13, 14.

L. dispersa (Pers.) Sommerf. (1826) – on a cement posts. Site 7.

L. expallens Ach. (1810) – on trunks of *C. betulus*, *F. excelsior* and *P. abies*. Sites 1, 6, 11.

L. hagenii (Ach.) Ach. (1810) – on a wooden fence, on a cement post. Site 7.

L. muralis (Schreb.) Rabenh. (1845) – on erratic blocks. Site 7.

L. polytropa (Ehrh. ex Hoffm.) Rabenh. (1845) – on erratic blocks. Site 7.

L. pulicaris (Pers.) Ach. (1814) – on trunks of *B. pendula*, *C. betulus*, *Salix* sp. and *P. sylvestris*, on twigs of *Q. robur*, on wood. Sites 5-9, 12, 13.

L. saligna (Schrad.) Zahlbr. (1928) – on decaying wood of stumps. Sites 7, 9.

L. sarcopisioides (A. Massal.) A.L. Sm. (1918) – on wood. Sites 1, 9.

L. subrugosa Nyl. (1875) – on a trunk of *F. excelsior*. Site 2.

L. symmicta (Ach.) Ach. (1814) – on a trunk of *F. excelsior*, on wood. Sites 2, 4, 5, 7.

L. umbrina (Ehrh.) A. Massal. (1852) – on wood. Site 7.

L. varia (Hoffm.) Ach. (1810) – on a wooden fence. Site 7.
Lecidea turgidula Fr. (1824) – on wood. Sites 9, 14. BILAS, KTC.
Lecidella elaeochroma (Ach.) M. Choisy (1950) – on trunks of *C. betulus*, *F. excelsior*, *A. glutinosa*, *Q. robur,* and *S. aucuparia*, on wood. Sites 1-8, 11-13.
Lepraria incana (L.) Ach. (1803) – on trunks of *C. betulus*, *Q. robur*, *P. abies*, *T. cordata*, *B. pendula*, *A. glutinosa,* and *P. tremula*. Sites 1-4, 10, 12-14. KTC.
L. lobificans Nyl. (1873) – on mosses, on the bark of a decaying stump of a deciduous trees: 1, 2, 6, 10, 11. BILAS; TLC by M. Kukwa (University of Gdańsk) LOD.
Lepraria sp. – on a trunk of *Q. robur*: 2. BILAS.
**Libertiella malmedyensis* Speg. et Roum. (1880) – on a thallus of *Peltigera didactyla* var. *didactyla* growing on soil in an overgrowing gravel pit: 12. BILAS, LOD.
**Lichenoconium erodens* M.S. Christ. et D. Hawksw. (1977) – on thalli of *Hypogymnia physodes* and *Hypocenomyce scalaris* growing on trunks of *P. abies* and *B. pendula*. Sites 1, 5. BILAS.
**L. lecanorae* (Jaap) D. Hawksw. (1979) – on apothecia of *Lecanora conizaeoides* growing on a trunk of *B. pendula*. Site 5. BILAS.
**L. pyxidatae* (Oudem.) Petr. et Syd. (1927) – on podetia of *Cladonia coniocraea* growing on a decaying stump. Site 12. LOD.
Loxospora elatina (Ach.) A. Massal. (1852) – on trunks of *C. betulus*, *P. abies*, *A. glutinosa*, *T. cordata,* and *F. excelsior*. Sites 1-6, 8, 11, 12. BILAS, KTC.
Melanelia glabratula (Lamy) Essl. (1978) – on trunks of *F. excelsior*, *C. betulus*, *P. tremula*, *Q. robur*, *T. cordata,* and *A. glutinosa*. Sites 1- 4, 6, 8, 11. BILAS, KTC.
M. subaurifera (Nyl.) Essl. (1978) – on a trunk of *Q. robur*. Site 14. KTC.
Menegazzia terebrata (Hoffm.) A. Massal. (1854) – on a trunk of *C. betulus*. Site 1.
Micarea botryoides (Nyl.) Coppins (1980) – on decaying wood of a pine stump. Site 9. LOD.
M. denigrata (Fr.) Hedl. (1892) – on fallen wood, on the bark of an old *P. sylvestris*. Sites 5, 7, 13. LOD.
M. hedlundii Coppins (1983) – on decaying wood of stumps and logs. Sites 1, 2, 10. BILAS, LOD.
M. misella (Nyl.) Hedl. (1892) – on a decaying log. Sites 5, 14. LOD.
M. prasina Fr. (1825) – on the decaying wood of *P. abies*, on bark of *P. sylvestris* Sites 1, 2, 13. LOD.
†*Microcalicium disseminatum* (Ach.) Vain. (1927) – on a bark of *Q. robur*. Site 14. KTC.
Mycoblastus fucatus (Stirt.) Zahlbr. (1926) – on trunks of *Q. robur*, *C. betulus,* and *F. excelsior*, on a decaying log. Sites 2, 8, 10, 11. KTC.
†*Mycocalicium subtile* (Pers.) Szatala (1925) – on the wood of *P. abies* snag. Site 14. LOD.
Ochrolechia androgyna (Hoffm.) Arnold (1885) – on trunks of *B. pendula*, *C. betulus,* and *A. platanoides*. Sites 5, 8, 12. KTC.
O. microstictoides Räsänen (1936) – on a trunk of *T. cordata*. Site 12. KTC.
O. subviridis (Høeg.) Erichsen (1930) – on a trunk of *P. tremula*. Sites 10, 14. KTC, LOD.
Opegrapha rufescens Pers. (1794) – on a trunk of *C. betulus*. Sites 1, 6. KTC.
O. varia Pers. (1794) – on trunk of *A. platanoides*. Sites 1-3, 11. KTC.

O. vermicellifera (Kunze) J.R. Laundon (1963) – on trunks of *Q. robur* and *U. glabra*. Sites 1, 11. BILAS, KTC, LOD.

O. viridis (Pers. ex Ach.) Behlen et Desberger (1861) – on trunks of *C. betulus* and *F. excelsior*. Sites 1, 3, 8, 11. KTC.

O. vulgata Ach. (1803) var. *subsiderella* Nyl. (1861) – on trunks of *C. betulus* and *F. excelsior*. Sites 1, 3, 11. KTC.

Parmelia saxatilis (L.) Ach. (1801) – on a trunk of *C. betulus*. Site 1. KTC.

P. sulcata Taylor (1836) – on trunks of deciduous trees and on wood. Sites 1-14.

Parmeliopsis ambigua (Wulfen) Nyl. (1866) – on a trunk of *A. glutinosa*. Site 4.

Peltigera didactyla (With.) J.R. Laundon var. *didactyla* (1984) – on soil in an overgrowing gravel pit. Site 12. BILAS, LOD.

P. polydactylon (Neck.) Hoffm. (1790) – on a decaying log, on soil in a thicket. Sites 1, 12. BILAS, LOD.

P. praetextata (Flörke ex Sommerf.) Zopf (1909) – on a fallen tree in a thicket of a gravel pit, on mossy bases of *F. excelsior*, *T. cordata*, and *A. platanoides*, on mossy soil of a roadside escarpment. Sites 1, 3, 11, 12. KTC, LOD.

P. rufescens (Weiss) Humb. (1793) – on soil in an overgrowing gravel pit. Site 12. BILAS, LOD.

Pertusaria albescens (Huds.) M. Choisy et Werner (1932) – on trunks of *C. betulus*, *F. excelsior*, and *P. tremula*. Sites 1, 3, 10.

P. amara (Ach.) Nyl. (1873) – on the bark of a deciduous trees. Sites 1-6, 8, 11-14.

P. coccodes (Ach.) Nyl. (1857) – on trunks of *T. cordata*, *A. glutinosa*, *C. betulus*, *Q. robur*, and *A. platanoides*. Sites 2-5, 8, 12. BILAS, KTC.

P. coronata (Ach.) Th. Fr. (1871) – on a trunk of *T. cordata*. Site 3. KTC.

P. flavida (DC.) Laundon (1963) – on a trunk of *T. cordata*. Site 2. KTC.

P. leioplaca DC. (1815) – on trunks of *C. betulus*, *F. excelsior* and *P. abies*. Sites 1–4, 6, 8, 11. BILAS, KTC.

P. multipuncta (Turner) Nyl. (1861) – on trunks of *C. betulus*, *F. excelsior*, and *T. cordata*. Sites 2, 6, 10. KTC.

P. pertusa (Weigel) Tuck. (1845) – on a trunk of *C. betulus*. Sites 8, 11.

P. pupillaris (Nyl.) Th. Fr. (1871) – on trunks of *C. avellana* and *C. betulus*. Sites 1, 14. BILAS, KTC, LOD.

Phaeophyscia nigricans (Flörke) Moberg (1977) – on the wooden fence surrounding the forester's lodge. Site 7. LOD.

Ph. orbicularis (Neck.) Moberg (1977) – on a wooden fence, on concrete. Site 7.

Ph. sciastra (Ach.) Moberg (1977) – on erratic blocks. Site 7.

**Phaeopyxis punctum* (A. Massal.) Rambold, Triebel et Coppins (1990) – on primary squamules of *Cladonia* sp. growing on a decaying log. Site 10. LOD.

Phlyctis argena (Spreng.) Flot. (1850) – on the bark of a deciduous trees and *P. abies*. Sites 1- 6, 8, 10-14.

"*Phlyctis erythrosora* Erichsen" – on trunks of *F. excelsior*, *Q. robur* and *P. tremula*, on deciduous tree stumps, on fallen wood. Sites 6, 7, 10, 11, 13. LOD (see also Czyżewka et al. 2001).

**Phoma cytospora* (Vouaux) D. Hawksw. (1981) – on thalli of *Parmelia sulcata* and *Hypogymnia physodes* growing on *T. cordata*. Site 11. BILAS.

Physcia adscendens (Fr.) H. Olivier (1882) – on the wood and decaying twigs of *Q. robur*. Sites 7, 12.

Ph. caesia (Hoffm.) Fürnr. (1839) – on a wooden fence. Site 7.

Ph. stellaris (L.) Nyl. (1856) – on a wooden fence. Site 7.

Ph. tenella (Scop.) DC. (1805) – on a trunk of *P. tremula*, on a wooden fence, on twigs of *Q. robur*. Sites 3, 7, 12.

Physconia distorta (With.) J.R. Laundon (1984) – on a wooden fence. Site 7.

Ph. enteroxantha (Nyl.) Poelt (1966) – on a wooden fence. Site 7.

Placynthiella dasaea (Stirt.) Tønsberg (1992) – on a trunk of an old *P. abies*. Site 1. LOD.

P. icmalea (Ach.) Coppins et P. James (1984) – on decaying wood and a stump, on the base of *A. glutinosa*, on a wooden fence. Sites 1, 2, 6, 7, 9, 10. LOD.

P. uliginosa (Schrad.) Coppins et P. James (1984) – on wood, on trunks of *C. betulus* and *P. abies*. Sites 3, 5, 9, 11.

Platismatia glauca (L.) W.L. Culb. et C.F. Culb. (1968) – on the bark of a deciduous tress and *P. sylvestris*, and on a wooden fence. Sites 1, 2, 7, 9-14.

Porina aenea (Wallr.) Zahlbr. (1922) – on trunks of *C. betulus* and *C. avellana*. Sites 1, 3, 8, 10. KTC.

Porpidia crustulata (Ach.) Hertel et Knoph (1984) – on erratic blocks. Sites 7, 12.

**Pronectria erythrinella* (Nyl.) Lowen (1990) – on a thallus of *Peltigera didactyla* var. *didactyla* growing on soil in an overgrowing gravel pit. Site 12. BILAS, LOD.

Pseudevernia furfuracea (L.) Zopf (1903) – on trunks of *Q. robur*, *A. platanoides*, *B. pendula*, *C. betulus*, and *P. sylvestris*. Sites 1, 3, 8, 9, 11, 13.

Pyrenula nitida (Weigel) Ach. (1814) – on a trunk of *C. betulus*. Site 1.

P. nitidella (Flörke ex Schaer.) Müll. Arg. (1885) – on trunks of *C. betulus* and *F. excelsior*. Sites 1, 3, 6, 8, 11.

Ramalina farinacea (L.) Ach. (1810) – on trunks of *C. betulus*, *Q. robur*, and *A. platanoides*, and on wooden fence. Sites 1, 2, 7, 12, 13.

R. pollinaria (Westr.) Ach. (1810) – on trunks of *A. platanoides*, *F. excelsior*, and on wooden fence. Sites 2, 3, 7.

Ropalospora viridis (Tønsberg) Tønsberg (1992) – on the bark of *C. avellana*. Site 1. BILAS.

Scoliciosporum chlorococcum (Graewe ex Stenh.) Vězda (1978) – on a trunk of *B. pendula*. Site 13.

S. umbrinum (Ach.) Arnold (1871) – on erratic blocks. Site 7.

***Stenocybe pullatula* (Ach.) Stein (1879) – on dead twigs of *A. glutinosa*. Site 4. BILAS, KTC, LOD.

Thelocarpon lichenicola (Fuckel) Poelt et Hafellner (1975) – on fallen decaying wood. Site 10. LOD.

Thelotrema lepadinum (Ach.) Ach. (1803) – on trunks of *C. betulus*, *A. glutinosa*, *Q. robur*, *F. excelsior* and *Salix* sp. Sites 1, 6. KTC, LOD.

Trapelia coarctata (Sm.) M. Choisy in Werner (1932) – on erratic blocks. Site 7.

Trapeliopsis flexuosa (Fr.) Coppins et P. James (1984) – on a decaying stump of a deciduous tree and on a wooden fence. Sites 7, 9, 10.

T. gelatinosa (Flörke) Coppins et P. James (1984) – on a decaying log. Site 10. LOD.

T. granulosa (Hoffm.) Lumbsch (1983) – on a trunk of *B. pendula*, on decaying stumps and logs, on the wooden fence surrounding the forester's lodge. Sites 2, 7, 9. KTC, LOD.

T. pseudogranulosa (Nyl.) Coppins (1983) – on mosses on a young *Q. robur*. Site 13. LOD.

T. viridescens (Schrad.) Coppins et P. James (1984) – on wood. Site 1. LOD.

**Tremella cladoniae* Diederich et M.S. Christ. (1996) – on squamules and podetia of *Cladonia coniocraea* and *C. ochrochlora* growing on decaying logs of *P. abies* and tree stumps. Sites 1, 13. BILAS, LOD.

**T. hypogymniae* Diederich et M.S. Christ. (1996) – on thalli of *Hypogymnia physodes* growing on *Q. robur* and *T. cordata*. Sites 11, 13. LOD.

**T. lichenicola* Diederich (1996) – on a thallus of *Mycoblastus fucatus* growing on *T. cordata*. Site 11. LOD.

Tuckermannopsis chlorophylla (Willd.) Hale (1987) – on a trunk of *C. betulus*, on a wooden fence. Sites 7, 11. KTC.

Usnea filipendula Stirt. (1881) – on trunks of *Q. robur* and *A. platanoides*. Sites 1, 9, 11, 12. KTC.

U. hirta (L.) Weber ex F.H. Wigg. (1780) – on a wooden fence. Site 7. KTC.

U. subfloridana Stirt. (1882) – on a trunk of *Q. robur*. Site 9. KTC.

Verrucaria aquatilis Mudd (1861) – on a siliceous stones in a forest stream. Site 1. BILAS.

V. muralis Ach. (1803) – on a siliceous stone in an overgrowing gravel pit. Site 3. LOD.

V. praetermissa (Trevisan) Anzi (1864) – on siliceous stones in a forest stream. Site 1. BILAS.

Xanthoria candelaria (L.) Th. Fr. (1861) – on a wooden fence. Site 7.

X. parietina (L.) Th. Fr. (1860) – on twigs of *A. platanoides* and *Q. robur*, on a wooden fence. Sites 7, 11, 12.

X. polycarpa (Hoffm.) Th. Fr. ex Rieber (1891) – on twigs of *Q. robur*, on a wooden fence. Sites 7, 9.

THE BUDZISK RESERVE AS A BIOCENTRE OF SPECIES DIVERSITY

Altogether 185 taxa of lichens (169 species), lichenicolous fungi (13 species) and allied saprobic fungi (3 species) were recorded in the Budzisk nature reserve. The findings constitute 62% of the lichen biota of the entire Knyszyńska Large Forest (Cieśliński, in press). The lichen biota has typical forest features: forest epiphytes are dominant - 90 species of the total 95 epiphytes recorded, and forest epixylic species - 32 of the total 48 recorded, that is almost 72.5% of the total number of species. 30 species (17.7%) can be considered to be old-growth forest lichens (Motiejūnaitė et al., in press; see also Table 1).

Table 1

Threatened lichen species and indicators of old-growth forests recorded in the Budzisk nature reserve (acc. to Cieśliński et al. 1992; Cieśliński, in press, and Motiejūnaitė et al., in press)

Species	The red data book categories		Old-growth forest indicator	Indicator value in adjacent countries
	in Poland	in NE Poland		
Arthonia byssacea	E	E	+	S, L
Bacidia subincompta (Fig. 2)	E	V	.	.
Cetrelia olivetorum	E	E	+	S, L
Chaenotheca brachypoda (Fig. 2)	E	E	+	S, L
Ch. chlorella	E	E	+	S, L
Ch. stemonea	E	E	.	.
Ch. xyloxena	E	E	.	S
Chrysothrix candelaris (Fig. 2)	E	.	+	L
Cladonia parasitica	E	E	+	S, L
Hypotrachyna revoluta	E	E	+	S, L
Lecanora albella (Fig. 2)	E	E	+	.
Loxospora elatina (Fig. 2)	E	.	+	.
Menegazzia terebrata (Fig. 2)	E	E	+	L
Opegrapha vermicellifera	E	E	+	S
Peltigera praetextata	E	.	.	.
Pertusaria coronata	E	V	+	S
P. multipuncta	E	E	+	S
Pyrenula nitida	E	.	.	S, L
P. nitidella (Fig. 2)	E	V	+	S, L
Thelotrema lepadinum (Fig. 2)	E	E	+	S, L
Trapeliopsis viridescens	E	E	+	.
Usnea filipendula	E	.	.	.
U. subfloridana	E	.	.	.
Bacidia laurocerasi	R	E	+	S
Cetrelia cetrarioides	.	E	+	.
Microcalicium disseminatum	.	E	+	.
Arthonia radiata	V	.	.	.
Arthothelium ruanum	V	.	.	S
Bacidia arceutina (Fig. 2)	V	E	+	.
B. beckhausii	V	V	.	.
B. rubella	V	.	.	S, L
Biatora efflorescens	V	V	.	.
Bryoria implexa	V	V	.	.
Calicium abietinum	V	E	.	S
C. glaucellum	V	V	.	.
C. salicinum	V	.	.	.
C. viride (Fig. 2)	V	V	+	.
Cetraria sepincola	V	.	.	.
Chaenotheca furfuracea	V	V	.	.

Tab. 1 cont.

Ch. trichialis	V	.	.	.
Evernia prunastri	V	.	.	.
Graphis scripta	V	.	.	.
Haematomma ochroleucum var. *ochroleucum*	V	.	+	L
Hypogymnia tubulosa	V	.	.	.
Lecanora subrugosa	V	V	.	.
Lecidea turgidula	V	V	+	S
Melanelia subaurifera	V	.	.	.
Ochrolechia androgyna	V	.	.	.
O. subviridis	V	.	.	.
Opegrapha rufescens	V	.	.	.
O. varia	V	.	.	S
O. viridis	V	.	+	S
O. vulgata	V	.	.	.
Pertusaria leioplaca	V	.	.	.
P. pertusa	V	.	.	S, L
Platismatia glauca	V	.	.	.
Ramalina farinacea	V	.	.	.
R. pollinaria	V	.	.	.
Tuckermannopsis chlorophylla	V	.	.	.
Usnea hirta	V	.	.	.
Verrucaria aquatilis	V	I	.	.
Xanthoria candelaria	V	.	.	.
Bacidina arnoldiana	.	V	.	.
Lecanora sarcopisioides	.	V	.	.
Peltigera polydactylon	.	V	.	.
Micarea misella	I	I	.	.
Trapeliopsis gelatinosa	I	I	.	.
Fellhanera gyrophorica (Fig. 2)	.	I	+	L
Fellhaneropsis vezdae (Fig. 2)	.	I	+	.
Micarea botryoides	.	I	.	.
M. hedlundii	.	I	.	.
Placynthiella dasaea	.	I	.	.
Trapeliopsis pseudogranulosa	.	I	.	.
Verrucaria praetermissa	R	I	.	.
Acrocordia cavata	.	.	+	S, L
Biatora ocelliformis	.	.	+	S
Pertusaria flavida	.	.	+	S
P. pupillaris	.	.	+	.

Explanations: the red data book categories: E – endangered, V – vulnerable, I – indeterminate, R – rare; indicator value: S – SE Sweden (acc. to Hallingbäck 1995), L – Lithuania (acc. to Andersson et al. 2002).

The lichen biota of the reserve is characterized by a high concentration of lichens that are threatened in Poland and in its NE part. Such species make up 61% of the total number of lichen species. As many as 23 species of the threatened lichens recorded in the reserve belong to the category Endangered (E) in Poland (19 species endangered in NE part of the country), and 36 – to the category Vulnerable (V) (14– in the NE part of the country). Those species are lichens typical of old-growth forests, confined to epiphytic and epixylic habitats of old woodlands.

Many of the lichens are also rare in the Knyszyńska Large Forest. Concentrated numbers of them, however, can be found mainly in the Budzisk reserve (Fig. 2).

Lichens that are rare, noteworthy, and whose distribution in Poland has not been studied in detail were also recorded, such as *Absconditella lignicola*, *Acrocordia cavata*, *Biatora ocelliformis*, *Fellhanera gyrophorica*, *Fellhaneropsis vezdae* (Fig. 2), *Micarea botryoides*, *M. hedlundii*, *M. misella*, *Pertusaria pupillaris*, *Placynthiella dasaea*, *Ropalospora viridis*. They were reported as new to the Knyszyńska Large Forest.

As the aquatic lichen biota in lowlands of Eastern and Central Eastern Europe is underinvestigated, little is known about the distribution of most species in such habitats. Due to accidental records, many of such lichens are entered in the category of rare or threatened species. During this study, two saxicolous aquatic lichens were found, *Verrucaria aquatilis* (category V) and *V. praetermissa* (category R), both growing on siliceous stones in a forest stream bed.

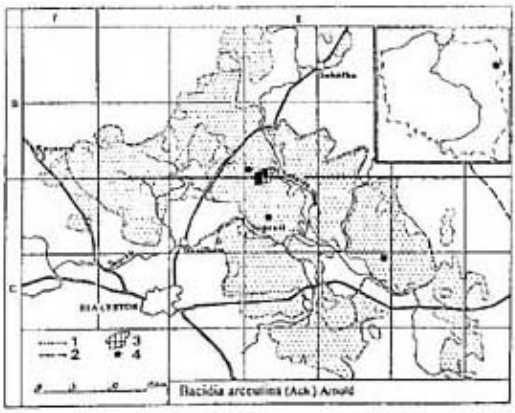
Lichenicolous fungi about which little is known in Poland were recorded during this study and reported for the first time in the reserve and the entire Knyszyńska Large Forest.

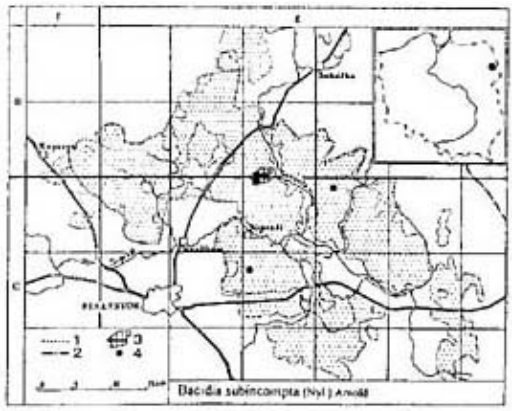
The absence of synanthropic species, characteristic of open habitats, usually growing on solitary trees and timber in agricultural landscape, contributes to the natural character of the epiphytic and epixylic forest lichen biota in the reserve. Synanthropic epiphytes (7 species) and epixylic lichens (16 species), growing on trees and the wooden fence surrounding the forester`s lodge, were found only in the Budzisk glade (site 7).

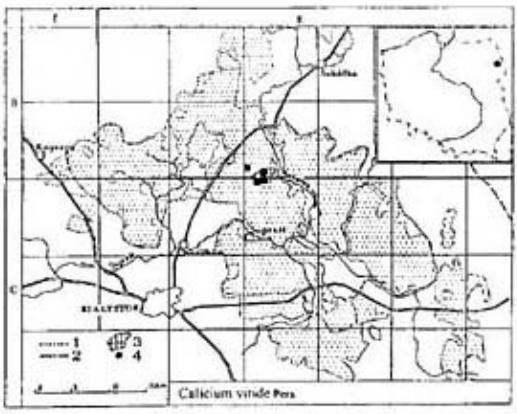
CONCLUSIONS

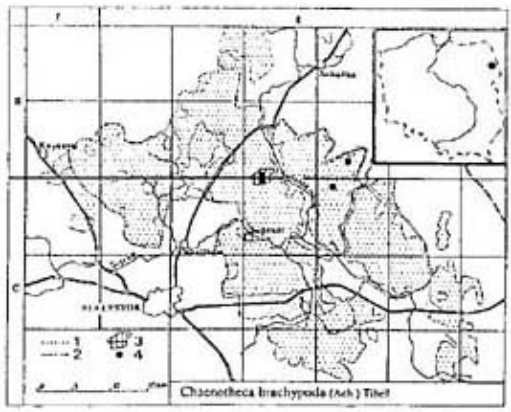
1. The Budzisk nature reserve is an important biocentre (refugium) of a diversity of lichens, lichenicolous and allied non-lichenized fungi characteristic of old-growth forests in Poland. Epiphytic and epixylic species characteristic of old and natural forests are still to be in the area. Their presence throughout the ages proves that econiches typical of forest ecosystems hardly influenced by human activities have survived. Furthermore, factors such as the location of the reserve inside a large forest complex, its microclimate, an undisturbed water system (vast springy areas), a natural diversification of age structure of trees and deadwood at different stages of decomposition, contribute to the phenomenon.

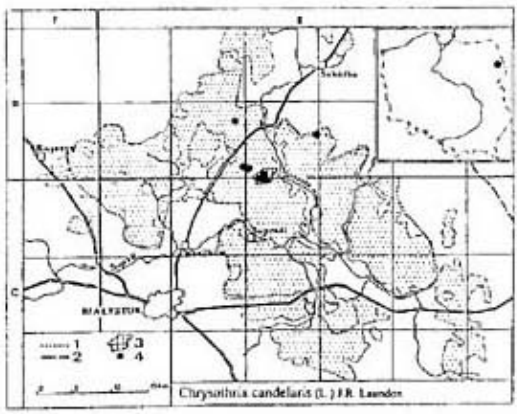
2. The reserve can be characterized as a biological centre with a high concentration of red-listed lichens of endangered and vulnerable categories as well as old-growth forest indicator species (Table 1), including a number of rare and noteworthy species or species whose distribution in Poland has not been studied in depth and that are new to the Knyszyńska Large Forest.

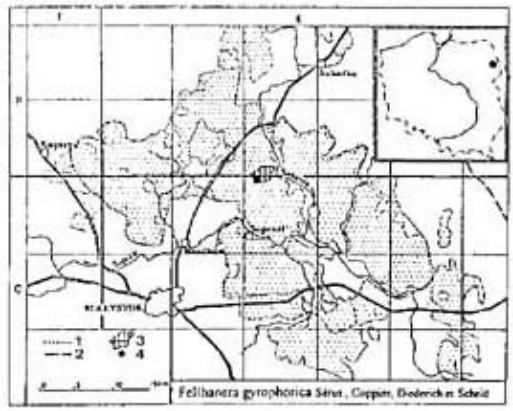












3. Studies on the distribution of these species in the wooded areas in North-Eastern Poland will enrich data on forest lichens, lichenicolous and allied fungi in this part of the country.

Acknowledgement: The present study was carried out as a research project financed by the Committee for Scientific Research, project No. 6 PO4G 086 17.

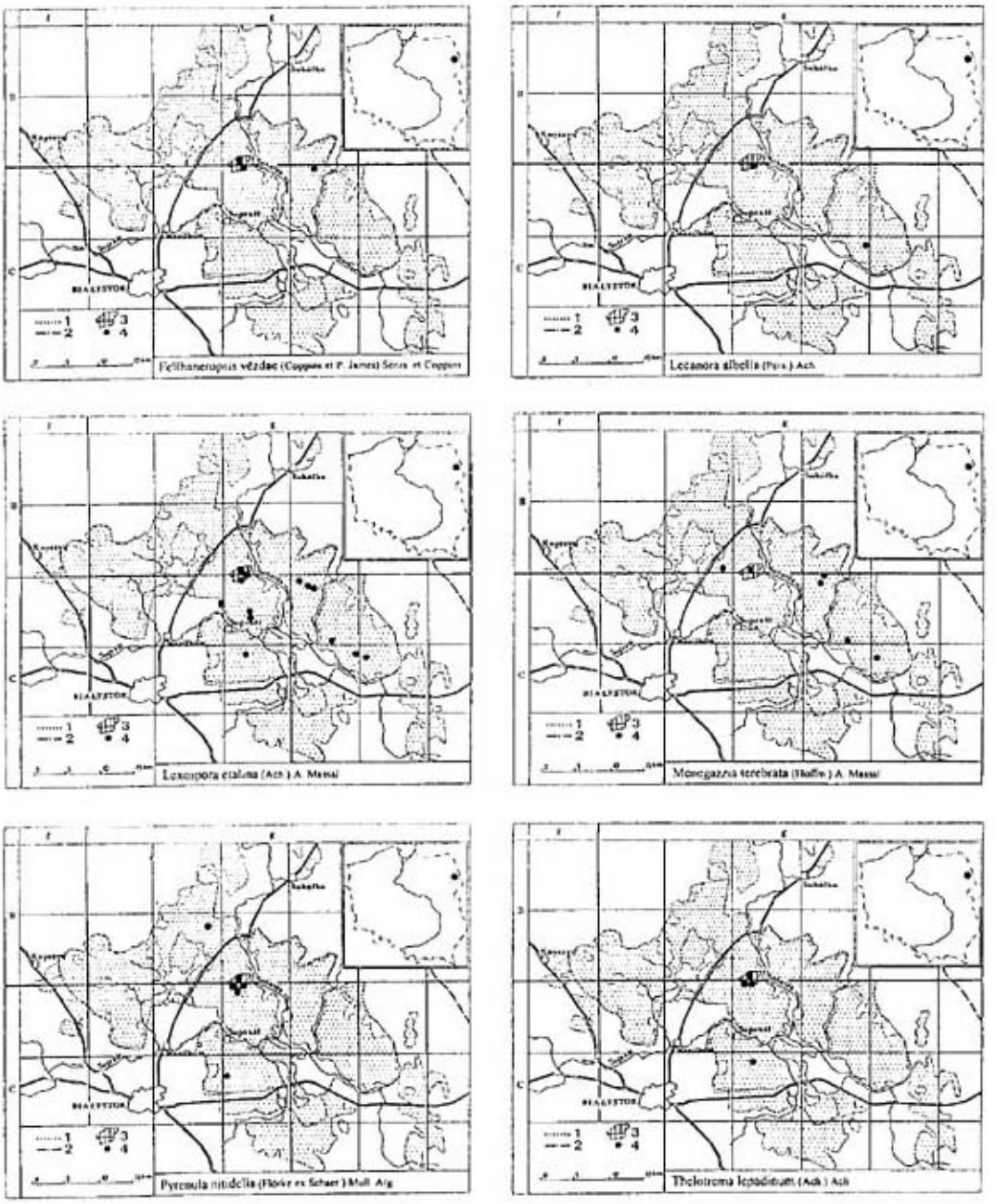


Fig. 2. Distribution of old-growth forest lichens in the Knyszyńska Large Forest
1 – boundary of the Puszcza Knyszyńska Landscape Park; 2 – state border line; 3 – Budzisk Nature Reserve; 4 – sites of lichen species

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Rezerwat Budzisk jako biocentrum różnorodności porostów w Puszczy Knyszyńskiej (Polska Północno-Wschodnia)

Streszczenie

Rezerwat leśny Budzisk jest położony w centrum rozległych lasów Puszczy Knyszyńskiej oraz w obrębie Parku Krajobrazowego Puszczy Knyszyńskiej, mającego według Krajowej Sieci Ekologicznej EECONET POLSKA znaczenie obszaru węzłowego rangi europejskiej, a badany rezerwat stanowi biocentrum o największym nagromadzeniu walorów przyrodniczych, w tym porostów. Badania porostów i innych grzybów przeprowadzono w roku 1999 metodą zdjęcia florystycznego w czternastu punktach badawczych. Materiały zielnikowe znajdują się w Herbariach BILAS (Vilnius, Lithuania), KTC (Kielce) i LOD (Łódź).

Łącznie w rezerwacie poznano 185 taksonów porostów (169 gatunków), grzybów naporostowych (13) i saprobiontów (3). Rezerwat Budzisk jest dla Polski Północno-Wschodniej ważną ostoją różnorodności gatunkowej leśnych porostów związanych ze starymi lasami o cechach pierwotnych. To swoiste biocentrum lichenologiczne skupia 77 gatunków, tj 45,5% ogólnej liczby leśnych taksonów epifitycznych i epiksylicznych rezerwatu, z których 63 (37%) są zagrożone w skali Polski, 43 (25,4%) – w skali Polski Północno-Wschodniej, a 30 (17,7%) gatunków to wskaźniki lasów puszczańskich. Wiele z tych gatunków jest rzadkich również w Puszczy Knyszyńskiej, ale najczęściej są obecne w rezerwacie Budzisk. Są tutaj także stanowiska epifitycznych i epiksylicznych gatunków rzadkich, interesujących lub o słabo poznanym rozmieszczeniu w Polsce, nowych dla Puszczy Knyszyńskiej, np. epifity i epiksylity: *Absconditella lignicola*, *Acrocordia cavata*, *Biatora ocelliformis*, *Fellhanera gyrophorica*, *Fellhaneropsis vezdae*, *Micarea hedlundii*, *Pertusaria puppilaris* oraz epilityczne gatunki wodne: *Verrucaria aquatilis* i *V. praetermissa*. Po raz pierwszy dla rezerwatu i puszczy podano grzyby naporostowe.

Poznanie tych gatunków w obszarze leśnym Polski Północno-Wschodniej wzbogaca wiedzę na temat leśnych porostów i grzybów naporostowych kraju.