ACTA MYCOLOGICA
Vol. 34 (1): 125–168
1999

Macromycetes in forest communities of the Ińsko Landscape Park (NW Poland)

MAŁGORZATA STASIŃSKA

Department of Botany, University of Szczecin
Felczaka 3a, PL-71-412 Szczecin, Poland

S t a s i ń s k a M.: Macromycetes in forest communities of the Ińsko Landscape Park (NW Poland). Acta Mycol. 34 (1): 125–168, 1999.

In the paper the results a 8-year mycocoenological study carried out on 34 permanent plots marked in the *Melico-Fagetum* Lohm. ap. Seibert 1954, the *Luzulo pilosae-Fagetum* W. Mat. et A. Mat. 1973, the *Fago-Quercetum petraeae* Tx. 1955 and the *Galio sylvatici-Carpinetum* Oberd. 1957 associations are presented and several ecological groups of fungi are discussed.

The total number of 267 macromycetes species was noted. Some species rarely found in Poland, such as: *Hericium erinaceus, Neobulgaria pura* and *Polyporus tuberaster* were noted.

Key words: macromycetes, mycocoenology, Ińsko Landscape Park, Pomerania region.

INTRODUCTION

Fungi constitute an important component of forest ecosystems. Particular species of deciduous and needle trees enter into mycorrhizal relations with certain species of fungi. The presence of fruit bodies of certain species, their abundance and frequency of occurrence brings information on the activity of the mycelium and its mycorrhizal ability as well as, indirectly, on the health status of trees (F e l l n e r and P e š k o v á 1995). The species composition of ectomycorrhizal fungi and quantitative relations among the mycorrhizal, saprotrophic and parasitic fungi are important indications of the conditions in the phytocenosis.

Recent reports on deteriorating viability of beech and oak trees in Europe (P r z y b y ł 1995) together with incommensurably low contribution of deciduous trees, mainly beech trees, in the forests of Pomerania, in spite of biotopic conditions potentially favourable for them (C z u b i ń s k i 1950), have stimulated interest in the communities including these trees, also from the point of view of the mycosociological study.

Mycosociological studies in which fungi are treated as indicators of changes in natural environment have been undertaken in different parts of Europe (B r e s i n s k y et al. 1995). In the region of western Pomerania such studies have been conducted in the Beech Forest near Szczecin (L i s i e w s k a 1963; B u j a k i e w i c z 1969), on the Uznam and Wolin Islands (L i s i e w s k a 1966), in the Goleniów Forest (F r i e d r i c h 1986) and the Cedynia Landscape Park (F r i e d r i c h 1994). The forests more to the east of Szczecin, including the Ińsko Landscape Park (ILP), have not been studied in the aspect of mycological changes. It is supposed that cessation of preferred pine cultivation will result in gradual elimination of this species from the tree-stand and restoration of the original composition of beech forests.

The subject of the study reported are macrofungi in selected forest communities of the Ińsko Landscape Park and their role as indicators of changes in the process of restoration of the original composition of beech forests which have been for a long time subjected to artificial pinetisation. The aims of the study are:

Recognition of macromycetes in forest communities of the Ińsko Landscape Park,

Determination of mycocoenological relations in the associations studied and their interpretation against results of other studies performed in Poland,

Identification of relations between ecological groups of fungi and particular tree species, assessment of the role of fungi as indicators in prediction of renaturalisation of phytocoenoses.

The paper is the first in the series presenting results of the study on macromycetes in selected forest communities of the ILP. It gives general information on the study area, methodology and mycosociological characteristics of the forest associations studied.

STUDY AREA

The Ińsko Landscape Park (Fig. 1) an area of 17 763 ha, was founded in 1981 to protect fragments of natural vegetation, clear-water lakes and hilly structure of the land (J a s n o w s k i and Ć w i k l i ń s k i 1977).

The land sculpture, geological structure and soils of the ILP are products of direct and indirect effect of Scandinavian glacier during the Baltic Glaciation. Glacial deposits are of meridional arrangement and form zones of sandr sands, frontal moraine and ground moraine, which differ in sculpture, geological structure and kind of soil (D o b r a c k i 1986).

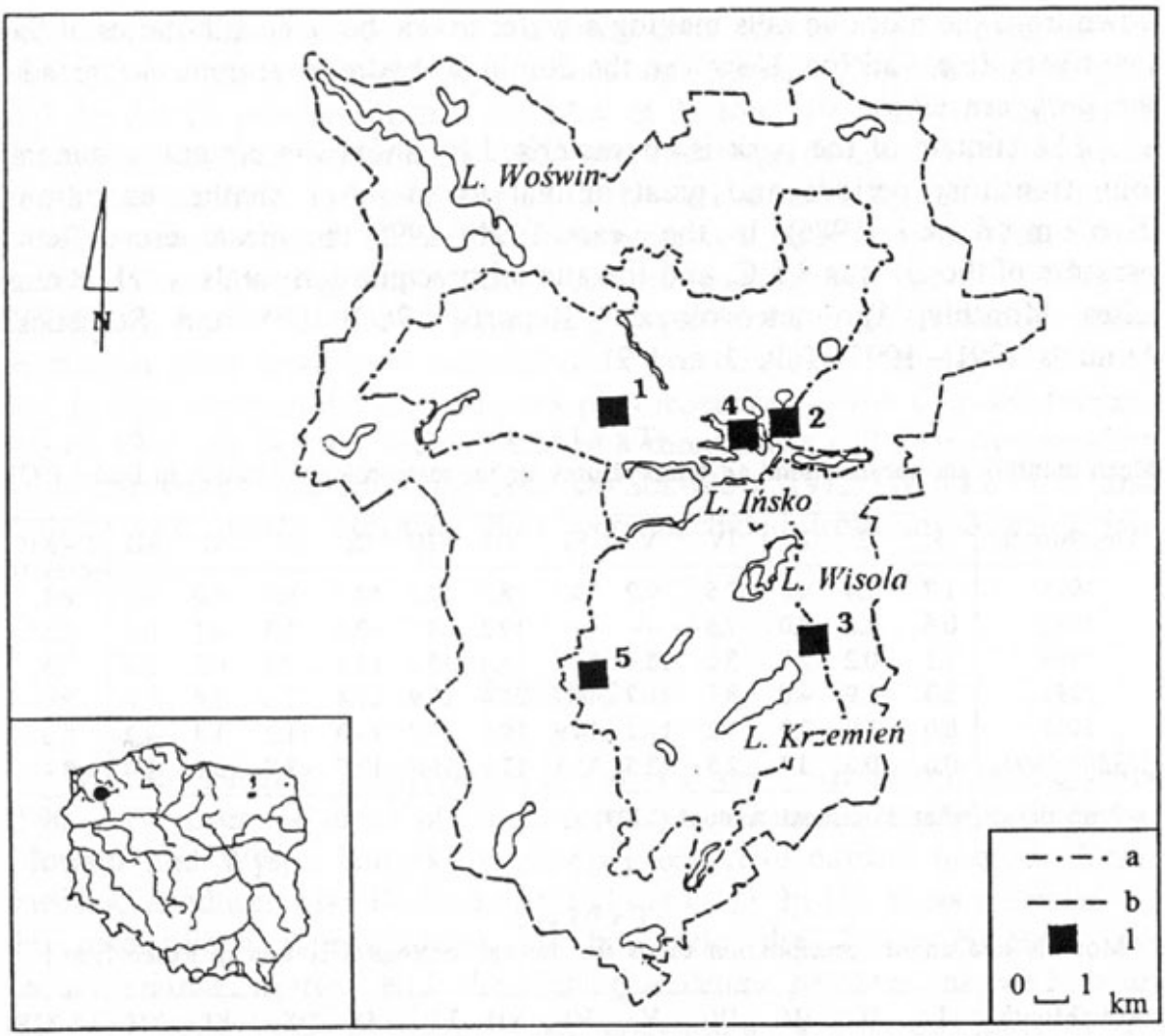

Fig. 1. Ińsko Landscape Park (ILP)
Reserve: 1 — Głowacz; 2 — Kamienna Buczyna; 3 — Krzemieńskie Źródliska (proposed); 4 — Wyspa Sołtyski; 5 — Perłówkowe Buki (proposed); a — border of the park; b — border of the protective zone

Characteristic elements in the park landscapes are rampart and domed hills of the frontal moraine. They surround deep water-eyes, peat-bog valleys, swamps, deep ravines and elongated gullies filled with lake water (M i k o ł a j s k i 1966).

The geological structure is dominated by the Quaternary deposits — mainly the Pleistocene ones, while in the valleys and gullies — the Holocene deposits (D o b r a c k i 1986). The pseudopodzolic soils are dominant, relatively low is the contribution of podzolic soils and hydromorphic soils (P r u s i n k i e w i c z and B e d n a r e k 1991).

The Ińsko Landscape Park is rich in water resources — abundant ground waters, numerous little rivers, streams and lakes (J a s n o w s k i and Ć w i k l i ń s k i 1977). The river network consists of many streams flowing

down from the moraine hills making a water divide between tributaries of the two rivers Rega and Ina. However, the dominant hydrogeographic elements in the park are lakes.

The climate of the park is characterised by short winters and summers, long transitory periods and great annual variation of weather conditions (K o ź m i ń s k i 1986). In the years 1991–1995 the mean annual temperature of the air was 8.5°C, and the annual precipitation totals – 711.8 mm (after Monthly Agrometeorological Reports 1986–1995 and Statistical Annuals 1991–1995, Tab. 1 and 2).

Table 1
Mean monthly and mean annual air temperatures for the meteorological station in Resko [°C]

Year/Month	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII	I–XII
1991	1.7	–2.4	4.8	7.5	9.2	13.7	18.5	17.5	13.7	8.7	4.0	0.8	8.1
1992	0.6	2.6	4.0	7.5	—	—	19.2	18.7	12.6	5.3	4.1	0.5	9.5[1]
1993	1.1	0.2	2.8	3.6	15.9	14.4	15.6	15.3	11.6	7.8	–0.2	2.0	7.5
1994	2.3	–1.9	4.0	8.7	11.7	14.7	21.4	17.9	13.4	7.1	5.4	3.0	9.0
1995	0.0	3.9	2.9	7.2	11.7	14.9	19.5	17.9	13.0	11.2	1.8	–4.2	8.3
1986–1995	0.6	0.6	3.4	7.5	12.5	15.1	17.8	16.8	12.7	8.7	3.6	1.0	8.4

„–" no data; [1] after Statistical Annual (1993)

Table 2
Monthly and annual precipitation totals for the meteorological station in Resko [mm]

Year/Month	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII	I–XII
1991	26	30	33	47	79	175	22	101	36	32	50	73	704
1992	29	51	100	32	42	39	22	107	30	32	74	32	590
1993	69	55	43	33	39	101	154	86	107	27	31	108	853
1994	129	15	105	29	50	29	9	36	59	43	46	98	648
1995	90	62	73	42	58	82	63	96	94	22	51	31	764
1986–1995	61	40	58	43	45	83	62	70	68	35	56	62	682

The vegetation cover of the park is diverse with the domination of forest communities occupying almost 53% of the area, which are highly diversified and show mosaic distribution, determined by to the habitat conditions. These are the remains of primeval deciduous forests with the dominant species of *Fagus sylvatica* (J a s n o w s k i and Ć w i k l i ń s k i 1977; B o r a t y ń s k a and B o r a t y ń s k i 1990) – substantially eliminated by introduction of *Pinus sylvestris* (C z u b i ń s k i 1950).

Deciduous forests, and beech forests in particular have been characteristic of the area of the park. On the map of potential natural vegetation cover their habitats occupy the largest area (J a s n o w s k i et al. 1995). At present

beech stands take over 30% of the forest area and are represented by the associations: the *Melico-Fagetum* Lohm. ap. Seibert 1954 (the main one) and the *Luzulo pilosae-Fagetum* W. Mat. et A. Mat. 1973. Phytocoenoses of the *Fago-Quercetum petraeae* Tx. 1955 occur as large complexes or fragments in the beech stands, and a small part of the area is taken by the *Galio sylvatici-Carpinetum* Oberd. 1957. The best-preserved fragments of these communities have been protected as a natural reserve (Grinn 1983a, b; Wołejko 1991; Wołejko and Kmiecik 1991) and in them permanent plots have been selected for mycosociological study.

In land depressions near streams phytocoenoses of the *Circaeo-Alnetum* Oberd. 1953 can be met, and in hollows without flows and near overgrowing water reservoirs – the *Ribo nigri-Alnetum* Sol.-Górn. 1975 (Wołejko and Kmiecik 1991), however, they were excluded from mycosociological observations.

METHODS

Mycosociological observations in the ILP were carried out in the years 1990–1997 over the areas of the three nature reserves: Kamienna Buczyna, Głowacz and Wyspa Sołtyski, and two prospective natural reserves: Krzemieńskie Źródliska and Perłówkowe Buki (Fig. 1). In the areas occupied by the associations representative of the park: the *Melico-Fagetum*, the *Luzulo pilosae-Fagetum* and the *Fago-Quercetum petraeae*, as well as in the *Galio sylvatici-Carpinetum* – an association rare in this part of the country (Tab. 3), 34 permanent plots, of 400 m^2 each, were established. The plots were chosen on the basis of relevés made by the Braun-Blanquet method and classified in the Matuszkiewicz system as well as following the consultations with florists. In each plot pH of the surface layers of the soil (2–5 cm deep) was determined by the potentiometric method (Tab. 3).

Observations in the permanent plots were conducted every 2–3 weeks in the period from April to November, the number of mycosociological observations in plots varied from 37 to 43.

Results of the observations are presented in tables prepared for the three groups of fungi species, depending on the substrate of occurrence: a) terrestrial fungi, b) litter-decomposing fungi and c) lignicolous fungi. The mycosociological relevés in the tables are arranged according to the moisture content at a given habitat, starting from the highest moisture patches. For each species its abundance according to the scale of Jahn et al. (1967), number of observations and degree of constancy in the Braun-Blanquet scale, have been determined.

Table 3
Characteristics of permanent plots

No. of plot	Locality	Type of community	Exposition	Inclination [°]	Cover of layer [%]				Predominant species in layer				Reaction of soil [pH]	Age[1] of trees	Comments
					a	b	c	d	a	b	c	d			
1	PB	*MF-Mu*	S	15	80	–	85	1	*Fs*	–	***Mu***, *An, Go, Gl, Me, Vr, Mb*	*Hc*	3.66	120	3 stumps of *Fs;* 1 stump of *Q;* a few fallen branches; cover of litter – 40%; near plot: *Qr*
2	PB	*MF-Mu*	S	15	80	10	75	2	***Fs***, *Qr*	*Fs, Ap*	***Mu***, *An, Gl, Go, Me, Vr*	*Hc, Mh*	3.85	120	4 stumps of *Fs*; cover of litter – 50%
3	PB	*MF-Mu*	S	15	95	–	15	1	*Fs*	–	***Mu***, *Go, Me, Vr, An*	*Hc*	3.64	150	3 stumps of *Fs*; 1 rotten trunk of *Fs*; cover of litter – 90%; near plot: *Sn, Cb*
4	KB	*MF-t*	W	25	40	35	60	1	***Fs***, *C*	***Fs***, *Ca*	*Go, Gl, Pn, Po, Mn, Df*	*Hc*	4.71	110	1 stump of *Fs*; 3 trunks of *Pt*; cover of litter – 40%; near plot: *Ag, Bp, Pt*
5	KB	*MF-t*	W	10	60	20	30	1	***Fs***, *Pt Cb*	***Fs***, *C, Ca*	*Go, An, Po, Vr, Pn, Df*	*Hc, Pr, Mh*	4.20	110	7 trunks of *Pt*; 1 rotten stump; cover of litter – 80%; near plot: *Pt, Bp, Ag*
6	KB	*MF-t*	S	35	50	5	80	1	*Fs*	*Fs*	*Go, Pn, Me, Po, Ss, Gl, Fs, An, Df*	*Hc*	5.17	110	3 stumps of *Fs*; cover of litter – 30%; near plot: *Bp, Cb, Qp*
7	KB	*MF-t*	W	40	40	–	35	2	*Fs*	–	*An, Oa, Df, Go, Po*	*Hc, Mh*	4.18	90	5 rotten stumps; 3 rotten trunks of *Fs*; cover of litter – 80%
8	G	*MF-t*	E	5	90	–	20	–	*Fs*	–	*Fa, Go, Oa, Df, Mn, Fs*	–	4.07	100	3 rotten stumps of *Fs*; cover of litter – 90%; near plot: *Ps*
9	G	*MF-t*	E	10	75	–	30	–	*Fs*	–	*Go, Fs, An, Oa, Vr, Df, Fa, Mn*	–	3.79	100	4 rotten stumps of *Fs*; 1 stump of *Q*; cover of litter – 80%

10	G	*MF-t*	E	5	80	–	30	–	*Fs*	–	*Go, An, Oa, Df, Mb, Fa*	–	4.02	100	3 rotten stumps of *Fs;* 3 trunks of *Fs*; cover of litter – 85%
15	KZ	*MF-Db*	NW	0	90	5	60	–	***Fs**, Cb*	*Fs, Ap*	***Db**, Go, An, Oa, Sa, Ap*	–	4.03	70	3 stumps of *Fs*; many fallen branches and twigs; cover of litter – 90%
16	KZ	*MF-Db*	NW	0	80	55	40	–	***Fs**, Qr*	*Fs, Ap, Sa*	***Db**, An, Oa, Fs, Ap, Go, Me*	–	3.79	70	2 stumps of *Fs*; 1 stump of *Q*; 1 rotten trunk of *Fs*; many fallen branches and twigs; cover of litter – 90%
17	KZ	*MF-Db*	N	0	90	5	50	–	***Fs**, Cb*	*Fs, Ap*	***Db**, An, Go, Fa, Oa, Ap, Fs*	–	3.72	65	1 stump of *Cb*; many fallen branches and twigs; cover of litter – 75%; near plot: *Larix decidua*
18	KZ	*MF-Fa*	W	0	90	10	75	1	***Fs**, Qr*	*Fs, Ap, Sa*	***Fa**, An, Lp, Me, Go, Fs, Mb, Oa*	*Hc, Mh*	3.78	90	2 rotten stumps of *Fs*; a few fallen branches; cover of litter – 65%
19	KZ	*MF-Fa*	W	0	40	5	50	1	*Fs*	*Fs*	***Fa**, Fs, Lp, An, Go, Oa, Me, Ap*	*Hc, Ds*	3.85	90	1 stump of *Fs*; 1 rotten trunk of *Fs*; many fallen branches and twigs; cover of litter – 70%
20	KZ	*MF-Cc*	NW	35	30	15	95	1	*Fs*	*Fs*	***Cc**, Db, An, Vr, Oa, Ap, Df, Go*	*Hc, Mh*	3.39	55	4 stumps of *Fs*; 2 rotten trunks of *Fs*; many fallen branches and twigs; cover of litter – 50%
21	KZ	*MF-Cc*	NW	30	55	10	95	1	*Fs*	***Fs**, Sn*	***Cc**, Db, An, Ap, Fs, Vr, Oa, Go*	*Hc*	4.29	55	3 stumps of *Fs*; 1 stump of *Cb*; 4 rotten trunks of *Fs*; many fallen branches and twigs; cover of litter – 50%; near plot: *Cb, Qr*
11	G	*LF*	S	20	80	5	30	3	*Fs*	***Fs**, C, Qp*	*Fs, Cp, Lp, Df, Oa, Go, Vr, Me*	*Ds, Mh*	4.02	80	2 rotten stumps of *Fs*; 1 rotten trunk; many fallen branches and twigs; cover of litter – 55%; near plot: *Ps*

Tab. 3 cont.

No. of plot	Locality	Type of community	Exposition	Inclination [°]	Cover of layer [%]				Predominant species in layer				Reaction of soil [pH]	Age[1] of trees	Comments
					a	b	c	d	a	b	c	d			
12	G	*LF*	NW	5	75	–	10	1	*Fs*	–	*Lp, Pn, Go, R*	*Ds, Mh*	3.37	80	1 rotten trunk of *Fs*; a few rotten branches of *Bp*; cover of litter – 75%; near plot: *Ps*
13	G	*LF*	NE	15	90	–	10	1	*Fs*	–	*Lp, An, Oa, Df*	*Ds, Mh*	3.78	100	3 rotten stumps of *Fs*; 2 rotten trunks of *Fs*; cover of litter – 80%
14	G	*LF*	NW	5	80	–	15	2	*Fs*	–	*Lp, An, Oa, Df, Go, Gl*	*Ds, Mh, Hc*	3.98	100	2 rotten stumps of *Fs*; 2 trunks of *Fs*; cover of litter – 85%; near plot: *Qp, Ps*
26	WS	*LF*	W	5	70	5	10	2	*Fs, Qr*	*Fs*	*Lp, Fs, Cp, Vr*	*Hc, Mh, Dh*	4.03	150	2 rotten stumps of *Fs*; 2 trunks of *Fs*; cover of litter – 40%
27	WS	*LF*	W	10	80	20	5	1	*Fs*	*Fs*	*Fs, Lp, Cp*	*Hc*	3.90	150	5 rotten trunks of *Fs*; cover of litter – 70%; near plot: *Qr*
28	WS	*LF*	W	10	60	10	15	2	*Fs*	*Fs*	*Fs, Lp, Cp, Pn, Cd*	*Hc, Mh, Dh*	4.14	150	3 stumps of *Fs*; 2 rotten trunks of *Fs*; cover of litter – 50%; near plot: *Qr*
30	WS	*LF*	N	10	70	–	5	1	*Fs*	–	*Fs, Lp, Df*	*Hc, Mh*	4.06	150	2 rotten stumps of *Fs*; 2 rotten trunks of *Fs*; cover of litter – 60%
31	WS	*LF*	N	0	80	15	8	3	*Fs, Qr*	*Fs*	*Fs, Lp, Df, Go*	*Hc, Mh, Dh*	3.89	150	2 stumps of *Fs*; 1 rotten trunk; cover of litter – 60%
29	WS	*LF*	S	0	80	2	5	1	*Fs*	*Fs*	*Fs, Lp, Df*	*Hc*	3.92	65	7 rotten trunks of *Fs*; cover of litter – 90%

32	WS	*LF*	NE	10	80	3	2	1	*Fs*	*Fs*	*Fs, Lp, Df*	*Hc, Mh*	3.87	65	1 rotten trunk of *Fs*; many fallen branches and twigs; cover of litter – 90%
33	WS	*LF*	NE	10	85	–	2	1	*Fs*	–	*Fs, Lp, Df*	*Hc, Mh*	3.90	65	2 rotten trunks of *Fs*; many fallen branches and twigs; cover of litter – 90%
34	WS	*LF*	N	15	80	–	3	1	*Fs*	–	*Fs, Lp, Df*	*Hc, Mh*	3.89	65	2 stumps of *Fs*; 2 rotten trunks of *Fs*; a few fallen branches; cover of litter – 85%
22	KZ	*GC*	NW	5	80	40	50	1	***Cb, Fs, Qp***	*Cb, Fs, Ca*	*Cb, Fs, Gl, Fa, Ap, Oa, Df, Pn*	*Hc, Mh*	3.80	60–90	2 rotten stumps; many fallen branches and twigs; cover of litter – 40%
23	WS	*GC*	S	45	60	40	70	1	***Qr, Fs***	*Fs, Sa, C*	*Gs, Pn, Mn, Po, Cd, An, Vr, Lv*	*Hc*	5.53	130	2 rotten trunks; cover of litter – 20%; near plot: *Ps*
24	WS	*GC*	S	45	60	20	80	–	***Qr, Fs***	*Fs, C, Sa*	*Gs, Mn, Pn, Lv, An, Vr, Cd, Fs*	–	4.93	130	1 rotten trunk of *Q*; cover of litter – 20%; near plot: *Ps, Cb*
25	WS	*FQ*	S	0	70	35	50	5	***Qp, Qr*** *Fs*	***Fs, Qr,*** *Sa*	***Vm, Lp, Mn,*** *Oa, Mb, Go*	***Dh, Hc,*** *Mh, Lg*	3.99	130	2 rotten stumps of *Q*; 1 stump of *Ps*; 1 stump of *Fs*; 2 trunks of *Fs*; cover of litter – 20%

Explanations: reserve: G – Głowacz, KB – Kamienna Buczyna, WS – Wyspa Sołtyski, KZ – Krzemieńskie Źródliska, PB – Perłówkowe Buki; N – North, S – South, E – East, W – West; [1] on the basis of documents for utilizing forests for reserve purposes from 1980/1990; **boldface** – species occurs with the largest percentage (%) of cover

MF-t – Melico-Fagetum typical face; *MF-Mu – Melico-Fagetum* face with *Melica uniflora*; *MF-Db – Melico-Fagetum* face with *Dentaria bulbifera*; *MF-Cc – Melico-Fagetum* face with *Corydalis cava*; *MF-Fa – Melico-Fagetum* face with *Festuca altissima*; *LF – Luzulo pilosae-Fagetum*; *GC – Galio sylvatici-Carpinetum*; *FQ – Fago-Quercetum petraeae*

Ag – Alnus glutinosa; *An – Anemone nemorosa*; *Ap – Acer pseudoplatanus*; *Bp – Betula pendula*; *C – Crataegus* sp.; *Ca – Corylus avellana*; *Cb – Carpinus betulus*; *Cc – Corydalis cava*; *Cd – Carex digitata*; *Cp – Carex pilulifera*; *Db – Dentaria bulbifera*; *Df – Dryopteris filix-mas*; *Fa – Festuca altissima*; *Fs – Fagus sylvatica*; *Gl – Galeobdolon luteum*; *Go – Galium odoratum*; *Gs – G. sylvaticum*; *Lp – Luzula pilosa*; *Lv – Lathyrus vernus*; *Mb – Maianthemum bifolium*; *Me – Milium effusum*; *Mn – Melica nutans*; *Mu – M. uniflora*; *Oa – Oxalis acetosella*; *Pn – Poa nemoralis*; *Po – Pulmonaria officinalis*; *Ps – Pinus sylvestris*; *Pt – Populus tremula*; *Q – Quercus* sp.; *Qp – Q. petraea*; *Qr – Quercus robur*; *R – Rubus* sp.; *Sa – Sorbus aucuparia*; *Sn – Sambucus nigra*; *Ss – Stachys sylvatica*; *Vm – Vaccinium myrtillus*; *Vr – Viola reichenbachiana*

Dh – Dicranella heteromalla; *Ds – Dicranum scoparium*; *Hc – Hypnum cupressiforme*; *Lg – Leucobryum glaucum*; *Mh – Mnium hornum*; *Pr – Plagiomnium rostratum*

The species nomenclature of *Ascomycota* was assumed after Michael et al. (1988), while that of *Basidiomycota* after Eriksson and Ryvarden (1973–1976), Eriksson et al. (1978–1984), Kuyper (1986), Kreisel (1987), Hjortstam et al. (1987, 1988), Stangl (1989), Arnolds (1990), Telleria (1990), Hansen and Knudsen (1992), Maas Geesteranus (1992a, b), Ryvarden and Gilbertson (1993–1994), and Roberts (1994–1995).

The nomenclature of vascular plants was assumed after Mirek et al. (1995), that of bryophytes after Corley et al. (1982), and that of forest communities after Matuszkiewicz and Matuszkiewicz (1996).

The collection of macrofungi was deposited in the Herbarium of the Szczecin University (SZUB).

DESCRIPTION OF THE FORESTS STUDIED

The ***Melico-Fagetum*** association occurs most often in a typical form. The main component of the tree-stand is *Fagus sylvatica* with a small contribution of *Quercus robur* or *Pinus sylvestris*. The shrub layer is relatively poorly developed and includes the species: *Fagus sylvatica*, *Acer pseudoplatanus* and *Sorbus aucuparia* saplings. The herb layer includes the character species of the association: *Dentaria bulbifera*, *Festuca altissima*, *Galium odoratum* and *Melica uniflora*, and the character species of the order *Fagetalia silvaticae*: *Galeobdolon luteum*, *Milium effusum* and *Pulmonaria officinalis*. The moss layer appears in small areas and includes the species: *Hypnum cupressiforme*, *Plagiomnium rostratum* and *Mnium hornum* (Grinn 1983a, b; Wołejko 1991). Depending on the sculpture of the area and habitat conditions in some recorded a domination of *Melica uniflora*, *Dentaria bulbifera*, *Festuca altissima* or *Corydalis cava* is noted.

In the area of the park the ***Luzulo pilosae-Fagetum*** develops in a typical form but is rather floristically poor. The tree-stand is dominated by *Fagus sylvatica* with small admixtures of *Quercus petraea* and *Pinus sylvestris*. The shrub layer is practically absent, and if present – composed mainly of beech saplings. The herb layer mainly includes *Luzula pilosa*, *Carex pilulifera*, *C. digitata* and *Poa nemoralis*, while the moss layer: *Hypnum cupressiforme*, *Dicranella heteromalla* and *Dicranum scoparium*. The bottom of the forest is covered with a thick, sometimes of a few tens centimetres, layer of decomposing litter (Grinn 1983a; Wołejko and Kmiecik 1991).

The species composition of the ***Fago-Quercetum petraeae*** association is similar to that of neighbouring beech forests. The densely and giving much

shade tree-stand includes mainly *Quercus petraea* and *Quercus robur*, with admixtures of *Fagus sylvatica* and *Pinus sylvestris*. There is practically no shrub layer, only occasionally beech saplings can be met. The herb layer is in some patches well developed and includes weakly acidiphilic species: *Maianthemum bifolium*, *Oxalis acetosella*, *Deschampsia flexuosa* and species typical of beech forests like *Galium odoratum*, *Luzula pilosa* and *Melica nutans*. The moss layer, covering up to 30% of the plot, includes *Hypnum cupressiforme*, *Dicranella heteromalla* and *Leucobryum glaucum* (W o ł e j k o and K m i e c i k 1991).

The ***Galio sylvatici-Carpinetum*** association develops in small patches near lakes. The dominant tree species are *Carpinus betulus* and *Quercus petraea* or *Quercus robur*, depending on the patch, always with admixture of *Fagus sylvatica*. The well-developed shrub layer includes such species as *Corylus avellana*, *Crataegus laevigata* and *Sorbus aucuparia*, apart from beech and hornbeam. The herb layer is well developed and includes the character species of the association and of the *Querco-Fagetea* class: *Actea spicata*, *Galium sylvaticum*, *Poa nemoralis*, *Carex digitata*, *Lathyrus montanus* and *Melica nutans*. The moss layer, rather poorly developed, includes *Hypnum cupressiforme* and *Mnium hornum* (W o ł e j k o 1991; W o ł e j k o and K m i e c i k 1991).

RESULTS OF OBSERVATIONS

Mycological analysis of the forest communities studied

In the ***Melico-Fagetum*** association the number of the *macromycetes* observed was 211. Dominant among them were terrestrial fungi (Tab. 4), and from among them mycorrhizal ones making up about 60%. The abundant and frequent were the species mycorrhizal with beech trees, like *Amanita citrina*, *A. phalloides*, *Hygrophorus eburneus*, *Laccaria amethystina*, *Lactarius blennius* and *Russula nigricans*, reaching high degree of constancy (V–III). Apart from the fungi related to beech trees, there is a marked presence of the species related to the occurrence of pine trees – *Amanita gemmata* and *Lactarius rufus*, or oak trees – *Lactarius quietus*. The most frequent representatives of the saprotrophic species are *Clitocybe clavipes*, *Lycoperdon perlatum*, *Phallus impudicus*, *Stropharia aeruginosa* and *St. squamosa*. Sporadically met are representatives of the species *Boletus edulis*, *Cantharellus cibarius*, *Geastrum fimbriatum* and *Strobilomyces strobilaceus*, which are less and less frequent in Poland.

The group of litter-decomposing fungi is the poorest in species (Tab. 4), characterised by low abundance and varied frequency but high stability.

Table 4

Macromycetes occurring in phytocoenoses of the *Melico-Fagetum* in the Ińsko Landscape Park

Face	*t*	*t*	*Fa*	*Fa*	*Mu*	*Mu*	*Mu*	*Db*	*Db*	*Db*	*Cc*	*Cc*	*t*	*t*	*t*	*t*	*t*	Constancy
Successive number	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	
Number of plot	4	5	18	19	1	2	3	17	15	16	20	21	6	7	8	9	10	
Reserve	KB	KB	KZ	KZ	PB	PB	PB	KZ	KZ	KZ	KZ	KZ	KB	KB	G	G	G	
Number of forest unit	408	408	511	514	474	474	474	515	511	513	515	515	408	408	127	127	127	
Number of observations	37	37	41	41	40	40	40	41	41	41	41	41	37	37	43	43	43	
Number of taxa	82	78	66	55	86	82	76	79	60	63	69	62	59	63	63	57	53	
1	2																	3
A. Terrestrial fungi																		
Laccaria amethystina Cke.	n_7	a_7	r_3	r_4	a_{11}	a_{11}	a_{13}	a_{16}	a_{17}	a_{11}	a_{12}	a_9	r_4	a_8	a_{17}	a_{15}	a_{16}	V
Phallus impudicus L.: Pers.	n_5	r_4	a_9	a_7	n_5	n_4	a_{12}	a_9	a_6	a_5	n_7	n_8	a_{13}	a_{18}	n_5	n_9	a_{16}	V
Xerocomus chrysenteron (Bull.) Quél.	n_4	n_6	a_{13}	a_{13}	n_9	n_6	a_9	a_{12}	a_9	a_9	r_2	r_2	a_{10}	n_8	n_9	a_{10}	a_{11}	V
Laccaria laccata (Scop.: Fr.) Bk. et Br.	r_4	r_2	a_{14}	a_9	n_2	n_3	a_9	r_6	r_1	r_1	r_2	r_2	n_4	r_3	a_{12}	a_9	a_{11}	V
Lycoperdon perlatum Pers.: Pers.	n_1	n_3	a_{14}	a_{15}	a_2	a_7	a_8	a_9	n_1	n_2	r_2	r_2	a_6	r_2	n_2	n_2	.	V
Lactarius blennius (Fr.) Fr.	a_9	a_8	a_9	a_6	a_5	a_7	a_7	n_4	.	n_1	r_1	r_1	n_1	n_1	n_2	n_1	n_3	V
Russula nigricans (Bull.: Fr.) Fr.	a_{14}	a_{13}	a_{21}	a_{21}	a_{15}	a_{17}	a_{13}	n_9	r_6	r_5	.	.	n_2	r_1	r_4	n_7	n_{11}	V
Amanita rubescens (Pers.: Fr.) S. F. Gray	a_6	a_6	a_{12}	a_{10}	a_9	a_7	r_1	n_6	r_2	r_2	.	.	r_1	r_1	n_5	n_6	n_7	V
Paxillus involutus (Batsch: Fr.) Fr.	n_7	n_5	n_9	n_7	n_6	n_8	r_9	r_9	r_1	r_1	.	r_1	.	r_1	n_8	n_7	n_8	V
Russula ochroleuca (Pers.) Fr.	r_2	r_1	a_7	a_8	a_9	a_{11}	a_{15}	a_{14}	n_9	n_8	.	.	.	r_1	a_8	a_{12}	a_{12}	V
Stropharia aeruginosa (Curt.: Fr.) Quél.	r_2	n_3	r_1	.	.	n_2	a_8	n_2	n_3	n_3	a_{10}	a_6	.	a_3	n_8	n_4	n_1	V
Lactarius quietus (Fr.) Fr.	r_3	r_2	n_3	n_3	a_6	a_8	r_2	r_2	r_3	r_2	.	.	.	r_3	.	r_1	r_1	IV
Clitocybe clavipes (Pers.: Fr.) Kumm.	r_1	r_2	r_2	r_2	n_4	n_2	r_1	a_5	n_2	n_4	n_3	n_3	.	.	.	.	.	IV
Amanita phalloides (Vaill.: Fr.) Link	r_2	n_5	a_3	a_8	n_1	n_2	a_4	r_1	.	.	.	.	.	.	n_2	r_1	r_1	IV
A. citrina (Schaeff.) Pers.	.	n_1	.	a_4	.	n_1	a_4	r_4	.	.	r_1	.	a_4	r_1	n_2	n_3	n_1	IV
Hygrophorus eburneus (Bull.: Fr.) Fr.	.	.	a_4	a_5	a_4	a_4	.	n_2	n_2	n_2	n_1	n_1	a_5	.	.	.	.	III
Lactarius rufus (Scop.: Fr.) Fr.	.	.	a_{14}	a_{14}	n_4	n_7	r_1	r_2	.	n_2	r_1	r_1	.	.	.	.	.	III
Tylopilus felleus (Bull.: Fr.) P. Karst.	.	.	r_1	.	a_4	r_1	.	n_1	n_1	n_1	.	.	.	.	r_1	r_1	r_1	III
Lepista flaccida (Scop.: Fr.) Pat.	n_2	n_2	.	.	a_5	a_8	.	.	a_6	n_4	r_1	r_1	.	.	.	.	.	III
Lepista nuda (Bull.: Fr.) Cke.	.	a_3	n_1	n_1	a_1	a_2	.	.	.	r_1	.	.	.	.	n_1	n_1	.	III

Russula mairei Sing.	.	.	n_3	n_3	.	.	n_2	.	r_1	r_1	.	.	.	.	r_2	r_2	r_1	III
Rickenella fibula (Bull.: Fr.) Raith.	n_1	n_1	n_1	.	a_3	n_2	.	.	.	.	.	.	.	a_1	r_1	.	.	III
Xerocomus badius (Fr.) Kühn. ex Gilb.	n_1	n_1	r_1	r_1	a_3	a_8	.	a_{11}	.	.	.	.	.	.	.	.	.	III
Russula cyanoxantha (Schaeff.) Fr.	r_1	r_2	n_2	n_1	n_3	r_1	r_2	.	.	.	.	.	.	.	.	.	.	III
R. xerampelina (Schaeff.) Fr.	r_1	r_1	r_1	r_2	r_2	r_3	.	.	.	.	.	.	.	r_1	.	.	.	III
Scleroderma verrucosum (Bull.): Pers.	r_1	.	n_2	.	.	.	.	r_2	.	.	.	.	n_1	.	n_3	a_4	a_4	III
Macrolepiota procera (Scop.: Fr.) Sing.	r_1	.	r_1	.	n_1	n_1	.	n_1	.	.	a_5	n_3	.	.	.	.	.	III
Humaria hemisphaerica (Wigg.: Fr.) Fuck.	.	.	n_2	.	n_1	n_1	.	n_2	.	.	n_1	n_1	a_5	.	.	.	.	III
Stropharia squamosa (Pers.: Fr.) Quél.	.	.	.	.	n_2	.	a_3	a_9	.	.	r_1	.	a_5	.	n_3	.	n_1	III
Hebeloma crustuliniforme (Bull.) Quél.	a_1	.	r_1	r_1	.	n_5	.	.	.	.	.	.	n_1	n_2	.	.	.	II
Tubaria furfuracea (Pers.: Fr.) Gill.	r_1	.	n_6	n_5	.	.	.	r_3	.	.	.	.	r_1	r_1	.	.	.	II
Russula fellea (Fr.: Fr.) Fr.	.	.	r_1	r_1	n_1	n_2	r_1	.	.	.	.	.	.	.	.	.	r_1	II
Macrolepiota rhacodes (Vitt.) Sing.	n_2	n_2	.	.	.	a_6	r_2	r_1	.	.	.	.	.	.	.	.	.	II
Tricholoma lascivum (Fr.) Gill.	a_3	n_1	r_1	r_1	.	.	.	.	.	.	.	.	.	.	.	.	.	II
Inocybe asterospora Quél.	n_1	.	n_1	n_1	.	.	.	r_1	.	.	.	.	.	.	.	.	.	II
Scleroderma citrinum Pers.	n_1	.	.	.	n_4	n_1	.	r_1	.	.	.	.	.	.	.	.	.	II
Xerocomus subtomentosus (L.: Fr.) Quél.	r_1	r_3	.	.	n_2	n_1	.	.	.	.	.	.	.	.	.	.	.	II
Amanita pantherina (DC.: Fr.) Krbh.	r_1	.	r_3	r_3	.	.	.	.	.	.	.	.	.	.	.	.	r_1	II
Russula delica Fr.	a_5	a_5	.	.	.	n_2	.	.	.	.	.	.	.	.	.	.	.	I
Mycena acicula (Schaeff.) Kumm.	a_4	.	.	.	n_1	.	.	.	.	.	.	.	.	.	.	.	r_1	I
Inocybe rimosa (Bull.: Fr.) Kumm.	n_1	.	.	.	n_3	.	.	.	.	.	.	.	.	.	r_1	.	.	I
Russula foetens (Pers.: Fr.) Fr.	n_1	.	.	.	.	.	.	r_1	.	.	.	.	.	.	r_1	.	.	I
Agaricus silvaticus Schaeff.	r_1	.	.	.	.	.	.	r_1	.	.	r_1	.	.	.	.	.	.	I
Russula sororia (Fr.) Romell	.	r_1	r_1	.	r_1	.	.	.	.	.	.	.	.	.	.	.	.	I
Amanita gemmata (Fr.) Bertil.	.	.	a_5	n_2	r_2	.	.	.	.	.	.	.	.	.	.	.	.	I
Russula fragilis (Pers.: Fr.) Fr.	.	.	r_1	r_1	.	.	r_1	.	.	.	.	.	.	.	.	.	.	I
Clavulina cinerea (Bull.: Fr.) Schroet.	.	.	r_1	r_1	.	.	.	r_1	.	.	.	.	.	.	.	.	.	I
Boletus erythropus (Fr.: Fr.) Krbh.	.	.	.	r_1	n_1	.	.	a_5	.	.	.	.	.	.	.	.	.	I
Clavulina cristata (Holmsk.: Fr.) Schroet.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	a_4	n_2	r_2	I
Coprinus atramentarius (Bull.: Fr.) Fr.	a_2	a_2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	I
Mutinus caninus (Huds.: Pers.) Fr.	a_{16}	.	.	.	.	.	.	.	.	.	r_3	.	.	.	.	.	.	I
Boletus edulis Bull.: Fr.	n_3	n_1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	I
Peziza badia Pers.: Fr.	n_1	.	.	.	r_1	.	.	.	.	.	.	.	.	.	.	.	.	I
Agaricus silvicola (Vitt.) Peck	r_2	r_1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	I
Russula alutacea (Pers.: Fr.) Fr.	r_2	r_1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	I

Tab. 4 cont.

1	2																	3
Clitocybe nebularis (Batsch: Fr.) Kumm.	r_1	n_3	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	I
Lactarius necator (J. F. Gmel.: Fr.) Pers.	r_1	r_1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	I
Cortinarius variecolor (Pers.: Fr.) Fr.	r_1	.	.	.	.	.	.	r_1	.	.	.	.	.	.	.	.	.	I
Tricholoma ustale (Fr.: Fr.) Kumm.	.	a_2	.	.	.	.	.	.	n_1	.	.	.	.	.	.	.	.	I
Inocybe maculata Boud.	.	r_2	r_1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	I
Russula aeruginea Lindbl. in Fr.	.	r_1	.	.	.	.	r_5	.	.	.	.	.	.	.	.	.	.	I
Mycena epipterygia (Scop.: Fr.) S. F. Gray	.	r_1	.	.	.	.	.	.	.	r_1	.	.	.	.	.	.	.	I
Inocybe godeyi Gill.	.	.	n_2	n_2	.	.	.	.	.	.	.	.	.	.	.	.	.	I
Clitopilus prunulus (Scop.: Fr.) Kumm.	.	.	r_1	n_2	.	.	.	.	.	.	.	.	.	.	.	.	.	I
Cantharellus cibarius Fr.	.	.	.	.	n_1	.	.	n_1	.	.	.	.	.	.	.	.	.	I
Cratarellus cornucopioides (L.: Fr.) Pers.	.	.	.	.	.	n_1	a_2	.	.	.	.	.	.	.	.	.	.	I
Inocybe geophylla (Sow.: Fr.) Kumm.	.	.	.	.	.	.	n_1	r_1	.	.	.	.	.	.	.	.	.	I
Tarzetta cupularis (L.: Fr.) Svrć.	a_5	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	I
Agrocybe dura (Bolt.: Fr.) Sing.	r_1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	I
Amanita muscaria (L.: Fr.) Hook.	r_1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	I
Chalciporus piperatus (Bull.: Fr.) Bat.	r_1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	I
Inocybe lacera (Fr.: Fr.) Kumm.	r_1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	I
I. erubescens Blytt.	r_1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	I
Russula claroflava Grove	r_1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	I
Leccinum scabrum (Bull.: Fr.) S. F. Gray	.	n_1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	I
Lactarius pubescens Fr.	.	r_1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	I
Inocybe petiginosa (Fr.) Gill.	.	.	r_1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	I
Laccaria tortilis (Bolt.) Cke.	.	.	r_1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	I
Entoloma chalybaeum (Fr.: Fr.) Noord. var. *lazulinum* (Fr.) Noord.	.	.	r_1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	I
Russula undulata Vel.	.	.	r_1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	I
Tricholoma terreum (Schaeff.: Fr.) Kumm.	.	.	.	.	n_2	.	.	.	.	.	.	.	.	.	.	.	.	I
Agrocybe praecox (Pers.: Fr.) Fay.	.	.	.	.	r_1	.	.	.	.	.	.	.	.	.	.	.	.	I
Boletus luridus Schaeff.: Fr.	.	.	.	.	.	n_1	.	.	.	.	.	.	.	.	.	.	.	I
Amanita porphyria (A. et S.: Fr.) Mlady	.	.	.	.	.	r_1	.	.	.	.	.	.	.	.	.	.	.	I
Calvatia utriformis (Bull.: Pers.) Jaap.	.	.	.	.	.	r_1	.	.	.	.	.	.	.	.	.	.	.	I
Collybia fusipes (Bull.: Fr.) Quél.	.	.	.	.	.	r_1	.	.	.	.	.	.	.	.	.	.	.	I

Strobilomyces strobilaceus (Scop.: Fr.) Berk.	.	.	.	.	.	r_1	.	.	.	.	.	.	.	.	.	.	.	I
Clitocybe geotropa (Bull.) Quél.	.	.	.	.	.	.	n_2	.	.	.	.	.	.	.	.	.	.	I
Lactarius fluens Boud.	.	.	.	.	.	.	r_1	.	.	.	.	.	.	.	.	.	.	I
Hygrophoropsis aurantiaca (Wulf.: Fr.) Mre.	.	.	.	.	.	.	.	n_4	.	.	.	.	.	.	.	.	.	I
Hebeloma mesophaeum (Pers.) Quél.	.	.	.	.	.	.	.	r_1	.	.	.	.	.	.	.	.	.	I
Suillus grevillei (Klotzsch: Fr.) Sing.	.	.	.	.	.	.	.	r_1	.	.	.	.	.	.	.	.	.	I
Inocybe cookei Bres.	.	.	.	.	.	.	.	.	.	r_1	.	.	.	.	.	.	.	I
Lepiota cristata (Bolt.: Fr.) Kumm.	.	.	.	.	.	.	.	.	.	.	.	.	n_1	.	.	.	.	I
Calvatia excipuliformis (Scop.: Pers.) Perdeck	.	.	.	.	.	.	.	.	.	.	.	.	r_1	.	.	.	.	I
Coprinus picaceus (Bull.: Fr.) S. F. Gray	.	.	.	.	.	.	.	.	.	.	.	.	.	r_1	.	.	.	I
Entoloma rhodopolium (Fr.) Kumm.	.	.	.	.	.	.	.	.	.	.	.	.	.	r_1	.	.	.	I
Geastrum fimbriatum Fr.	.	.	.	.	.	.	.	.	.	.	.	.	.	r_1	.	.	.	I
Amanita fulva (Schaeff.:) Pers.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	n_3	I
B. Litter-decomposing fungi																		
Collybia dryophila (Bull.: Fr.) Kumm.	a_{13}	a_{14}	a_9	a_{11}	a_{12}	a_{14}	a_{20}	n_7	n_8	n_8	n_5	n_5	n_4	a_{14}	a_{16}	a_{14}	a_{18}	V
C. peronata (Bolt.: Fr.) Kumm.	a_9	a_7	n_4	n_4	a_7	a_6	a_8	a_4	a_{12}	a_{10}	r_5	r_5	n_3	a_6	n_9	n_{12}	n_{10}	V
C. butyracea (Bull.: Fr.) Kumm.	a_4	a_4	n_2	n_5	a_6	n_4	a_{11}	n_4	n_6	n_6	n_7	r_4	r_1	n_4	n_5	n_8	a_9	V
Mycena pura (Pers.: Fr.) Kumm.	r_2	r_2	r_3	r_4	r_1	r_2	r_4	r_3	r_3	r_4	n_7	n_5	n_6	n_6	r_3	r_3	.	V
M. sanguinolenta (A. et S.: Fr.) Kumm.	n_3	n_1	r_1	r_1	r_4	r_2	r_2	r_2	r_1	.	n_3	.	r_1	.	r_1	r_2	r_1	V
M. vitilis (Fr.) Quél.	n_1	a_4	n_1	n_2	a_4	a_3	r_2	r_1	r_1	r_1	.	.	n_1	n_1	.	r_2	r_2	V
M. galopus (Pers.: Fr.) Kumm.	r_2	r_1	r_4	r_3	r_2	.	r_1	r_2	r_2	r_1	n_3	n_4	r_1	.	r_1	.	r_1	V
Xylaria carpophila (Pers.) Fr.	.	r_3	n_4	n_4	n_3	n_3	a_8	r_2	a_6	a_6	r_3	r_2	.	n_3	r_1	r_1	.	V
Dasyscyphus virgineus S. F. Gray	a_{13}	a_{11}	.	.	n_{10}	r_9	a_{10}	a_{11}	n_{11}	n_{11}	.	.	r_7	a_{13}	n_{11}	n_{11}	n_{11}	IV
Hymenoscyphus fructigenus (Bull.: Fr.) S. F. Gray	.	.	n_4	n_3	.	r_1	r_3	r_3	.	.	.	.	r_1	r_1	a_6	a_5	a_3	III
Collybia confluens (Pers.: Fr.) Kumm.	n_1	n_2	.	.	.	.	.	a_3	n_1	n_2	n_1	.	.	.	.	.	.	II
Mycena capillaris (Schum.: Fr.) Kumm.	.	.	.	.	n_1	n_1	a_3	.	n_1	.	.	.	.	n_1	.	.	.	II
Collybia maculata (A. et S.: Fr.) Kumm.	.	.	.	.	n_1	.	.	.	n_1	n_1	.	.	n_2	.	n_4	.	.	II
Mycena fagetorum (Fr.) Gill.	.	r_1	.	.	r_1	r_1	.	.	.	.	.	.	r_1	.	.	.	.	II
M. leucogala (Cke.) Sacc.	r_1	.	.	.	.	.	.	.	.	.	.	r_1	r_1	.	.	.	.	I
M. stylobates (Pers.: Fr.) Kumm.	.	r_1	.	r_1	r_1	.	.	.	.	.	.	.	.	.	.	.	.	I
M. pelianthina (Fr.) Quél.	.	r_1	.	.	r_1	.	.	.	.	.	.	.	.	r_1	.	.	.	I
Clitocybe odora (Bull.: Fr.) Kumm.	r_1	.	r_2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	I
Otidea alutacea (Pers.) Mass.	r_1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	I

Tab. 4 cont.

1	2																	3
Otidea onotica (Pers.: Fr.) Fuck.	r_1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	I
Collybia tuberosa (Bull.: Fr.) Kumm.	.	.	.	.	.	a_2	.	.	.	.	.	.	.	.	.	.	.	I
Marasmius setosus (Sow.) Noord.	.	.	.	.	.	.	r_2	.	.	.	.	.	.	.	.	.	.	I
M. scorodonius (Fr.: Fr.) Fr.	.	.	.	.	.	.	.	n_2	.	.	.	.	.	.	.	.	.	I
Mycena vulgaris (Pers.: Fr.) Kumm.	.	.	.	.	.	.	.	r_1	.	.	.	.	.	.	.	.	.	I
C. Lignicolous fungi																		
Megacollybia platyphylla (Pers.: Fr.) Kotl. et Pouz.	n_3	n_5	n_5	n_5	n_5	n_6	a_{23}	n_6	a_{14}	a_{15}	a_{17}	a_{16}	n_6	a_{12}	a_{10}	a_{13}	a_{13}	V
Mycena galericulata (Scop.: Fr.) S. F. Gray	n_2	n_7	r_1	n_2	a_8	a_9	n_8	n_2	n_7	n_6	a_{16}	a_{15}	n_8	n_6	n_6	n_8	n_8	V
Crepidotus variabilis (Pers.: Fr.) Kumm.	r_1	a_5	r_1	r_1	n_3	n_3	a_{15}	n_6	n_5	r_5	a_9	a_8	r_1	a_{12}	n_4	n_3	n_3	V
Xerula radicata (Relhan: Fr.) Dörfelt	n_1	.	a_{15}	a_9	a_8	n_7	a_{10}	n_4	n_2	n_3	n_8	r_6	a_{17}	r_5	a_9	n_6	n_6	V
Pluteus atricapillus (Batsch) Fay.	r_3	r_2	r_1	.	r_1	.	n_{15}	r_3	r_{10}	r_7	n_{11}	n_5	r_3	r_4	r_4	r_5	r_6	V
Nectria cinnabarina (Tode: Fr.) Fr.	.	.	n_8	n_9	r_3	r_3	a_{10}	n_9	n_{11}	a_{13}	n_{11}	n_{11}	r_8	a_9	r_6	r_6	n_9	V
Mycena haematopus (Pers.: Fr.) Kumm.	a_7	n_6	.	.	a_1	a_1	a_6	r_1	r_3	r_4	n_4	n_2	.	r_2	r_1	.	r_3	IV
Calocera cornea (Batsch: Fr.) Fr.	n_1	a_1	.	.	n_3	n_1	n_2	.	n_3	n_3	a_5	n_1	.	n_2	r_2	r_4	r_1	IV
Armillaria mellea (Vahl.: Fr.) Kumm. s. l.	.	n_1	.	.	n_3	n_2	a_4	n_3	a_4	a_4	a_7	a_6	a_7	a_3	a_3	.	a_3	IV
Xylaria hypoxylon (L.: Fr.) Grev.	.	.	.	.	a_{11}	a_{10}	n_6	n_{10}	n_9	n_9	a_{15}	a_{10}	a_{12}	a_{14}	a_{11}	n_7	a_{10}	IV
Hypholoma fasciculare (Huds.: Fr.) Kumm.	a_1	.	.	.	a_6	a_2	a_3	.	a_6	a_9	n_1	n_1	.	a_3	a_3	n_4	n_1	IV
Exidia plana (Wigg.) Donk	.	r_1	a_2	r_1	a_5	a_2	r_1	r_1	.	.	.	.	a_6	r_1	a_6	n_3	n_2	IV
Dacrymyces stillatus Nees: Fr.	.	.	.	r_2	r_1	r_3	n_6	r_1	.	r_2	r_5	r_5	.	n_4	r_3	r_3	r_7	IV
Hypoxylon deustum (Hoffm.: Fr.) Grev.	.	.	.	.	a_{27}	a_{27}	n_{27}	r_3	a_{30}	a_{30}	a_{38}	a_{38}	n_8	a_{30}	a_{36}	a_{29}	.	IV
Xylaria polymorpha (Pers.: Fr.) Grev.	.	.	.	.	a_5	a_{11}	n_4	r_3	a_{19}	a_{18}	a_{17}	a_{16}	r_3	a_{11}	n_6	n_9	.	IV
Fomes fomentarius (L.: Fr.) Kickx	a_{37}	a_{37}	.	.	n_{30}	r_7	.	.	n_{32}	n_{32}	n_{30}	n_{30}	.	.	r_{21}	r_{14}	n_{36}	IV
Marasmius rotula (Scop.: Fr.) Fr.	a_4	n_1	.	.	.	.	n_1	.	n_1	n_1	a_3	n_1	n_2	n_2	n_1	n_1	.	IV
Bisporella citrina (Batsch: Fr.) Korf et Carpenter	.	.	r_2	n_2	.	.	.	r_1	r_1	r_1	r_1	r_1	.	r_2	n_3	n_2	n_2	IV
Stereum hirsutum (Willd.: Fr.) S. F. Gray	.	.	.	.	n_5	n_3	a_5	.	a_5	r_3	a_{29}	a_{29}	r_2	a_{20}	n_5	a_{12}	.	IV
Fomitopsis pinicola (Sw.: Fr.) P. Karst.	a_{37}	a_{37}	.	.	.	.	.	n_{31}	r_7	r_7	a_{39}	a_{39}	.	.	r_{14}	r_{21}	a_{43}	III
Stereum rugosum (Pers.: Fr.) Fr.	n_4	.	.	.	r_3	.	r_3	.	r_{12}	a_{24}	.	.	r_7	n_8	n_4	.	n_{19}	III
Daedaleopsis confragosa (Bolt.: Fr.) Pers.	r_5	.	.	.	.	n_7	.	.	n_7	r_4	n_9	r_5	r_1	.	r_7	.	r_3	III
Psathyrella piluliformis (Bull.: Fr.) Orton	.	a_4	n_1	.	n_2	.	n_2	.	a_3	.	.	.	a_2	.	a_1	a_1	a	III
Pholiota lenta (Pers.: Fr.) Sing.	.	n_2	r_2	.	r_3	.	.	r_1	r_1	r_1	.	.	.	.	r_1	r_1	r_2	III

Hypholoma sublateritium (Fr.) Quél.	n_3	n_2	.	.	.	n_1	n_1	.	.	.	a_1	a_3	.	n_2	n_3	.	.	III
Lycoperdon pyriforme Schaeff.: Pers.	.	.	.	.	a_{16}	.	.	.	n_2	a_9	a_{25}	a_{25}	a_{16}	a_{13}	.	a_{13}	.	III
Ganoderma applanatum (Pers.) Pat.	.	.	.	.	.	.	n_{23}	.	r_6	r_{12}	.	r_3	r_8	r_7	n_{28}	n_{15}	.	III
Bjerkandera adusta (Willd.: Fr.) P. Karst.	.	n_{10}	.	.	.	r_3	r_3	n_{22}	.	n_{15}	a_{23}	a_{22}	.	.	.	.	.	III
Stereum subtomentosum Pouz.	.	n_8	.	.	a_8	.	.	.	r_2	.	a_{38}	a_{38}	.	n_8	.	r_2	.	III
Oligoporus caesius (Schrad.: Fr.) Gilb. et Ryv.	.	r_2	r_1	.	.	.	.	.	r_1	.	r_1	r_1	r_1	.	.	r_2	.	III
Trametes versicolor (L.: Fr.) Pil.	.	.	.	.	.	n_6	.	.	r_4	r_5	a_{11}	r_4	.	r_5	.	n_{10}	.	III
Polyporus varius (Pers.): Fr.	r_1	.	.	.	r_5	r_1	.	.	.	.	r_8	r_3	.	r_5	.	.	.	II
Hymenochaete rubiginosa (Dicks.: Fr.) Lév.	.	.	.	.	a_4	r_3	.	r_4	.	.	.	r_2	.	r_2	.	a_7	.	II
Scutellinia scutellata (L.: Fr.) Lamb.	.	.	.	.	.	.	.	.	.	.	r_1	r_1	r_1	r_1	.	a_2	n_1	II
Trametes hirsuta (Fr.) Pil.	.	r_3	r_5	.	n_7	.	.	r_1	.	r_3	.	.	.	.	.	.	.	II
Peniophora quercina (Pers.: Fr.) Cke.	.	r_1	.	r_3	r_1	r_2	.	.	.	.	.	.	r_2	.	.	.	.	II
Diatrype disciformis (Hoffm.: Fr.) Fr.	.	.	r_1	.	r_1	.	.	.	.	.	.	r_2	.	.	r_1	r_2	.	II
Marasmius alliaceus (Jacq.: Fr.) Fr.	.	.	.	r_1	.	.	a_8	.	.	n_3	a_4	r_1	.	.	.	.	.	II
Kuehneromyces mutabilis (Schaeff.: Fr.) Sing. et Smith	.	.	.	.	.	.	.	.	.	n_1	a_3	.	n_1	n_1	.	.	n_2	II
Pleurotus ostreatus (Jacq.: Fr.) Kumm.	n_1	a_3	.	.	.	.	.	.	.	.	a_1	.	a_2	.	.	.	.	II
Polyporus ciliatus Fr.: Fr.	.	r_1	.	.	r_1	.	r_1	r_1	.	.	.	.	.	.	.	.	.	II
Ascocoryne cylichnium (Tul.) Korf	.	.	.	.	n_1	n_2	n_1	.	.	.	.	.	n_2	.	.	.	.	II
Calocera viscosa (Pers.: Fr.) Fr.	.	.	.	.	r_4	r_3	r_1	r_1	.	.	.	.	.	.	.	.	.	II
Hypoxylon fragiforme (Scop.: Fr.) Kickx	.	.	.	.	r_1	.	.	r_2	.	.	r_1	.	.	.	r_2	.	.	II
Panellus stypticus (Bull.: Fr.) P. Karst.	.	.	.	.	.	a_3	.	.	r_2	r_2	.	.	.	n_7	.	.	.	II
Mycena inclinata (Fr.) Quél.	.	.	.	.	.	a_1	a_3	.	.	.	a_5	n_1	.	.	.	.	.	II
Trametes gibbosa (Pers.: Fr.) Fr.	.	.	.	.	.	.	n_3	.	.	.	a_8	a_{17}	.	.	.	.	r_5	II
Coprinus micaceus (Bull.: Fr.) Fr.	.	.	.	.	.	.	n_1	.	.	.	a_5	a_5	a_4	.	.	.	.	II
Crepidotus mollis (Schaeff.: Fr.) Kumm.	r_1	a_{15}	.	.	.	.	.	.	r_1	.	.	.	.	.	.	.	.	I
Mycena polygramma (Bull.: Fr.) S. F. Gray	r_1	.	.	.	.	.	.	.	.	.	r_1	.	.	r_1	.	.	.	I
Phlebia radiata Fr.	.	r_2	.	.	.	.	n_7	a_3	.	.	.	.	.	.	.	.	.	I
Crucibulum laeve (Huds.) Kambly in Kambly et Lee	.	.	.	.	.	.	n_3	.	.	.	.	.	n_2	n_2	.	.	.	I
Ramaria stricta (Pers.: Fr.) Quél.	.	.	.	.	.	.	.	.	r_2	r_2	.	.	r_1	.	.	.	.	I
Chondrostereum purpureum (Pers.: Fr.) Pouz.	.	n_3	.	.	.	.	.	n_{10}	.	.	.	.	.	.	.	.	.	I
Cyathus striatus (Huds.) Willd.: Pers.	.	n_2	.	.	.	.	.	.	.	.	.	.	.	n_2	.	.	.	I
**Schizopora radula* (Pers.: Fr.) Hallenb.	.	r_1	.	.	.	.	.	.	.	.	.	r_1	.	.	.	.	.	I
Meripilus giganteus (Pers.: Fr.) P. Karst.	.	.	.	a_{19}	.	.	n_4	.	.	.	.	.	.	.	.	.	.	I
Flammulina velutipes (Curt.: Fr.) Sing.	.	.	.	.	a_3	.	.	.	.	.	.	a_1	.	.	.	.	.	I

Tab. 4 cont.

1	2	3
Schizophyllum commune Fr.: Fr.	. . . . n_3 . . . . n_3	I
Exidia glandulosa (Bull.): Fr.	. . . . r_1 . . . . r_2 . .	I
Pholiota squarrosa (Weig.: Fr.) Kumm.	. . . . . a_2 . a_1	I
Pholiota aurivella (Batsch: Fr.) Kumm.	. . . . . n_1 . . . . . n_1	I
Daedalea quercina (L.: Fr.) Pers.	. . . . . r_2 . . r_3	I
Hirneola auricula-judae (Bull.: Fr.) Berk.	. . . . . . a_3 . . n_2	I
Mycena maculata P. Karst.	. . . . . . a_3 . . . a_1	I
Heterobasidion annosum (Fr.) Bref.	. . . . r_8 . . r_5	I
Phlebia tremellosa (Schrad.: Fr.) Nakas. et Burds.	. . . . n_5 n_2	I
Panellus serotinus (Pers.: Fr.) Kühn.	. . . . n_3 n_3	I
Datronia mollis (Sommerf.: Fr.) Donk	. . . . n_2 . . . r_2 . .	I
Ascocoryne sarcoides (Jacq.: Fr.) Groves et Wilson	. . . . n_1 n_2	I
**Botryobasidium medium* J. Erikss.	r_1	I
Hebeloma radicosum (Bull.: Fr.) Ricken	. a_3	I
Nectria coccinea (Pers.: Fr.) Fr.	. . . a_4	I
Lentinus lepideus (Fr.: Fr.) Fr.	. . . . r_1	I
Laetiporus sulphureus (Bull.: Fr.) Murr.	. . . . . a_3	I
Ganoderma lucidum (Curt.: Fr.) P. Karst.	. . . . . r_2	I
Peziza micropus Pers.	. . . . . . n_2	I
Mycena alcalina (Fr.: Fr.) Kumm.	. . . . . . r_1	I
Tricholomopsis rutilans (Schaeff.: Fr.) Sing.	. . . . . . r_1	I
Thelephora terrestris Ehr. ex Willd.: Fr.	. . . . r_3	I
Phaeolus schweinitzii (Fr.) Pat.	. . . . r_2	I
Pholiota flammans (Fr.) Kumm.	. . . . r_1	I
Oudemansiella mucida (Schrad.: Fr.) Höhn.	. . . . n_2	I
**Hyphoderma setigerum* (Fr.) Donk	. . . . r_1	I
**Peniophora incarnata* (Pers.: Fr.) P. Karst.	. . . . r_1	I
**Phanerochaete tuberculata* (P. Karst.) Parm.	. . . . r_1	I
**Hypocrea lactea* (Fr.): Fr.	. . . . r_1 . . .	I
Sphaerobolus stellatus Tode: Pers.	. . . . r_3 .	I

Explanations: degree of abundance (Jahn et al. 1967): a — abundant, n — numerous, r — rare; (* — det. W. Wojewoda; other explanations: see Table 3

The most often observed species are *Collybia butyracea*, *C. dryophila*, *Dasyscyphus virgineus* and *Xylaria carpophila*, while *Collybia maculata* and *Mycena capillaris*, frequent in other regions in Poland, are rare.

Much more diverse is the group of lignicolous fungi (Tab. 4) – over 30% of the species occur at great degree of constancy (V – III), and their frequency and abundance vary significantly in particular patches. A considerable number of species, including *Fomes fomentarius*, *Ganoderma applanatum*, *Hypoxylon deustum*, *Lycoperdon pyriforme* and *Xylaria hypoxylon*, occur on beech tree stumps at different stages of decomposition. On much mouldered trunks often observed are *Megacollybia platyphylla* and *Mycena haematopus*, while on trunks in the first stages of mouldering – *Stereum subtometosum*. On branches and twigs of beech trees *Bisporella citrina* and *Nectria cinnabarina* are frequently met. Sporadic presence of *Datronia mollis*, *Ganoderma lucidum*, *Hebeloma radicosum*, *Oudemansiella mucida* and *Phaeolus schweinitzii*, the species very rare in Poland, is noted.

A comparative analysis of macromycetes noted in the patches of the *Melico-Fagetum* in the ILP and other regions in Poland shows that the species characterised by a high degree of constancy in the park: *Collybia dryophila*, *C. peronata*, *Dasyscyphus virgineus*, *Hygrophorus eburneus*, *Lactarius blennius*, *Marasmius alliaceus*, *Megacollybia platyphylla*, *Phallus impudicus* and *Xerula radicata* are also common in this association in other regions in Poland.

In the ***Luzulo pilosae-Fagetum*** the number of macromycetes species noted was 202. From among terrestrial fungi (Tab. 5) the mycorrhizal species make up almost 78%, and the dominant in this group are the species forming mycorrhizae with beech trees such as: *Amanita phalloides*, *A. rubescens*, *Hygrophorus eburneus*, *Laccaria amethystina*, *Lactarius blennius*, *Russula ochroleuca* and *R. nigricans*. These species are abundant and frequent, and reach high degrees of constancy (V – III). In the patches studied the presence of mycorrhizal species living in symbiosis with pine trees – *Lactarius rufus* and *Xerocomus badius*, or oak trees – *Lactarius quietus* is also noted. The group of saprotrophic species is represented most frequently by: *Lepista flaccida*, *Phallus impudicus*, *Stropharia aeruginosa* and *St. squamosa*.

On the litter the number of fungi species was much lower. About 53% of the litter-decomposing species appear frequently and reach high degree of constancy (V – III), this group includes e.g.: *Collybia butyracea*, *C. dryophila*, *C. peronata*, *C. maculata*, *Dasyscyphus virgineus* and *Xylaria carpophila*, and *Collybia tuberosa* growing on decaying fruit bodies of *Russula nigricans*.

The most numerous group of fungi are lignicolous ones and 30% of them are frequent and abundant as well as characterised by high degree of constancy (V – III). The species *Armillaria mellea*, *Bjerkandera adusta*, *Fomitopsis pinicola*,

Table 5

Macromycetes occurring in phytocoenoses of the *Luzulo pilosae-Fagetum* in the Ińsko Landscape Park

Successive number	1	2	3	4	5	6	7	8	9	10	11	12	13	Constancy
Number of plot	26	27	28	30	31	11	14	12	13	29	32	33	34	
Reserve	WS	WS	WS	WS	WS	G	G	G	G	WS	WS	WS	WS	
Number of forest unit	411	411	411	411	411	128	127	127	127	411	411	411	411	
Number of observations	42	42	42	42	42	43	43	43	43	42	42	42	42	
Number of taxa	102	98	82	99	57	90	89	70	62	59	53	53	56	
1	2													3
A. Terrestrial fungi														
Phallus impudicus L.: Pers.	a_{10}	a_{12}	a_{12}	a_9	a_8	a_9	a_{16}	a_{10}	n_8	a_4	a_4	a_6	a_4	V
Laccaria amethystina Cke.	a_6	a_8	a_5	a_7	a_6	a_{17}	a_{17}	a_{15}	a_{13}	a_5	a_7	a_{10}	a_{10}	V
Lactarius blennius (Fr.) Fr.	a_3	a_9	a_8	a_5	n_3	a_9	a_8	n_7	n_3	n_1	n_2	n_5	n_5	V
Russula mairei Sing.	r_2	n_{11}	n_6	n_6	r_3	r_1	r_3	r_1	r_1	r_2	r_3	r_3	r_3	V
R. ochroleuca (Pers.) Fr.	n_3	a_6	r_1	a_4	a_2	n_3	a_9	a_{12}	n_8	.	r_1	r_2	r_1	V
Stropharia aeruginosa (Curt.: Fr.) Quél.	n_2	n_6	n_6	a_6	n_3	n_4	n_3	r_2	n_3	.	n_1	a_5	a_3	V
Xerocomus chrysenteron (Bull.) Quél.	a_{10}	a_9	a_6	a_6	a_4	a_{13}	a_{11}	a_8	a_8	r_3	.	r_1	.	V
Russula nigricans (Bull.: Fr.) Fr.	a_{16}	a_{14}	a_9	a_8	a_7	a_{16}	a_{13}	n_2	n_4	r_1	.	.	.	IV
Amanita rubescens (Pers.: Fr.) S. F. Gray	a_{14}	n_4	n_4	n_3	a_6	a_{15}	a_{13}	n_5	r_3	r_1	.	.	.	IV
Tylopilus felleus (Bull.: Fr.) P. Karst	a_1	a_5	n_1	r_1	a_3	n_1	n_2	r_1	n_3	r_1	.	.	.	IV
Clitocybe clavipes (Pers.: Fr.) Kumm.	r_1	r_2	n_3	r_2	r_1	.	n_3	n_3	r_1	n_1	n_1	.	.	IV
Laccaria laccata (Scop.: Fr.) Bk. et Br.	a_{11}	n_1	n_1	a_1	.	a_{20}	a_9	n_4	r_4	.	.	r_1	.	IV
Lactarius quietus (Fr.) Fr.	a_9	a_6	n_2	r_1	r_1	a_9	n_4	r_2	r_2	.	.	.	.	IV
Paxillus involutus (Batsch: Fr.) Fr.	a_8	n_6	r_4	n_6	r_5	n_9	a_9	r_1	r_2	.	.	.	.	IV
Amanita citrina (Schaeff.) Pers.	n_3	a_3	n_3	a_5	a_3	n_3	n_3	a_9	r_4	.	.	.	.	IV
Lactarius rufus (Scop.: Fr.) Fr.	a_5	n_2	.	n_2	r_1	a_{10}	n_5	n_5	.	.	.	.	r_1	IV
Russula fellea (Fr.: Fr.) Fr.	n_3	a_4	r_2	r_2	.	r_2	r_1	r_1	r_1	.	.	.	.	IV
Amanita phalloides (Vaill.: Fr.) Link	n_3	r_2	.	a_4	n_3	r_2	n_5	n_5	r_4	.	.	.	.	IV
Macrolepiota procera (Scop.: Fr.) Sing.	r_1	r_1	r_1	n_1	r_1	.	n_2	r_1	.	.	.	.	r_1	IV
Lepista flaccida (Scop.: Fr.) Pat.	.	r_1	n_2	.	.	.	n_3	r_1	n_3	.	n_1	n_1	n_1	IV

Lycoperdon perlatum Pers.: Pers.	a_{18}	a_4	n_1	a_4	.	a_5	a_6	.	.	r_2	.	.	.	III
Stropharia squamosa (Pers.: Fr.) Quél.	a_{10}	n_3	n_2	n_1	r_1	r_1	n_1	.	.	.	.	.	.	III
Xerocomus badius (Fr.) Kühn. ex Gilb.	a_9	a_8	a_5	a_3	a_4	n_2	n_4	.	.	.	.	.	.	III
Hygrophorus eburneus (Bull.: Fr.) Fr.	a_3	a_7	a_5	a_4	n_1	n_1	a_1	.	.	.	.	.	.	III
Russula cyanoxantha (Schaeff.) Fr.	n_3	n_2	r_1	.	.	n_2	r_2	r_1	.	.	.	.	.	III
Russula xerampelina (Schaeff.) Fr.	r_1	.	r_1	.	.	.	r_1	r_1	r_1	.	.	r_1	.	III
Lepista nuda (Bull.: Fr.) Cke.	.	a_2	n_1	n_1	.	.	n_1	a_2	.	.	.	.	.	II
Boletus erythropus (Fr.: Fr.) Krbh.	n_7	n_2	r_1	r_1	.	.	.	.	.	.	.	.	.	II
Leccinum scabrum (Bull.: Fr.) S. F. Gray	r_1	r_1	r_1	r_2	.	.	.	.	.	.	.	.	.	II
Clitopilus prunulus (Scop.: Fr.) Kumm.	r_1	r_1	.	.	.	n_6	n_3	.	.	.	.	.	.	II
Russula alutacea (Pers.: Fr.) Fr.	r_1	r_1	.	.	.	r_4	r_1	.	.	.	.	.	.	II
Amanita fulva (Schaeff.:) Pers.	.	n_1	.	n_1	.	.	n_1	a_{14}	.	.	.	.	.	II
Tricholoma lascivum (Fr.) Gill.	a_4	a_1	.	a_2	.	.	.	.	.	.	.	.	.	II
Tricholoma ustale (Fr.: Fr.) Kumm.	n_2	.	.	.	r_1	.	.	.	.	.	.	.	r_1	II
Mutinus caninus (Huds.: Pers.) Fr.	n_1	.	.	n_8	.	.	.	.	.	.	.	.	r_1	II
Amanita pantherina (DC.: Fr.) Krbh.	r_2	r_1	.	.	.	r_1	.	.	.	.	.	.	.	II
Hebeloma sinapizans (Paulet: Fr.) Gill.	r_1	r_2	.	.	.	r_1	.	.	.	.	.	.	.	II
Cantharellus tubaeformis (Bull.): Fr.	.	.	.	a_1	.	.	.	.	.	.	.	a_2	a_1	II
Scleroderma citrinum Pers.	.	.	.	.	.	n_4	n_3	a_{24}	.	.	.	.	.	II
Tricholoma sulphureum (Bull.: Fr.) Kumm.	a_4	a_2	.	.	.	.	.	.	.	.	.	.	.	I
Inocybe rimosa (Bull.: Fr.) Kumm.	n_2	.	.	.	.	n_2	.	.	.	.	.	.	.	I
Tubaria furfuracea (Pers.: Fr.) Gill.	n_2	.	.	.	.	r_1	.	.	.	.	.	.	.	I
Amanita gemmata (Fr.) Bertill.	n_1	r_1	.	.	.	.	.	.	.	.	.	.	.	I
Mycena acicula (Schaeff.) Kumm.	n_1	.	.	n_1	.	.	.	.	.	.	.	.	.	I
Agrocybe praecox (Pers.: Fr.) Fay.	r_3	r_3	.	.	.	.	.	.	.	.	.	.	.	I
Clavulina cristata (Holmsk.: Fr.) Schroet.	r_1	.	.	.	.	r_1	.	.	.	.	.	.	.	I
Russula rosea Pers.	r_1	.	.	.	.	.	.	r_1	.	.	.	.	.	I
Clitocybe nebularis (Batsch: Fr.) Kumm.	.	n_1	n_1	.	.	.	.	.	.	.	.	.	.	I
Russula maculata Quél.	.	r_2	r_1	.	.	.	.	.	.	.	.	.	.	I
Clitocybe gibba (Pers.: Fr.) Kumm.	.	r_1	r_1	.	.	.	.	.	.	.	.	.	.	I
Lactarius vellereus (Fr.) Fr.	.	.	.	a_3	.	n_1	.	.	.	.	.	.	.	I
Boletus edulis Bull.: Fr.	.	.	.	n_1	n_5	.	.	.	.	.	.	.	.	I

Tab 5 cont.

1	2													3
Russula delica Fr.	.	.	.	n_1	.	.	.	n_1	.	.	.	.	.	I
Amanita vaginata (Bull.: Fr.) Vitt.	.	.	.	r_1	.	.	r_3	.	.	.	.	.	.	I
Hygrophoropsis aurantiaca (Wulf.: Fr.) Mre.	.	.	.	.	n_1	.	.	n_2	.	.	.	.	.	I
Russula foetens (Pers.: Fr.) Fr.	.	.	.	.	.	n_2	n_1	.	.	.	.	.	.	I
Hebeloma crustuliniforme (Bull.) Quél.	n_1	.	.	.	.	.	.	.	.	.	.	.	.	I
Agaricus silvicola (Vitt.) Peck	r_2	.	.	.	.	.	.	.	.	.	.	.	.	I
Russula heterophylla (Fr.) Fr.	r_1	.	.	.	.	.	.	.	.	.	.	.	.	I
R. vesca Fr.	r_1	.	.	.	.	.	.	.	.	.	.	.	.	I
Hydnum repandum L.: Fr.	.	.	.	a_4	.	.	.	.	.	.	.	.	.	I
Inocybe geophylla (Sow.: Fr.) Kumm.	.	.	.	n_1	.	.	.	.	.	.	.	.	.	I
Lycoperdon umbrinum Pers.: Pers.	.	.	.	r_3	.	.	.	.	.	.	.	.	.	I
Russula densifolia Gill.	.	.	.	r_2	.	.	.	.	.	.	.	.	.	I
R. virescens (Schaeff.) Fr.	.	.	.	r_2	.	.	.	.	.	.	.	.	.	I
Clavulina cinerea (Bull.: Fr.) Schroet.	.	.	.	r_1	.	.	.	.	.	.	.	.	.	I
Ramaria formosa (Pers.: Fr.) Quél.	.	.	.	r_1	.	.	.	.	.	.	.	.	.	I
Russula emetica (Schaeff.: Fr.) Pers.	.	.	.	r_1	.	.	.	.	.	.	.	.	.	I
Russula olivacea (Schaeff.) Fr.	.	.	.	r_1	.	.	.	.	.	.	.	.	.	I
Tricholoma pardinum (Pers.) Quél.	.	.	.	r_1	.	.	.	.	.	.	.	.	.	I
Cantharellus cibarius Fr.	.	.	.	.	a_3	.	.	.	.	.	.	.	.	I
Xerocomus subtomentosus (L.: Fr.) Quél.	.	.	.	.	n_1	.	.	.	.	.	.	.	.	I
Entoloma eulividum Noord.	.	.	.	.	.	a_2	.	.	.	.	.	.	.	I
Russula sororia (Fr.) Romell	.	.	.	.	.	n_8	.	.	.	.	.	.	.	I
Lactarius necator (J. F. Gmel.: Fr.) Pers.	.	.	.	.	.	n_3	.	.	.	.	.	.	.	I
Amanita muscaria (L.: Fr.) Hook.	.	.	.	.	.	n_2	.	.	.	.	.	.	.	I
Inocybe asterospora Quél.	.	.	.	.	.	n_1	.	.	.	.	.	.	.	I
Lactarius camphoratus (Bull.: Fr.) Fr.	.	.	.	.	.	n_1	.	.	.	.	.	.	.	I
Rickenella fibula (Bull.: Fr.) Raith.	.	.	.	.	.	n_1	.	.	.	.	.	.	.	I
Russula aeruginea Lindbl. in Fr.	.	.	.	.	.	r_2	.	.	.	.	.	.	.	I
R. brunneoviolacea Crawsh.	.	.	.	.	.	r_1	.	.	.	.	.	.	.	I

Xerocomus rubellus (Krbh.) Quél.	.	.	.	.	.	r_1	.	.	.	.	.	.	.	I
Craterellus cornucopioides (L.: Fr.) Pers.	.	.	.	.	.	.	n_1	.	.	.	.	.	.	I
Amanita spissa (Fr.) Kumm.	.	.	.	.	.	.	r_1	.	.	.	.	.	.	I
Cystoderma carcharias (Pers.) Fay.	.	.	.	.	.	.	.	n_3	.	.	.	.	.	I
Amanita porphyria (A. et S.: Fr.) Mlady	.	.	.	.	.	.	.	r_1	.	.	.	.	.	I
Lactarius fluens Boud.	.	.	.	.	.	.	.	r_1	.	.	.	.	.	I
Psathyrella candolleana (Fr.: Fr.) Mre.	.	.	.	.	.	.	.	.	.	.	.	.	a_1	I
B. Litter-decomposing fungi														
Collybia dryophila (Bull.: Fr.) Kumm.	a_{15}	a_{18}	a_{19}	a_{14}	n_{11}	a_{16}	a_{19}	n_{16}	a_{20}	n_7	a_{12}	a_{12}	a_{10}	V
Dasyscyphus virgineus S. F. Gray	n_{11}	n_{12}	n_{12}	n_{12}	a_{11}	n_{10}	a_{12}	a_{12}	a_{12}	n_{12}	a_{12}	a_{12}	a_{12}	V
Collybia peronata (Bolt.: Fr.) Kumm.	n_6	n_9	n_8	a_{10}	a_9	n_2	n_{11}	n_8	n_{13}	n_8	a_{14}	a_{14}	a_{15}	V
C. butyracea (Bull.: Fr.) Kumm.	n_4	n_9	n_6	n_5	a_5	n_6	a_{13}	n_{10}	a_{10}	n_4	a_7	a_{10}	a_7	V
Xylaria carpophila (Pers.) Fr.	r_1	r_2	r_3	n_2	r_1	n_2	n_4	r_1	n_3	r_3	r_4	r_2	r_3	V
Collybia maculata (A. et S.: Fr.) Kumm.	n_1	a_4	n_1	n_1	.	n_2	n_7	n_3	a_5	n_1	n_3	a_8	a_8	V
Mycena pura (Pers.: Fr.) Kumm.	r_1	r_2	n_3	r_3	r_3	r_2	r_2	n_2	r_2	.	n_4	n_2	n_4	V
Collybia tuberosa (Bull.: Fr.) Kumm.	n_2	a_1	n_1	.	a_2	a_1	a_4	a_2	a_1	.	.	.	.	IV
Hymenoscyphus fructigenus (Bull.: Fr.) S. F. Gray	n_2	r_1	.	.	.	a_5	r_1	r_1	r	.	.	.	.	III
Mycena sanguinolenta (A. et S.: Fr.) Kumm.	r_1	r_1	.	.	.	n_3	r_2	r_1	r_1	.	.	.	.	III
M. vitilis (Fr.) Quél.	.	n_2	n_1	.	.	a_3	.	.	.	.	r_1	r_1	.	II
M. galopus (Pers.: Fr.) Kumm.	.	.	n_1	.	.	a_3	.	r_1	r_2	r_1	.	.	.	II
Clitocybe odora (Bull.: Fr.) Kumm.	r_1	r_1	.	.	.	.	.	.	.	.	.	.	.	I
Mycena leucogala (Cke.) Sacc.	.	r_1	r_1	.	.	.	.	.	.	.	.	.	.	I
M. capillaris (Schum.: Fr.) Kumm.	.	.	r_1	.	.	.	.	.	.	.	r_1	.	.	I
Collybia confluens (Pers.: Fr.) Kumm.	.	.	.	.	.	.	n_1	.	.	.	.	a_2	.	I
Mycena stylobates (Pers.: Fr.) Kumm.	r_1	.	.	.	.	.	.	.	.	.	.	.	.	I
M. vulgaris (Pers.: Fr.) Kumm.	.	.	.	.	.	.	.	n_6	.	.	.	.	.	I
Collybia hariolorum (DC.: Fr.) Quél.	.	.	.	.	.	.	.	.	.	.	.	.	r_1	I
C. Lignicolous fungi														
Fomitopsis pinicola (Sw.: Fr.) P. Karst.	a_{42}	n_{42}	n_{42}	a_{42}	n_{42}	n_{43}	r_{36}	a_{43}	n_{43}	a_{42}	a_{42}	a_{42}	a_{42}	V
Hypholoma fasciculare (Huds.: Fr.) Kumm.	a_{14}	a_3	a_3	a_2	n_1	a_4	a_3	a_5	a_5	a_2	a_6	a_3	a_3	V

Tab 5 cont.

1	2													3
Xerula radicata (Relhan: Fr.) Dörfelt	a_9	n_4	n_4	n_5	n_5	n_4	a_{11}	a_7	r_3	n_3	n_1	n_2	a_3	V
Megacollybia platyphylla (Pers.: Fr.) Kotl. et Pouz.	n_7	a_{16}	n_{11}	n_9	r_6	r_4	a_{22}	a_{15}	n_{11}	n_{10}	a_{12}	a_{20}	a_{16}	V
Mycena galericulata (Scop.: Fr.) S. F. Gray	n_6	a_9	n_7	r_3	r_3	a_{12}	n_9	n_8	a_{10}	n_6	n_7	n_5	a_9	V
Pluteus atricapillus (Batsch) Fay.	r_5	n_9	n_{10}	r_5	r_4	r_2	r_4	r_4	r_4	n_9	r_2	r_3	r_7	V
Nectria cinnabarina (Tode: Fr.) Fr.	r_3	r_3	r_3	r_3	r_3	n_7	n_7	n_4	a_{11}	r_3	n_8	n_7	n_8	V
Stereum hirsutum (Willd.: Fr.) S. F. Gray	a_3	a_3	.	a_5	a_3	a_5	a_3	n_1	a_6	a_3	a_5	a_3	a_5	V
Fomes fomentarius (L.: Fr.) Kickx	n_{39}	a_{42}	a_{42}	a_{42}	n_{39}	a_{43}	r_{21}	a_{43}	.	a_{39}	n_{39}	n_{39}	n_{39}	V
Mycena haematopus (Pers.: Fr.) Kumm.	n_1	a_9	a_6	a_1	n_2	a_4	a_3	a_5	a_1	r_1	r_1	.	r_1	V
Crepidotus variabilis (Pers.: Fr.) Kumm.	.	r_1	r_1	n_2	n_2	a_8	n_5	n_3	a_6	n_3	n_3	r_1	n_3	V
Psathyrella piluliformis (Bull.: Fr.) Orton	a_3	r_2	a_4	n_3	r_1	n_2	r_1	.	r_1	r_1	r_1	r_1	.	V
Ganoderma applanatum (Pers.) Pat.	r_{32}	a_{35}	a_{42}	n_{42}	n_{32}	r_{22}	.	n_{36}	.	a_{39}	n_{32}	n_{32}	n_{32}	V
Pholiota lenta (Pers.: Fr.) Sing.	.	r_1	r_1	r_1	r_1	n_4	n_3	n_3	r_2	r_1	.	r_1	r_1	V
Hypoxylon deustum (Hoffm.: Fr.) Grev.	n_{16}	a_{39}	a_{32}	.	.	r_8	r_8	.	n_{21}	r_9	n_{16}	r_7	r_9	IV
Xylaria hypoxylon (L.: Fr.) Grev.	n_2	.	.	a_5	.	a_{10}	a_5	n_3	a_{12}	n_5	r_1	n_4	n_4	IV
Calocera cornea (Batsch: Fr.) Fr.	n_1	n_1	n_1	.	n_2	.	n_2	n_1	n_1	n_2	n_1	n_1	.	IV
Dacrymyces stillatus Nees: Fr.	r_1	.	r_1	.	.	n_3	n_3	n_3	n_1	r_1	r_2	r_2	n_3	IV
Exidia plana (Wigg.) Donk	a_3	.	n_1	a_3	.	a_6	.	n_2	n_2	.	n_1	n_1	n_1	IV
Oligoporus caesius (Schrad.: Fr.) Gilb. et Ryv.	.	r_1	r_1	r_3	r_2	.	.	r_3	r_1	r_2	r_2	.	r_1	IV
Daedaleopsis confragosa (Bolt.: Fr.) Pers.	.	.	.	a_9	r_6	r_2	n_6	.	r_1	n_6	n_7	n_2	r_1	IV
Armillaria mellea (Vahl.: Fr.) Kumm. s. l.	a_8	a_5	n_1	a_7	.	a_9	a_9	a_6	.	a_1	.	.	.	IV
Hypoxylon fragiforme (Scop.: Fr.) Kickx	r_2	r_2	.	n_4	r_1	.	.	.	.	r_1	r_4	r_5	r_5	IV
Stereum subtomentosum Pouz.	.	a_{30}	a_{33}	n_{23}	.	a_{18}	n_2	.	a_{26}	a_{33}	r_7	.	.	IV
Bjerkandera adusta (Willd.: Fr.) P. Karst.	.	n_7	.	a_{36}	.	.	r_1	.	a_3	n_8	n_9	n_9	n_9	IV
Lycoperdon pyriforme Schaeff.: Pers.	a_{11}	.	a_8	a_7	.	a_{12}	a_7	.	a_8	a_9	.	.	.	III
Trametes versicolor (L.: Fr.) Pil.	.	n_5	.	r_2	.	r_3	a_9	.	n_5	r_2	.	r_2	.	III
Hypholoma sublateritium (Fr.) Quél.	a_4	a_2	.	.	.	a_2	a_2	.	.	.	a_4	a_2	.	III
Phlebia tremellosa (Schrad.: Fr.) Nakas. et Burds.	r_3	.	r_3	.	.	.	n_5	n_3	.	.	r_5	r_7	.	III
Trametes hirsuta (Fr.) Pil.	r_2	r_2	.	.	a_3	.	n_3	r_2	r_2	.	.	.	.	III
Hirneola auricula-judae (Bull.: Fr.) Berk.	.	a_2	a_4	a_5	.	a_1	a_2	.	.	a_3	.	.	.	III
Phlebia radiata Fr.	.	n_4	n_3	n_7	n_3	n_2	.	.	.	n_2	.	.	.	III

Xylaria polymorpha (Pers.: Fr.) Grev.	.	.	.	a_4	.	.	a_8	n_2	.	n_3	a_4	n_2	.	III
Marasmius alliaceus (Jacq.: Fr.) Fr.	.	.	.	r_1	.	.	.	r_2	.	r_2	n_3	r_2	r_1	III
Bisporella citrina (Batsch: Fr.) Korf et Carpenter	.	.	.	r_1	r_1	.	.	.	r_1	.	r_2	r_1	r_1	III
Coprinus micaceus (Bull.: Fr.) Fr.	a_{10}	a_3	.	.	.	a_3	a_2	.	.	a_2	.	.	.	II
Neobulgaria pura (Fr.) Petrak	a_1	.	.	.	.	.	.	.	.	n_1	a_4	a_5	a_3	II
Marasmius rotula (Scop.: Fr.) Fr.	n_1	n_2	n_1	.	.	.	.	.	.	n_1	.	.	n_1	II
Polyporus varius (Pers.): Fr.	r_2	a_{19}	a_{15}	n_6	.	.	.	.	.	a_4	.	.	.	II
Oudemansiella mucida (Schrad.: Fr.) Höhn.	.	a_7	a_6	n_1	.	.	.	.	.	.	n_1	.	n_2	II
Mycena inclinata (Fr.) Quél.	.	a_4	a_3	.	a_2	a_9	a_1	.	.	.	.	.	.	II
Ramaria stricta (Pers.: Fr.) Quél.	.	r_1	.	n_{10}	r_5	.	.	.	.	r_3	.	.	r_1	II
Trametes gibbosa (Pers.: Fr.) Fr.	.	.	a_9	a_9	.	n_3	.	.	.	a_9	n_4	.	.	II
Calocera viscosa (Pers.: Fr.) Fr.	.	.	.	r_5	.	r_1	r_2	.	.	.	r_1	r_1	.	II
Pleurotus ostreatus (Jacq.: Fr.) Kumm.	a_7	.	.	a_2	.	.	a_9	.	n_2	.	.	.	.	II
Peniophora quercina (Pers.: Fr.) Cke.	n_6	n_2	.	r_1	.	.	.	.	.	.	.	.	r_1	II
Pholiota squarrosa (Weig.: Fr.) Kumm.	n_3	.	.	n_4	.	a_2	a_3	.	.	.	.	.	.	II
Heterobasidion annosum (Fr.) Bref.	.	n_{23}	n_{23}	n_{16}	.	.	.	.	.	.	.	.	r_7	II
Schizophyllum commune Fr.: Fr.	.	n_3	.	n_4	.	.	r_1	.	n_2	.	.	.	.	II
Kuehneromyces mutabilis (Schaeff.: Fr.) Sing. et Smith	.	.	n_1	.	.	.	n_4	n_1	n_2	.	.	.	.	II
Scutellinia scutellata (L.: Fr.) Lamb.	.	.	r_1	.	r_1	n_4	.	.	.	r_1	.	.	.	II
Stereum rugosum (Pers.: Fr.) Fr.	.	.	.	.	.	n_5	n_4	.	.	.	.	n_{14}	n_8	II
Piptoporus betulinus (Bull.: Fr.) P. Karst.	.	.	.	.	.	r_{29}	r_7	r_{43}	.	.	.	r_7	.	II
Peziza micropus Pers.	a_1	a_{15}	a_{10}	.	.	.	.	.	.	.	.	.	.	II
Laetiporus sulphureus (Bull.: Fr.) Murr.	n_6	.	.	.	.	.	.	.	.	.	n_4	n_6	.	II
**Phellinus robustus* (P. Karst.) Bourd. et Galz.	r_{16}	r_9	r_9	.	.	.	.	.	.	.	.	.	.	II
Pluteus umbrosus (Pers.: Fr.) Kumm.	.	r_1	r_2	.	.	.	.	.	.	r_3	.	.	.	II
P. petasatus (Fr.) Gill.	.	r_1	r_1	r_1	.	.	.	.	.	.	.	.	.	II
Mycena polygramma (Bull.: Fr.) S. F. Gray	.	.	r_1	.	.	.	.	r_1	.	.	.	.	r_1	II
Datronia mollis (Sommerf.: Fr.) Donk	.	.	.	a_{26}	.	.	n_7	.	.	n_7	.	.	.	II
Ascocoryne cylichnium (Tul.) Korf	.	.	.	r_1	.	.	.	.	.	.	r_1	.	r_1	II
Thelephora terrestris Ehr. ex Willd.: Fr.	.	.	.	.	a_4	a_8	n_1	.	.	.	.	.	.	II
Hymenochaete rubiginosa (Dicks. Fr.) Lév.	.	.	.	.	.	.	.	.	a_7	a_9	n_3	.	.	II
Hericium clathroides (Pallas: Fr.) Pers.	r_5	r_3	.	.	.	.	.	.	.	.	.	.	.	I
Hymenoscyphus calyculus (Sow.: Fr.) Phill.	r_1	.	.	.	.	.	.	.	.	.	.	.	r_1	I

Tab 5 cont.

1	2													3
Panellus serotinus (Pers.: Fr.) Kühn.	.	a_3	a_2	.	.	.	.	.	.	.	.	.	.	I
Daedalea quercina (L.: Fr.) Pers.	.	n_7	.	.	.	.	.	n_8	.	.	.	.	.	I
Diatrype disciformis (Hoffm.: Fr.) Fr.	.	r_1	r_1	.	.	.	.	.	.	.	.	.	.	I
**Inonotus radiatus* (Sow.: Fr.) P. Karst.	.	.	.	r_4	.	.	.	.	.	r_1	.	.	.	I
Polyporus tuberaster (Jacq.): Fr.	.	.	.	r_1	.	.	.	.	.	r_1	.	.	.	I
Cyathus striatus (Huds.) Willd.: Pers.	.	.	.	.	.	.	n_4	.	a_5	.	.	.	.	I
Tremella mesenterica Retz.: Fr.	a_1	.	.	.	.	.	.	.	.	.	.	.	.	I
Crucibulum laeve (Huds.) Kambly in Kambly et Lee	n_2	.	.	.	.	.	.	.	.	.	.	.	.	I
Polyporus squamosus (Huds.): Fr.	r_3	.	.	.	.	.	.	.	.	.	.	.	.	I
Hapalopilus nidulans (Fr.) P. Karst.	r_2	.	.	.	.	.	.	.	.	.	.	.	.	I
Hebeloma radicosum (Bull.: Fr.) Ricken	r_2	.	.	.	.	.	.	.	.	.	.	.	.	I
Crepidotus mollis (Schaeff.: Fr.) Kumm.	r_1	.	.	.	.	.	.	.	.	.	.	.	.	I
Exidia glandulosa (Bull.): Fr.	r_1	.	.	.	.	.	.	.	.	.	.	.	.	I
Geopyxis carbonaria (A. et S.: Fr.) Sacc.	r_1	.	.	.	.	.	.	.	.	.	.	.	.	I
Hericium erinaceus (Bull.: Fr.) Pers.	r_1	.	.	.	.	.	.	.	.	.	.	.	.	I
Mycena maculata P. Karst.	.	a_2	.	.	.	.	.	.	.	.	.	.	.	I
Pluteus salicinus (Pers.: Fr.) Kumm.	.	n_4	.	.	.	.	.	.	.	.	.	.	.	I
Paxillus atrotomentosus (Batsch: Fr.) Fr.	.	.	.	r_5	.	.	.	.	.	.	.	.	.	I
**Phanerochaete laevis* (Fr.) J. Erikss. et Ryv.	.	.	.	r_1	.	.	.	.	.	.	.	.	.	I
Pluteus leoninus (Schaeff.: Fr.) Kumm.	.	.	.	r_1	.	.	.	.	.	.	.	.	.	I
Flammulina velutipes (Curt.: Fr.) Sing.	.	.	.	.	.	a_1	.	.	.	.	.	.	.	I
Pholiota aurivella (Batsch: Fr.) Kumm.	.	.	.	.	.	.	a_3	.	.	.	.	.	.	I
Tricholomopsis rutilans (Schaeff.: Fr.) Sing.	.	.	.	.	.	.	r_1	.	.	.	.	.	.	I
Ganoderma lucidum (Curt.: Fr.) P. Karst.	.	.	.	.	.	.	.	r_1	.	.	.	.	.	I
Chondrostereum purpureum (Pers.: Fr.) Pouz.	.	.	.	.	.	.	.	.	n_3	.	.	.	.	I
Pholiota flammans (Fr.) Kumm.	.	.	.	.	.	.	.	.	n_3	.	.	.	.	I
**Phanerochaete sordida* (P. Karst.) J. Erikss. et Ryv.	.	.	.	.	.	.	.	.	.	.	r_1	.	.	I
**Ph. tuberculata* (P. Karst.) Parm.	.	.	.	.	.	.	.	.	.	.	.	r_1	.	I
Lentinellus cochleatus (Pers.: Fr.) P. Karst.	.	.	.	.	.	.	.	.	.	.	.	.	n_1	I
**Phanerochaete velutina* (DC.: Fr.) P. Karst.	.	.	.	.	.	.	.	.	.	.	.	.	r_1	I

Explanations: see Table 3–4.

Fomes fomentarius, *Ganoderma applanatum* and *Hypoxylon deustum* are abundant on alive or relatively recently fallen beech tree trunks. Trunks and stumps in the stage of advanced decomposition are often grown with *Megacollybia platyphylla*, *Mycena haematopus*, *Stereum subtomentosum* and *Marasmius alliaceus*. Fallen branches and twigs are grown with species producing fine but numerous fruit bodies, like *Bisporella citrina*, *Calocera cornea*, *Crepidotus variabilis* and *Nectria cinnabarina*.

Relatively numerous is the group of lignicolous fungi reaching the second degree of constancy (Tab. 5) including: *Ascocoryne cylichnium* and *Oudemansiella mucida* – growing on relatively recently fallen beech tree trunks; *Datronia mollis*, *Neobulgaria pura* and *Trametes gibbosa* – growing on trunks and stumps in the stage of intermediately advanced decomposition; *Peziza micropus*, *Pluteus umbrosus*, *Polyporus varius* and *Scutellina scutellata* – on highly decomposed tree trunks. *Laetiporus sulphureus* and *Hymenochaete rubiginosa* grow on the stumps of oak trees and *Heterbasidion annosum* – on the roots of pine trees.

Analysis of the macromycetes occurring in the *Luzulo pilosae-Fagetum* association in the park and in other regions in Poland has shown that many species found frequently in the park, e.g. *Amanita citrina A. rubescens*, *Armillaria mellea*, *Collybia dryophila*, *C. peronata*, *Laccaria amethystina*, *L. laccata*, *Megacollybia platyphylla*, *Mycena galericulata*, *Phallus impudicus*, *Russula ochroleuca*, *Xerocomus chrysenteron*, and *Xerula radicata*, are also common elsewhere.

The number of macromycetes species noted in the ***Fago-Quercetum petraeae*** association is 76. Half of this number are terrestrial fungi (Tab. 6) of which 80% are mycorrhizal species. The most frequent and abundant are *Amanita rubescens*, *Boletus erythropus*, *Laccaria amethystina*, *Russula ochroleuca* and *Xerocomus chrysenteron*. The presence of pine trees in the neighbourhood accounts for the occurrence of a numerous group of species related to this tree, e.g. *Lactarius rufus*, *Tylopilus felleus*, *Rozites caperatus* and *Xerocomus badius*.

The contribution of litter-decomposing fungi is insignificant (Tab. 6).

The group of lignicolous fungi is rather rich in species (Tab. 6). *Fomes fomentarius*, *Fomitopsis pinicola* and *Ganoderma applanatum* are often found on decaying beech tree trunks, *Daedalea quercina* and *Hymenochaete rubiginosa* often cover oak tree stumps, while *Trichaptum abietinum* – pine tree stumps. Stems of the living oak trees are sometimes covered with *Fistulina hepatica* and *Laetiporus sulphureus*, which may produce large size fruit bodies. Of the lignicolous fungi noted, 40% produce annual or perennial fruit bodies and 20% are harmful tree parasites.

Similarly as in other regions of Poland, in the *Fago-Quercetum petraeae* association in the ILP the terrestrial fungi are dominant.

Table 6

Macromycetes occurring in phytocoenose of the *Fago-Quercetum petraeae* in the Ińsko Landscape Park

Successive number	1
Number of plot	25
Reserve	WS
Number of forest unit	411
Number of observations	42
Number of taxa	76

1	2
A. Terrestrial fungi	
Laccaria amethystina Cke.	a_{15}
Xerocomus badius (Fr.) Kühn. ex Gilb.	a_{10}
Xerocomus chrysenteron (Bull.) Quél.	a_{10}
Lepista nuda (Bull.: Fr.) Cke.	a_7
Amanita citrina (Schaeff.) Pers.	a_5
Lactarius quietus (Fr.) Fr.	a_5
Lycoperdon perlatum Pers.: Pers.	a_4
Amanita phalloides (Vaill.: Fr.) Link	a_2
Hydnum repandum L.: Fr.	a_2
Tricholoma sulphureum (Bull.: Fr.) Kumm.	a_2
Boletus erythropus (Fr.: Fr.) Krbh.	n_{13}
Russula ochroleuca (Pers.) Fr.	n_{12}
Amanita rubescens (Pers.: Fr.) S. F. Gray	n_9
Paxillus involutus (Batsch: Fr.) Fr.	n_6
Russula nigricans (Bull.: Fr.) Fr.	n_6
Lactarius rufus (Scop.: Fr.) Fr.	n_5
Laccaria laccata (Scop.: Fr.) Bk. et Br.	n_4
Tylopilus felleus (Bull.: Fr.) P. Karst.	n_3
Boletus edulis Bull.: Fr.	n_2
Hygrophoropsis aurantiaca (Wulf.: Fr.) Mre.	n_2
Scleroderma citrinum Pers.	n_1
Tricholoma saponaceum (Fr.: Fr.) Kumm.	n_1
Cantharellus cibarius Fr.	r_3
Russula fellea (Fr.: Fr.) Fr.	r_3
Clitopilus prunulus (Scop.: Fr.) Kumm.	r_2
Russula virescens (Schaeff.) Fr.	r_2
Agaricus silvicola (Vitt.) Peck	r_1
Amanita muscaria (L.: Fr.) Hook.	r_1
A. pantherina (DC.: Fr.) Krbh.	r_1
Lepista flaccida (Scop.: Fr.) Pat.	r_1
Macrolepiota procera (Scop.: Fr.) Sing.	r_1
Rozites caperatus (Pers.: Fr.) P. Karst.	r_1
Russula cyanoxantha (Schaeff.) Fr.	r_1
R. fragilis (Pers.: Fr.) Fr.	r_1
R. sororia (Fr.) Romell	r_1
R. vesca Fr.	r_1
Tubaria furfuracea (Pers.: Fr.) Gill.	r_1
Xerocomus subtomentosus (L.: Fr.) Quél.	r_1
B. Litter – decomposing fungi	
Collybia dryophila (Bull.: Fr.) Kumm.	a_{12}
C. butyracea (Bull.: Fr.) Kumm.	n_5
C. peronata (Bolt.: Fr.) Kumm.	n_4
C. maculata (A. et S.: Fr.) Kumm.	n_3
C. Lignicolous fungi	
Fomitopsis pinicola (Sw.: Fr.) P. Karst.	a_{42}
Fomes fomentarius (L.: Fr.) Kickx	a_{42}
Daedalea quercina (L.: Fr.) Pers.	a_{39}
Hymenochaete rubiginosa (Dicks.: Fr.) Lév.	a_{23}
Trichaptum abietinum (Dicks.: Fr.) Ryv.	a_{16}
Armillaria mellea (Vahl.: Fr.) Kumm. s. l.	a_2
Hypholoma fasciculare (Huds.: Fr.) Kumm.	a_1
Pholiota squarrosa (Weig.: Fr.) Kumm.	a_1
Ganoderma applanatum (Pers.) Pat.	n_{16}
Stereum rugosum (Pers.: Fr.) Fr.	n_{16}
Laetiporus sulphureus (Bull.: Fr.) Murr.	n_9
Nectria cinnabarina (Tode: Fr.) Fr.	n_5
Stereum hirsutum (Willd.: Fr.) S. F. Gray	n_5
Bjerkandera adusta (Willd.: Fr.) P. Karst.	n_4
Dacrymyces stillatus Nees: Fr.	n_4
Mycena galericulata (Scop.: Fr.) S. F. Gray	n_4
Calocera cornea (Batsch: Fr.) Fr.	n_3
Phlebia radiata Fr.	n_3
Xylaria hypoxylon (L.: Fr.) Grev.	n_3
Exidia plana (Wigg.) Donk	n_2
Daedaleopsis confragosa (Bolt.: Fr.) Pers.	r_{12}
Fistulina hepatica (Schaeff.): Fr.	r_7
**Phellinus robustus* (P. Karst.) Bourd. et Galz.	r_7
Heterobasidion annosum (Fr.) Bref.	r_6
Xerula radicata (Relhan: Fr.) Dörfelt	r_6
Peniophora quercina (Pers.: Fr.) Cke.	r_5
Paxillus atrotomentosus (Batsch: Fr.) Fr.	r_4
Trametes gibbosa (Pers.: Fr.) Fr.	r_4
Megacollybia platyphylla (Pers.: Fr.) Kotl. et Pouz.	r_3
Calocera viscosa (Pers.: Fr.) Fr.	r_2
Polyporus varius (Pers.): Fr.	r_2
Trametes versicolor (L.: Fr.) Pil.	r_2
Tricholomopsis rutilans (Schaeff.: Fr.) Sing.	r_2
Pluteus atricapillus (Batsch) Fay.	r_1

Explanations: see Table 3–4

In the ***Galio sylvatici-Carpinetum*** association the number of macromytes noted was 120. Over 60% of the terrestrial fungi (Tab. 7) are mycorrhizal species accompanying different species of trees. Apart from those related to oak and beech trees, there also those related to pines. The most frequent, but not really abundant are e.g. *Amanita citrina*, *A. rubescens*, *Boletus erythropus*, *Laccaria amethystina*, *L. laccata*, *Lactarius quietus*, *L. rufus*, *Russula ochroleuca*, *Xerocomus badius* and *X. chrysenteron*.

The group of litter-decomposing species (Tab. 7) is represented much less abundantly, the species most often met are *Collybia butyracea*, *C. dryophila* and *C. peronata*.

The contribution of lignicolous fungi (Tab. 7) in the patches studied is comparable to that of terrestrial ones. Relationships between particular species of fungi and trees (kind of substrate) are markedly visible. Such species as e.g. *Daedalea quercina* and *Hymenochaete rubiginosa* grow in large numbers on oak tree stumps and *Xerula radicata* – near beech tree stumps.

Analysis of macromycetes occurring in the *Galio sylvatici-Carpinetum* in the park and in other regions of Poland has proved that many of the fungi species found in the area studied, e.g. *Amanita phalloides*, *Lactrius quietus* and *Mycena inclinata* are also frequently noted in other regions.

Contribution of ecological groups of fungi in the forest associations studied

The contribution of ecological groups of fungi in the forest associations in the area of the park is similar (Fig. 2).

The ecological group richest in species is that of terrestrial fungi (Fig. 2). The total number of taxons noted is 129, which makes up 48.5% of all the species observed in permanent plots. As far as the number of species is concerned, the group of terrestrial fungi is represented by from 2 to 5 times more species than herbal plants noted in permanent plots (Fig. 3). Among them the mycorrhizal species are dominant and make up almost 70% of the terrestrial species. The most frequent and abundant are those in mycorrhizis with beech trees, than those in mycorrhizis with the oak and pine trees.

The group of litter-decomposing fungi in the forest associations studied is not numerous (Fig. 2). In total the number of species observed is 26, so 9.7% of all fungi species in permanent plots.

The lignicolous fungi make the second most abundantly represented group. The total number of species observed is 112, which makes up 41.8% of the species noted in permanent plots. Analysis of the percent contribution of this group of fungi in the forest associations studied shows that it is the lowest in the *Melico-Fagetum* (41.7%) while the highest in the *Luzulo pilosae-Fagetum* (46.8%). In this ecological group of fungi the parasitic species make up about 17%.

Table 7

Macromycetes occurring in phytocoenoses of the *Galio sylvatici-Carpinetum* in the Ińsko Landscape Park

Successive number	1	2	3
Number of plot	23	24	22
Reserve	WS	WS	KZ
Number of forest unit	411	411	510
Number of observations	42	42	41
Number of taxa	89	81	86
1	2		
A. Terrestrial fungi			
Laccaria amethystina Cke.	a_{12}	a_{15}	a_{16}
Russula ochroleuca (Pers.) Fr.	a_{12}	n_{11}	n_{12}
Boletus erythropus (Fr.: Fr.) Krbh.	a_{11}	a_{15}	n_3
Amanita citrina (Schaeff.) Pers.	a_8	n_5	a_9
Xerocomus chrysenteron (Bull.) Quél.	a_7	a_8	a_{12}
Stropharia aeruginosa (Curt.: Fr.) Quél.	a_4	n_4	a_7
Hygrophorus eburneus (Bull.: Fr.) Fr.	a_3	n_2	n_1
Paxillus involutus (Batsch: Fr.) Fr.	n_{11}	n_9	n_8
Xerocomus badius (Fr.) Kühn. ex Gilb.	n_9	n_9	a_{10}
Laccaria laccata (Scop.: Fr.) Bk. et Br.	n_8	n_4	a_{10}
Lactarius quietus (Fr.) Fr.	n_7	n_6	a_{11}
Amanita rubescens (Pers.: Fr.) S. F. Gray	n_7	r_5	a_{11}
Clitocybe clavipes (Pers.: Fr.) Kumm.	n_6	n_7	r_4
Lepista flaccida (Scop.: Fr.) Pat.	n_6	n_4	r_5
Lactarius rufus (Scop.: Fr.) Fr.	n_4	n_5	a_9
Lepista nuda (Bull.: Fr.) Cke.	n_4	n_4	a_7
Russula nigricans (Bull.: Fr.) Fr.	n_4	n_4	a_6
Tylopilus felleus (Bull.: Fr.) P. Karst.	n_3	r_2	a_3
Cantharellus cibarius Fr.	n_3	r_1	r_1
Hydnum repandum L.: Fr.	n_2	a_3	n_3
Amanita phalloides (Vaill.: Fr.) Link	n_2	n_2	a_4
Hygrophoropsis aurantiaca (Wulf.: Fr.) Mre.	n_2	r_1	n_4
Russula fellea (Fr.: Fr.) Fr.	r_4	r_4	r_4
Clitopilus prunulus (Scop.: Fr.) Kumm.	r_3	r_3	r_3
Russula emetica (Schaeff.: Fr.) Pers.	r_2	r_2	r_1
Leccinum scabrum (Bull.: Fr.) S. F. Gray	r_2	r_1	r_1
Macrolepiota procera (Scop.: Fr.) Sing.	r_1	r_1	a_4
Amanita gemmata (Fr.) Bertill.	r_1	r_1	r_1
Clavulina rugosa (Bull.: Fr.) Schroet.	a_3	a_2	.
Tricholoma sulphureum (Bull.: Fr.) Kumm.	a_2	n_1	.
Humaria hemisphaerica (Wigg.: Fr.) Fuck.	a_2	n_1	.
Boletus edulis Bull.: Fr.	n_3	n_1	.
Inocybe geophylla (Sow.: Fr.) Kumm.	n_3	n_1	.
Amanita muscaria (L.: Fr.) Hook.	r_1	r_1	.
Lycoperdon perlatum Pers.: Pers.	n_3	.	a_9
Stropharia squamosa (Pers.: Fr.) Quél.	n_1	.	n_1
Amanita pantherina (DC.: Fr.) Krbh.	r_1	.	r_1
Russula cyanoxantha (Schaeff.) Fr.	r_1	.	r_1

Hebeloma crustuliniforme (Bull.) Quél.	.	r_1	n_2
Scleroderma citrinum Pers.	.	r_1	n_1
Cratherellus cornucopioides (L.: Fr.) Pers.	a_1	.	.
Xerocomus subtomentosus (L.: Fr.) Quél.	n_1	.	.
Hebeloma sinapizans (Paulet: Fr.) Gill.	r_1	.	.
Helvella lacunosa Afz.: Fr.	r_1	.	.
Inocybe rimosa (Bull.: Fr.) Kumm.	r_1	.	.
Leotia lubrica (Scop.) Pers.: Fr.	r_1	.	.
Macrolepiota rhacodes (Vitt.) Sing.	r_1	.	.
Tubaria furfuracea (Pers.: Fr.) Gill.	r_1	.	.
Russula sororia (Fr.) Romell	.	r_2	.
Agrocybe praecox (Pers.: Fr.) Fay.	.	r_1	.
Boletus luridus Schaeff.: Fr.	.	r_1	.
Russula vesca Fr.	.	r_1	.
Scleroderma verrucosum (Bull.): Pers.	.	.	a_8
Russula virescens (Schaeff.) Fr.	.	.	n_2
Inocybe asterospora Quél.	.	.	n_1
Clitocybe nebularis (Batsch: Fr.) Kumm.	.	.	n_1
Russula xerampelina (Schaeff.) Fr.	.	.	r_1
R. fragilis (Pers.: Fr.) Fr.	.	.	r_1
B. Litter-decomposing fungi			
Collybia dryophila (Bull.: Fr.) Kumm.	a_{10}	a_7	a_{16}
C. peronata (Bolt.: Fr.) Kumm.	n_5	a_8	a_8
C. butyracea (Bull.: Fr.) Kumm.	n_4	n_4	r_2
Hymenoscyphus fructigenus (Bull.: Fr.) S. F. Gray	n_2	n_2	n_4
Mycena vitilis (Fr.) Quél.	n_3	.	n_3
Collybia maculata (A. et S.: Fr.) Kumm.	r_2	r_2	.
Ciboria batschiana (in Zopfet Sydow) Buchwald	r_1	r_1	.
Mycena pura (Pers.: Fr.) Kumm.	r_1	r_1	.
M. galopus (Pers.: Fr.) Kumm.	.	r_1	n_2
C. Lignicolous fungi			
Fomitopsis pinicola (Sw.: Fr.) P. Karst.	a_{42}	a_{42}	a_{41}
Mycena galericulata (Scop.: Fr.) S. F. Gray	a_7	a_9	a_{11}
Armillaria mellea (Vahl.: Fr.) Kumm. s. l.	a_3	a_3	a_6
Fomes fomentarius (L.: Fr.) Kickx	n_{39}	n_{30}	a_{41}
Daedaleopsis confragosa (Bolt.: Fr.) Pers.	n_{10}	r_3	r_5
Nectria cinnabarina (Tode: Fr.) Fr.	n_7	n_6	a_8
Xylaria hypoxylon (L.: Fr.) Grev.	n_5	n_5	a_{13}
Crepidotus variabilis (Pers.: Fr.) Kumm.	n_3	n_5	a_7
Stereum hirsutum (Willd.: Fr.) S. F. Gray	n_3	n_3	a_{11}
Calocera cornea (Batsch: Fr.) Fr.	n_3	r_2	n_5
Exidia plana (Wigg.) Donk	n_2	n_2	a_2
Calocera viscosa (Pers.: Fr.) Fr.	n_2	n_1	n_2
Megacollybia platyphylla (Pers.: Fr.) Kotl. et Pouz.	r_5	r_4	n_4
Pluteus atricapillus (Batsch) Fay.	r_4	r_2	r_5
Daedalea quercina (L.: Fr.) Pers.	r_3	n_{28}	r_3
Peniophora quercina (Pers.: Fr.) Cke.	r_3	r_3	r_2
Schizophyllum commune Fr.: Fr.	r_2	r_1	n_4
Pholiota lenta (Pers.: Fr.) Sing.	r_2	r_1	n_2

Tab. 7 cont.

1	2		
Xerula radicata (Relhan: Fr.) Dörfelt	r_2	r_1	r_1
Panellus stypticus (Bull.: Fr.) P. Karst.	r_1	n_3	a_6
Bisporella citrina (Batsch: Fr.) Korf et Carpenter	r_1	r_1	n_2
Lycoperdon pyriforme Schaeff.: Pers.	a_9	.	a_8
Mycena haematopus (Pers.: Fr.) Kumm.	n_1	.	a_1
Marasmius rotula (Scop.: Fr.) Fr.	n_1	.	n_2
Ramaria stricta (Pers.: Fr.) Quél.	r_1	.	r_3
Hymenochaete rubiginosa (Dicks.: Fr.) Lév.	n_7	n_7	.
Cyathus striatus (Huds.) Willd.: Pers.	n_3	n_1	.
**Vuilleminia comedens* (Nees: Fr.) Mre.	r_1	r_1	.
Stereum rugosum (Pers.: Fr.) Fr.	.	a_{14}	n_6
Psathyrella piluliformis (Bull.: Fr.) Orton	.	a_1	a_2
Hypholoma fasciculare (Huds.: Fr.) Kumm.	.	n_2	n_4
Polyporus varius (Pers.): Fr.	.	r_4	r_1
Dacrymyces stillatus Nees: Fr.	.	r_1	n_5
Trametes hirsuta (Fr.) Pil.	.	r_1	r_2
Trichaptum abietinum (Dicks.: Fr.) Ryv.	a_5	.	.
Heterobasidion annosum (Fr.) Bref.	n_{19}	.	.
Hirneola auricula-judae (Bull.: Fr.) Berk.	n_1	.	.
Phlebia tremellosa (Schrad.: Fr.) Nakas. et Burds.	n_1	.	.
Ganoderma applanatum (Pers.) Pat.	r_7	.	.
Paxillus atrotomentosus (Batsch: Fr.) Fr.	r_1	.	.
Tricholomopsis rutilans (Schrad.: Fr.) Sing.	r_1	.	.
Laetiporus sulphureus (Bull.: Fr.) Murr.	.	a_5	.
Crucibulum laeve (Huds.) Kambly in Kambly et Lee	.	n_1	.
Exidia glandulosa (Bull.): Fr.	.	r_1	.
Bjerkandera adusta (Willd.: Fr.) P. Karst.	.	.	a_{38}
Trametes versicolor (L.: Fr.) Pil.	.	.	a_{10}
Xylaria polymorpha (Pers.: Fr.) Grev.	.	.	a_7
Pleurotus ostreatus (Jacq.: Fr.) Kumm.	.	.	a_3
Mycena inclinata (Fr.) Quél.	.	.	a_2
Coprinus micaceus (Bull.: Fr.) Fr.	.	.	a_1
Pholiota squarrosa (Weig.: Fr.) Kumm.	.	.	a_1
Stereum subtomentosum Pouz.	.	.	n_6
Phlebia radiata Fr.	.	.	n_4

Explanations: see Table 3–4

In the forest associations in the Ińsko Landscape Park, the contribution of particular groups of fungi significantly depends on the ecological conditions in the patches studied.

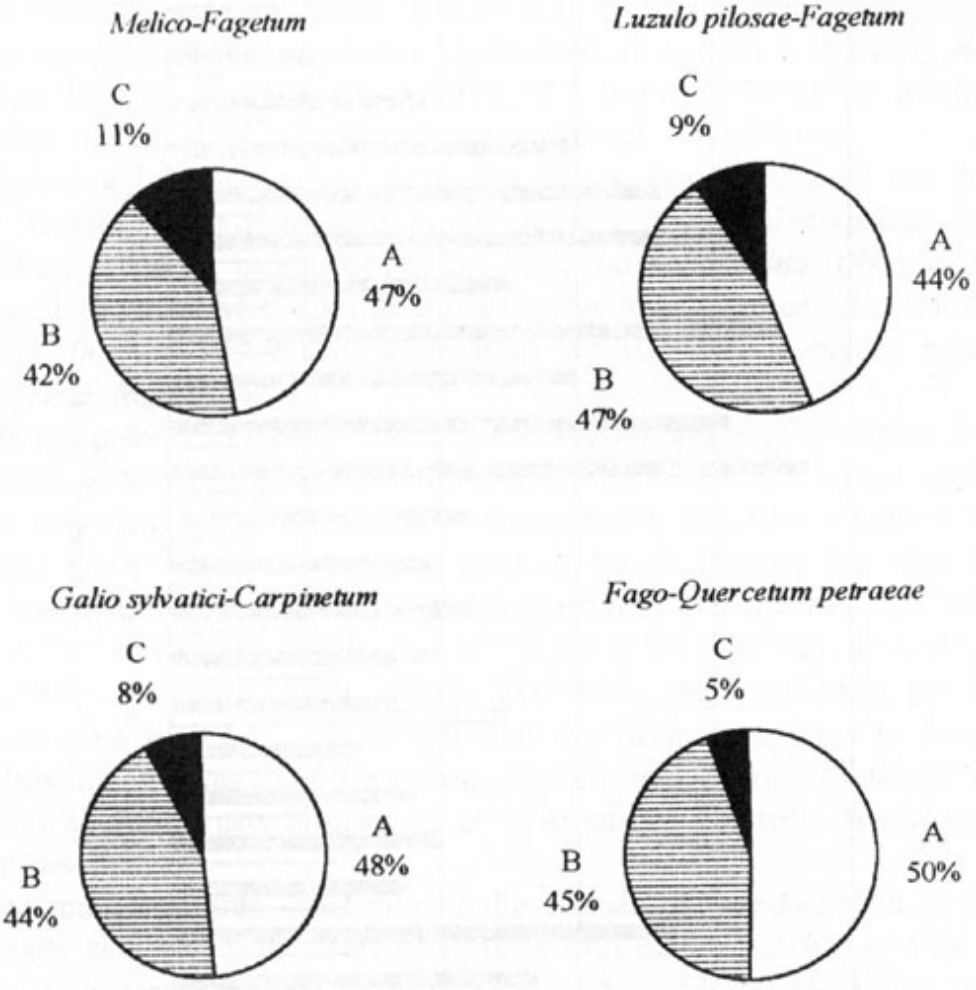

Fig. 2. Proportion of ecological groups of macromycetes in forest communities of the Ińsko Landscape Park
A – terrestrial fungi; B – lignicolous fungi; C – litter-decomposing fungi

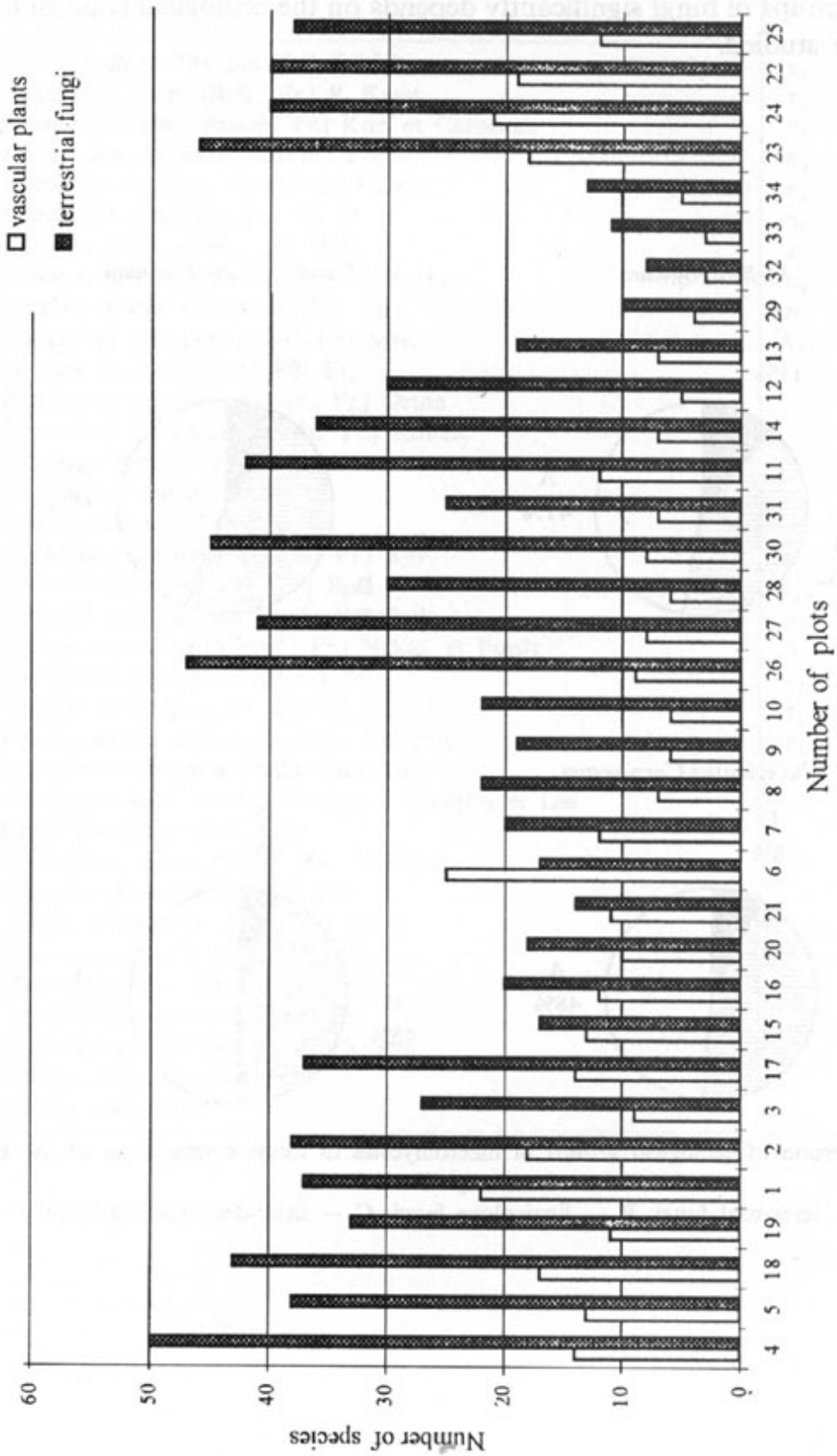

Fig. 3. Number of species of terrestrial fungi and vascular plants on the plots in forest communities of the Ińsko Landscape Park *Melico-Fagetum* – plots: 1–10, 15–21; *Luzulo pilosae-Fagetum* – plots: 11–14, 26–34; *Galio sylvatici-Carpinetum* – plots: 22–24; *Fago-Quercetum petraeae* – plot: 25

DISCUSSION

Macromycetes of forest associations in the Ińsko Landscape Park

From the mycosociological point of view, the ***Melico-Fagetum*** is the most comprehensively studied association. The species composition of the fungi found in the patches of this association in the area of the park is similar to that reported from other areas in Pomerania (L i s i e w s k a 1963, 1966, 1974) and the Wielkopolska Lowland (E n d l e r 1971), while shows some differences from those in the Częstochowa Upland (A d a m c z y k 1996) and other regions in Europe (J a h n et al. 1967; T h o e n 1970, 1971), attributed to differences in the type of substrate and climatic conditions.

Against a background of the other forest associations of the park, the *Melico-Fagetum* is distinguished by the richness of exclusive species, including those often noted in beech forests e.g. *Mycena pelianthina* (W o j e w o d a 1975), and those related to the *Fagion sylvaticae* alliance (L i s i e w s k a 1974) e.g. *Inocybe petiginosa*, *Marasmius setosus*, *Strobilomyces strobilaceus* and *Mycena fagetorum*.

Many species abundant in the *Melico-Fagetum*, e.g. *Collybia dryophila*, *Hypoxylon deustum*, *Laccaria amethystina*, *L. laccata*, *Pluteus atricapillus*, *Russula ochroleuca* and *Xerocomus chrysenteron*, are characterised by large ecological scale. They are met not only in beech forests, but also in other forest associations, mainly in oak-linden-hornbeam forests (N e s p i a k 1959; L i s i e w s k a 1965; Ł a w r y n o w i c z 1973; G u m i ń s k a 1991–1992; F r i e d r i c h 1994). Therefore, the hypothesis put forward by N e s p i a k (1968) and saying that the *Melico-Fagetum* is the association showing a greater connection in the aspect of its fungi to oak-linden-hornbeam forests than to other types of beech forests, seems supported by our results.

The macromycetes occurring in the ***Luzulo pilosae-Fagetum*** in the park are equally rich and diversified as those found in the patches of this association in other areas in Pomerania (F r i e d r i c h 1986, 1994) but show some significant differences from those found in other regions of Poland (D o m a ń s k i et al. 1963; L i s i e w s k a et al. 1977; A d a m c z y k 1996) and Europe (J a h n et al. 1967; P i l á t 1969; T h o e n 1970, 1971), which is accounted for by differences in the substrates and climatic conditions.

As far as mycosociological relations are concerned, the patches of the *Luzulo pilosae-Fagetum* in the ILP are similar to those of the *Melico-Fagetum*. This fact can be accounted for by the dominant role of beech trees in the tree-stand of both associations and the presence of the same species as admixtures, e.g. pine trees. These factors are responsible for weakening of

differences between the species composition of fungi in these two associations (Ł a w r y n o w i c z 1973; B u j a k i e w i c z 1981).

The macromycetes occurring in the ***Fago-Quercetum petraeae*** are most similar to those found in this association in the Cedynia Landscape Park (F r i e d r i c h 1994), while much less to those reported from the same associations in other areas in Pomerania (L i s i e w s k a 1963, 1966, 1974; B u j a k i e w i c z 1986) and the Wielkopolska Lowland (E n d l e r 1971).

In the aspect of species composition, frequency and abundance, the macromycetes noted in the *Fago-Quercetum petraeae* in the ILP resemble those occurring in the *Galio sylvatici-Carpinetum*. This fact is a consequence of the dominant role of oak trees and a considerable contribution of pine trees in the tree-stands of both associations. The latter is manifested by the presence of some species in mycorrhizal relations with pine trees, e.g. *Cantharellus cibarius*, *Lactarius rufus*, *Paxillus involutus*, *Xerocomus badius*, and some lignicolous species related to this tree species, e.g. *Calocera viscosa*, *Paxillus atrotomentosus* and *Trichaptum abietinum*. A small contribution of *Fagus sylvatica* in the tree stand in this association in the park is probably the reason why certain species, e.g. *Lactarius blennius*, (noted in this association in other regions of Pomerania (B u j a k i e w i c z 1986; F r i e d r i c h 1994) and abundant in neighbouring patches of the *Luzulo pilosae-Fagetum*) do not occur in the association in the park. Also, the presence of such species as *Helvella crispa* or *Scleroderma verrucosum*, reported as distinctive for the *Fago-Quercetum* from the Darss Peninsula (K r e i s e l 1957) and from Netherlands (J a n s e n 1984), was not established.

The macromycetes found in the ***Galio sylvatici-Carpinetum*** association make a group much poorer in species than those reported from the *Galio sylvatici-Carpinetum* in the Wielkopolska Lowland (L i s i e w s k a 1965; B u j a k i e w i c z and F i k l e w i c z 1965; L i s i e w s k a and B u j a k i e w i c z 1976) or western part of Pomerania (F r i e d r i c h 1994).

Many of the fungi species occurring in the *Galio sylvatici-Carpinetum* in the park have been also noted in patches of *Stellario-Carpinetum* in Pomerania (F r i e d r i c h 1979) and *Tilio-Carpinetum* in other regions in Poland (N e s p i a k 1959; Ł a w r y n o w i c z 1973; W o j e w o d a 1975, 1978; L i s i e w s k a et al. 1977; G u m i ń s k a 1991–1992; L i s i e w s k a 1995; B u j a k i e w i c z 1995; S k i r g i e ł ł o 1995; S k i r g i e ł ł o and L i s i e w s k a 1996). They have been also reported from oak-linden-hornbeam forests outside the borders of our country (P i l á t 1969; W i n t e r h o f f 1977; H o r a k and R ö l l i n 1988), they are mostly characterised by a large ecological scale (Ł a w r y n o w i c z 1973) and occur in oak-linden-hornbeam forests and in beech forests, e.g. *Stropharia squamosa* and *Boletus erythropus* (L i s i e w s k a 1974).

In the ILP, the majority of the fungi species found in the *Galio sylvatici-Carpinetum* were also observed in the *Melico-Fagetum* and the *Luzulo pilosae-Fagetum*. This fact can undoubtedly be attributed to a great contribution of beech trees in their tree-stands as many of the species were those in mycorrhizae with this tree, e.g. *Hygrophorus eburneus*, *Russula ochroleuca* and *R. nigricans*. In comparison with the other associations in the park, the *Galio sylvatici-Carpinetum* is characterised by the greatest mean number of fungi species.

Analysis of macromycetes occurring in forest associations in the ILP, against the analogous data for the same associations in other regions of the country, leads to a conclusion that the majority of fungi species from the area are characterised by wide ecological scale. Among them there is a group of fungi considered by Lisiewska (1974) to be associated with the Fagetalia order forests, e.g. *Collybia butyracea*, *Marasmius rotula*, *Mycena galericulata*, *Phallus impudicus*, *Russula cyanoxantha*, *R. nigricans*, and a group of fungi most often met in beech tree forests (Wojewoda 1975), e.g. *Collybia peronata*, *Hygrophorus eburneus*, *Lactarius blennius*, *Marasmius alliaceus*, *Mycena capillaris*, *Oudemansiella mucida*, *Polyporus varius*, *Russula fellea* and *Tricholoma ustale*. From the species belonging to the latter group *Mycena crocata* – noted in the Beech Forest near Szczecin (Lisiewska 1963) – does not occur. The presence of *Boletus luridus* was noted only once at a single site. It is a species preferring thermophilous beech woods growing on alkaline substrates, met on the Wolin Island and in the Cedynia Landscape Park (Lisiewska 1966, 1974; Friedrich 1994).

Among the macromycetes found in the forest associations in the park, there is a group of species in general rare in Poland and moreover often met in the mountains than in lowland areas, including: *Datronia mollis*, *Hebeloma radicosum*, *Hericium erinaceus*, *Panellus serotinus*, *Neobulgaria pura*, *Polyporus varius* and *Strobilomyces strobilaceus*. From among the species reported from very few sites in Poland *Stereum subtomentosum* found the optimum conditions for development in the park. Other rare species occurring in the park are: *Geastrum fimbriatum*, *Phaeolus schweinitzii*, *Polyporus tuberaster* and *Pluteus petasatus* (Wojewoda and Ławrynowicz 1992).

In general, the richness in species and the presence of many rare or endangered species make the Ińsko Landscape Park a very interesting area for the study of macromycetes.

Macromycetes as indicators of the status of forest associations

Fungi make an important and permanent element of each phytocoenosis on which they depend but which they also influence (Kornaś 1957; Wojewoda 1975). The contribution of fungi in patches of a particular

forest association depends on many biotic and abiotic factors as well as on the specific role of the fungi in the biocoenosis (Bujakiewicz 1982; Friedrich 1994).

The ecological group of fungi most abundantly represented in the forest associations studied was that of terrestrial ones. They enter into the closest relations with particular phytocoenoses and are relatively best suited to characterise a forest (Bujakiewicz 1982; Friedrich 1994). In the group of terrestrial fungi in the ILP the mycorrhizal species are dominant and make up almost 70% of all terrestrial species. A substantial contribution of mycorrhizal species in the forest associations testifies to correct biological relations in the phytocoenoses (Bujakiewicz 1982; Friedrich 1994).

The majority of forest trees cannot develop normally without a fungi partner (Meyer 1973), which not only provides nutrients for the tree but *also protects it from disease inducing organisms (Rudawska 1990, 1993).* Thanks to much advanced ecological speciation, the fungi are very sensitive to changes in the habitat conditions (Kornaś 1957). A disturbance in the equilibrium in the environment leads to mycelium withdrawal or its weakening, whose consequence is production of fewer fruit bodies or their less frequent production (Ławrynowicz and Nespiak 1983; Przybylski 1993). Decreasing number of fruit bodies and disappearance of certain species of mycorrhizal fungi may indicate a decrease in mycorrhizal abilities of the spawn and indirectly also deterioration in the condition of trees. Degeneration of macromycetes and forest tree population are usually parallel processes (Termorshuizen and Schaffers 1987). Therefore, the fungi may play a role of indicators of the tree stand health status (Fellner 1993; Fellner and Pešková 1995) and changes in the habitat conditions in a given phytocoenosis.

The majority of mycorrhizal species noted in the park associations are those in mycorrhizae with beech and oak trees, while those accompanying pines are in minority. The domination of species living in mycorrhizae with deciduous trees supports the opinion of many authors (Olaczek and Piotrowska 1986; Czerwiński 1993) that in beech forests and oak-linden-hornbeam forests, pine trees make a foreign element and the presence of the fungi species associated with pines is determined by the presence of the mycorrhizal partner.

The litter-decomposing fungi are saprotrophic organisms taking part in the process of decomposition of organic matter. Many species from this ecological group are associated with specific kind of substrate and plant community, which ensure the optimum conditions for their development (Bujakiewicz 1982; Friedrich 1994). The fungi from this group can also play a role of indicators of changes in the environment.

The lignicolous fungi are also strongly related to the kind of substrate, some of them more to the kind of tree while others more to the state of its decomposition. The majority of them are saprophytes as well as harmful parasites, depending on the mode of nutrition and functions in a given biocoenose. Likewise that of terrestrial and litter-decomposing fungi, their development is also determined by the status of the plant community as the microclimate it establishes decides about the rate of wood decomposition and fungi succession (Wojewoda 1975; Friedrich 1994). The frequency and abundance of fungi are determined by the abundance and availability of the substrate. In response to increased availability of substrate they can produce an increased number of fruit bodies or an increased number of species of such fungi may appear. Therefore, also this group of fungi may provide information on changes in the habitat conditions in a give phytocoenosis (Fellner 1993; Fellner and Pešková 1995). According to these authors, the quantitative relations of the mycorrhizal to saprotrophic and parasite fungi may be indicative of the health status of the tree-stand.

Acknowledgements: I wish to express my gratitude to all persons who assisted me in the study. My particular thanks go to Professor Maria Ławrynowicz who enkindled my interest in the subject of the study and helped me in determination of the herbal material as well as supported me in carrying out the work with her kind advice. My thanks are due to: Professor Władysław Wojewoda for help in determination of many species and rendering access to literature, Professors Alina Skirgiełło and Krystyna Czyżewska for critical comments and suggestions, late Professor Tadeusz Głazek, head of Department of Botany at USz for his support of the project, late Professor Mieczysław Jasnowski for giving me access to unpublished data and for consultations in selection of permanent plots. I am also much grateful to Doctors Urszula Grinn and Lesław Wołejko for allowing me use their unpublished data and for fruitful discussions. I would also like to thank all my friends and colleagues from Department of Botany for their help and support.

REFERENCES

Adamczyk J. 1996. Les champign's supérieurs des hétraies du nord du plateau de Częstochowa (Pologne méridionale). Lejeunia. Rev. Bot. pp. 1–83.

Arnolds E. J. M. 1990. Tribus *Hygrocybeae*. [In:] E. J. M. Arnolds, C. Bas. *Tricholomataceae* (1). [In:] C. Bas, Th. W. Kuyper, M. E. Noordeloos, E. Vellinga (eds). Flora agaricana Neerlandica. Critical monographs on families of agarics and boleti occurring in the Netherlands. II. A. General part. B. Taxonomic part: *Pleurotaceae*, *Pluteaceae*, *Tricholomataceae* (1). A. A. Balkema (Rotterdam) Brookfield, pp. 70–115.

Boratyńska K., Boratyński A. 1990. Systematyka i geograficzne rozmieszczenie. [In:] S. Białobok (ed.). Buk zwyczajny *Fagus sylvatica* L. PWN, Poznań–Warszawa, pp. 27–73.

Bresinsky A., Kreisel H., Primas A. 1995. Habitats of fungi. A guide to their ecological and floristic characterization in Central Europe. Regensb. Mykol. Schr. 5: 1–304.

Bujakiewicz A. 1969. Udział grzybów wyższych w lasach łęgowych i olesach Puszczy Bukowej pod Szczecinem. Bad. Fizjogr. Pol. Zach. B, 23: 61–96.

Bujakiewicz A. 1981. Grzyby Babiej Góry. II. Wartość wskaźnikowa *macromycetes* w zespołach leśnych. A. Uwagi wstępne i charakterystyka lasów regla dolnego. Acta Mycol. 17 (1–2): 63–125.

Bujakiewicz A. 1982. Grzyby Babiej Góry. III. Wartość wskaźnikowa *macromycetes* w zespołach leśnych. Acta Mycol. 18 (1): 3–44.

Bujakiewicz A. 1986. Udział *macromycetes* w zbiorowiskach roślinnych występujących na podłożu torfowym w Słowińskim Parku Narodowym. Bad. Fizjogr. Pol. Zach. B, 37: 101–129.

Bujakiewicz A. 1995. Fungi. *Agaricales*. [In:] J. B. Faliński, W. Mułenko (eds). Cryptogamous plants in the forest communities of Białowieża National Park. General problems and taxonomic groups analysis (Project CRYPTO). Phythocoenosis 7 (N.S.), Archv. Geobot. 4: 141–148.

Bujakiewicz A., Fiklewicz G. 1965. Obserwacje fenologiczno-ekologiczne nad grzybami wyższymi w grądach okolic Opalenicy (Zachodnia Wielkopolska). PTPN, Prace Kom. Biol.: 26 (3): 13–69.

Corley M. F. V., Crundwell A. C., Düll R., Hill M. O., Smith A. J. E. 1981 (1982). Mosses of Europe and the Azores: an annotated list of species, with synonyms from the recent literature. J. Bryol. 11: 609–689.

Czerwiński A. 1993. Bory sosnowe i zbiorowiska leśne z udziałem sosny w Polsce. [In:] S. Białobok, A. Boratyńska, W. Bugała (eds). Biologia sosny zwyczajnej. Sorus, Poznań–Kórnik, pp. 282–300.

Czubiński Z. 1950. Zagadnienia geobotaniczne Pomorza. Bad. Fizjogr. Pol. Zach. 2 (4): 439–658.

Dobracki R. 1986. Budowa geologiczna utworów czwartorzędowych Wysoczyzny Ińskiej. [In:] Racjonalna gospodarka – ochroną potencjału produkcyjnego gleb Pomorza Zachodniego. Ogólnopol. Symp. Eroz. PTG. AR w Szczecinie: 4–7.

Domański S., Gumińska B., Lisiewska M., Nespiak A., Skirgiełło A., Truszkowska W. 1963. Mikoflora Bieszczadów Zachodnich. II. (Ustrzyki Górne 1960). Monogr. Bot. 15: 3–75.

Endler Z. 1971. Grzyby wyższe lasów bukowych nadleśnictwa Kąty. Acta Mycol. 7: 279–298.

Eriksson J., Hjortstam K., Ryvarden L. 1978–1984. The *Corticiaceae* of North Europe. 5–7. Fungiflora. Oslo, pp. 887–1449.

Eriksson J., Ryvarden L. 1973–1976. The *Corticiaceae* of North Europe. 2–4. Fungiflora. Oslo, pp. 60–886.

Fellner R. 1993. Air polltion and mycorrhizal fungi in Central Europe. [In:] D. N. Pegler, L. Boddy, B. Ing et P. M. Kirk (eds.). Fungi of Europe: Investigation, Recording and Conservation. Royal Botanic Gardens, Kew, pp. 239–250.

Fellner R., Pešková V. 1995. Effects of industrial pollutants on ectomycorrhizal relationships in temperate forests. Can. J. Bot. 73 (Suppl. 1): 1310–1315.

Friedrich S. 1979. Wstępne badania nad grzybami pomnikowego lasu grabowo-dębowego w Ziemomyślu na Pomorzu Szczecińskim. Zesz. Nauk. AR w Szczecinie: 77 (22): 103–113.

Friedrich S. 1985 (1986). *Macromycetes* na tle zespołów leśnych Puszczy Goleniowskiej. Acta Mycol. 21 (1): 43–76.

Friedrich S. 1994. Charakterystyka socjologiczno-ekologiczna mikoflory zbiorowisk leśnych Cedyńskiego Parku Krajobrazowego. Zesz. Nauk. AR w Szczecinie. Ser. Rozprawy 161: 1–100.

Grinn U. 1983a. Rezerwat przyrody „Głowacz". Dokumentacja przyrodnicza. AR w Szczecinie. Maszynopis: 1–10.

Grinn U. 1983b. Rezerwat przyrody „Kamienna Buczyna". Dokumentacja przyrodnicza. AR w Szczecinie. Maszynopis: 1–8.

Gumińska B. 1991–1992. Higher fungi of the *Tilio-Carpinetum* forest association in the Skołczanka Reserve near Cracow. Acta Mycol. 27 (1): 137–158.

Hansen L., Knudsen H. 1992 (eds.). Nordic *Macromycetes*. II. *Polyporales, Boletales, Agaricales, Russulales*. Nordsvamp, Copenhagen, pp. 1–474.

Hjortstam K., Larsson K. H., Ryvarden L. 1988. The *Corticiaceae* of North Europe. 8. Fungiflora. Oslo, pp. 1450–1629.

Hjortstam K., Larsson K. H., Ryvarden L. (no date). The *Corticiaceae* of North Europe. 1. Fungiflora. Oslo, pp. 1–59.

Horak E., Röllin O. 1988. Der Einfluss von Klärschlamm auf die Makromycetenflora eines Eichen-Hainbuchen-Waldes bei Genf, Schweiz, Herausgeber Eidgenössische Austalt für das Forstliche Versuchswesen. 64 (1): 21–147.

Jahn H., Nespiak A., Tüxen R. 1967. Pilzsoziologische Untersuchungen in Buchenwäldern (*Carici-Fagetum, Melico-Fagetum* und *Luzulo-Fagetum*) des Wesergebirges. Mitt. Flor.-Soz. Arbeitsgem. N. F. 11–12: 159–197.

Jansen A. E. 1984. Vegetation and macrofungi of acid oakwoods in the Norteast of the Netherlands. Agricult. Reserch Reports 923. Pudoc. Wageningen, pp. 1–162.

Jasnowski M., Ćwikliński E. 1977. Iński Park Krajobrazowy. Dokumentacja podstawowa. AR w Szczecinie. Maszynopis: 1–103.

Jasnowski M., Ćwikliński E., Markowski S. 1995. Pojezierze Południowopomorskie, Pojezierze Lubuskie, Pojezierze Wielkopolskie. [In:] W. Matuszkiewicz (ed.). Potencjalna roślinność naturalna Polski. Mapa przeglądowa. 1:300 000. Arkusz 6. Inst. Geog. i Przestrz. Zagospod. PAN.

Kornaś J. 1957. Zbiorowiska roślin zarodnikowych i ich klasyfikacja. Wiad. Bot. 1 (1–2): 3–18.

Koźmiński Cz. 1986. Agroklimat Wyżyny Ińskiej. [In:] Racjonalna gospodarka – ochroną potencjału produkcyjnego gleb Pomorza Zachodniego. Ogólnopol. Symp. Eroz. PTG. AR w Szczecinie: 12–13.

Kreisel H. 1957. Die Pilzflora des Darss und ihre Stellung in der Gesamtvegetation. Fedd. Repert. 137: 110–183.

Kreisel H. 1987. (ed.). Pilzflora der Deutschen Demokratischen Republik. *Basidiomycetes* (Gallert-, Hut- und Bauchpilze). VEB G. Fischer Verl., Jena, pp. 1–281.

Kuyper Th. W. 1986. A revision of genus *Inocybe* in Europa. I. Subgenus inosperma and the smooth-spored species of subgenus *Inocybe*. Persoonia. Suppl. 3: 1–247.

Lisiewska M. 1963. Mikoflora zespołów leśnych Puszczy Bukowej pod Szczecinem. Monogr. Bot. 15: 77–151.

Lisiewska M. 1965. Udział grzybów wyższych w grądach Wielkopolski. Acta Mycol. 1: 169–268.

Lisiewska M. 1966. Grzyby wyższe Wolińskiego Parku Narodowego. Acta Mycol. 2: 25–77.

Lisiewska M. 1974. *Macromycetes* of beech forests within the eastern part of the *Fagus* area in Europe. Acta Mycol. 10 (1): 3–72.

Lisiewska M. 1995. Fungi. *Boletales*. [In:] J. B. Faliński, W. Mułenko (eds.). Cryptogamous plants in the forest communities of Białowieża National Park. General problems and taxonomic groups analysis (Project CRYPTO). Phythocoenosis 7 (N.S.), Archv. Geobot. 4: 137–140.

Lisiewska M., Bujakiewicz A. 1976. Grzyby wyższe na tle zespołów leśnych. [In:] T. Wojterski. (ed.). Roślinność rezerwatu „Dębina" pod Wągrowcem w Wielkopolsce. Bad. Fizjogr. Pol. Zach. B, 29: 119–134.

Lisiewska M., Tortić M., Szmid M. 1976 (1977). Mikoflora lasów okolic Żegiestowa i Muszyny w Beskidzie Sądeckim. Acta Mycol. 12 (2): 211–224.

Ławrynowicz M. 1973. Grzyby makroskopowe w grądach Polski Środkowej. Acta Mycol. 9 (2): 133–204.

Ławrynowicz M., Nespiak A. 1983. Grzyby jako element atrakcyjności terenów rekreacyjnych. Acta Univ. Lodz. Folia sozol. (1): 35–50.

Maas Geesteranus R. A. 1992a. Mycenas of the Northern Hemisphere. I. Studies in Mycenas and other papers. North–Holland–Amsterdam–Oxford–New York–Tokyo, pp. 1–391.

Maas Geesteranus R. A. 1992b. Mycenas of the Northern Hemisphere. II. Conspectus of the Mycenas of the Northern Hemisphere. North–Holland–Amsterdam–Oxford–New York–Tokyo, pp. 1–493.

Matuszkiewicz W. 1984. Przewodnik do oznaczania zbiorowisk roślinnych Polski (ed. 2). PWN, Warszawa, pp. 1–298.

Matuszkiewicz W., Matuszkiewicz J. M. 1996. Przegląd fitosocjologiczny zbiorowisk leśnych Polski. Phytocoenosis. 8 (N.S.), Sem. Geobot. 3: 1–79.

Meyer F. H. 1973. Distribution of ectomycorrhizae in native and man-made forest. [In:] G. C. Marks, T. T. Kozlowski (eds.). Ectomycorrhizae. Academic press, London–New York, pp. 151–205.

Michael E., Hennig B, Kreisel H. 1988. Handbuch für Pilzfreunde. VEB G. Fischer Verl., Jena, pp. 1–310.

Miesięczne Przeglądy Agrometeorologiczne za lata 1986–1995. Zakł. Agrometeorologii. IMGW, Warszawa.

Mikołajski J. 1966. Geografia województwa szczecińskiego. STN. Wydz. Nauk Społ. 11: 1–156.

Mirek Z., Piękoś-Mirkowa H., Zając A., Zając M. 1995. Vascular plants of Poland – a checklist. Krytyczna lista roślin naczyniowych Polski. Polish. Bot. Stud., Guidebook Series. Inst. Bot. im. W. Szafera PAN. 15: 1–308.

Nespiak A. 1959. Studia nad udziałem grzybów kapeluszowych w zespołach leśnych na terenie Białowieskiego Parku Narodowego. Monogr. Bot. 8: 3–141.

Nespiak A. 1968. Krytyczne uwagi o socjologii grzybów. Wiad. Bot. 12 (2): 93–104.

Olaczek R., Piotrowska H. 1986. Lasy Wolińskiego Parku Narodowego w świetle teorii faz i form degeneracji fitocenoz. Parki Narodowe i Rezerwaty Przyrody. 7 (2): 5–14.

Pilát A. 1969. Houby Československa ve svém životním *prostředí*. Československá Akademie Véd, Praha, pp. 1–267.

Prusinkiewicz Z., Bednarek R. 1991. Gleby. [In:] L. Starkel (ed.). Geografia Polski. Środowisko przyrodnicze. PWN, Warszawa, pp. 387–412.

Przybylski T. 1993. Autekologia i synekologia. [In:] S. Białobok, A. Boratyńska, W. Bugała (ed.). Biologia sosny zwyczajnej. Sorus, Poznań–Kórnik, pp. 255–281.

Przybył K. 1995. Zamieranie dębów w Polsce. Idee ekologiczne 8 (4). Inst. Dendrologii PAN. Sorus, Poznań–Kórnik, pp. 1–85.

Roberts P. 1994. Globose and ellipsoid-spored *Tulasnella* species from Devon and Surrey, with a key to the genus in Europe. Mycol. Res. 98 (12): 1431–1452.

Roberts P. 1995. British *Tremella* species I: *Tremella aurantia* et *T. mesenterica*. Mycologist. 9 (3): 110–114.

Roczniki statystyczne województwa szczecińskiego. 1991–1996. Główny Urząd Statystyczny, Warszawa.

Rudawska M. 1990. Mikoryza. [In:] S. Białobok (ed.). Buk zwyczajny *Fagus sylvatica* L. PWN, Poznań–Warszawa, pp. 159–184.

Rudawska M. 1993. Mikoryza. [In:] S. Białobok, A. Boratynska, W. Bugała (ed.). Biologia sosny zwyczajnej. Sorus, Poznań–Kórnik, pp. 137–182.

Ryvarden L., Gilbertson R. L. 1993–1994. European *Polyporales*. Part 1–2. Fungiflora. Oslo, pp. 1–743.

Skirgiełło A. 1995. Fungi. Gasteromycetous fungi. [In:] J. B. Faliński, W. Mułenko (eds.). Cryptogamous plants in the forest communities of Białowieża National Park General problems and taxonomic groups analysis (Project CRYPTO). Phythocoenosis 7 (N.S.), Archv. Geobot. 4: 125–128.

Skirgiełło A., Lisiewska M. 1996. Mycorrhizal fungi of trees. [In:] J. B. Faliński, W. Mułenko (eds.). Cryptogamous plants in the forest communities of Białowieża National Park. Functional groups analysis and general synthesis (Project CRYPTO 3). Phythocoenosis 8 (N.S.), Archv. Geobot. 6: 69–74.

Stangl J. 1989. Die gattung *Inocybe* in Bayern. Hoppea. 46: 5–388.

Telleria M. T. 1990. Annotated list of the *Corticiaceae* sensu lato (*Aphyllophorales, Basidiomycotina*) for Peninsular Spain and Balearic Islands. J. Cramer. Gebrüder Borntraeger Verl., Berlin–Stuttgart, pp. 1–152.

Termorshuizen A. J., Schaffers A. P. 1987. Occurrence of carpophores of ectomycorrhizal fungi in selected stands of *Pinus sylvestris* in the Netherlands in relation to stand vitality and air pollution. Plant Vand Soil. 104 (2): 209–217.

Thoen D. 1970. Etude mycosociologique de quelques associations forestieres des districts picardo-brabançon, mosan et ardennais de Belque. Bull. Rech. Agron. Gembloux 5 (1–2): 310–326.

Thoen D. 1971. Etude mycosociologique de quelques associations forestieres des districts picardo-brabançon, mosan et ardennais de Belque. Bull. Rech. Agron. Gembloux 6 (1–2): 215–243.

Winterhoff W. 1976 (1977). Die Pilzflora des Naturschutzgebietes Sandhausener Dünen bei Heidelberg, Veröff. Naturschutz Landschaftspflege Bad.-Württ. 44–45: 51–118.

Wojewoda W. 1975. *Macromycetes* Ojcowskiego Parku Narodowego. II. Charakterystyka socjologiczno-ekologiczno-geograficzna. Acta Mycol. 11 (2): 163–209.

Wojewoda W. 1978. Grzyby wielkoowocnikowe rezerwatu Lipówka w Puszczy Niepołomickiej. [In:] Leśny rezerwat Lipówka w Puszczy Niepołomickiej. Studia Nature Zakł. Ochr. Przyr. PAN. A, 17: 159–168.

Wojewoda W., Ławrynowicz M. 1992. Czerwona lista grzybów wielkoowocnikowych zagrożonych w Polsce. [In:] K. Zarzycki, W. Wojewoda et Z. Heinrich (ed.). Lista roślin zagrożonych w Polsce (ed. 2). Inst. Bot. im. W. Szafera PAN. pp. 27–56.

Wołejko L. 1991. Rezerwat przyrody „Krzemieńskie Źródliska". Dokumentacja przyrodnicza. AR w Szczecinie. Urząd Wojewódzki w Szczecinie. Wydział Ochrony Środowiska. Maszynopis: 1–26.

Wołejko L., Kmiecik S. 1991. Rezerwat przyrody „Wyspa Sołtyski". Dokumentacja przyrodnicza. Urząd Wojewódzki w Szczecinie. Wydział Ochrony Środowiska. Maszynopis: 1–21.

Macromycetes zbiorowisk leśnych Ińskiego Parku Krajobrazowego

Streszczenie

Badania mikologiczne w IPK prowadzono w latach 1990–1997 na obszarze trzech istniejących rezerwatów przyrody: Kamienna Buczyna, Głowacz i Wyspa Sołtyski oraz dwóch projektowanych: Krzemieńskie Źródliska i Perłówkowe Buki (Fig. 1). Obserwacji dokonywano na 34 stałych powierzchniach, po 400 m^2 każda, wyznaczonych w najbardziej reprezentatywnych dla tego obszaru płatach zespołów leśnych: *Melico-Fagetum*, *Luzulo pilosae-Fagetum* i *Fago-Quercetum petraeae*, oraz rzadkiego w tej części Polski zespołu grądu *Galio sylvatici-Carpinetum* (Tab. 3). Łącznie stwierdzono 267 gatunków *macromycetes*, w *Melico-Fagetum* – 211 (Tab. 4), w *Luzulo pilosae-Fagetum* – 202 (Tab. 5), w *Galio sylvatici-Carpinetum* – 120 (Tab. 7), a w *Fago-Quercetum petraeae* – 76 gatunków (Tab. 6). Do bogatszych w gatunki grzybów należy *Galio sylvatici-Carpinetum*, w którym średnia liczba gatunków na powierzchni jest największa – 85,3.

Analiza składu gatunkowego grzybów występujących w zespołach leśnych parku pozwala stwierdzić, że większość gatunków grzybów tu występujących odznacza się szeroką skalą ekologiczną. Wśród nich wyodrębnia się grupa grzybów uznanych przez Lisiewską (1974) za związane z lasami z rzędu *Fagetalia*, m.in.: *Collybia butyracea*, *Marasmius rotula*, *Mycena galericulata*, *Phallus impudicus*, *Russula cyanoxantha*, *R. nigricans*, oraz grupa grzybów najczęściej spotykanych w lasach bukowych (Wojewoda 1975) m.in.: *Collybia peronata*, *Hygrophorus eburneus*, *Lactarius blennius*, *Marasmius alliaceus*, *Mycena capillaris*, *Oudemansiella mucida*, *Polyporus varius*, *Russula fellea* i *Tricholoma ustale*.

Wśród grzybów występujących w zespołach leśnych parku wyróżnia się grupa gatunków na ogół rzadko notowanych w naszym kraju i występujących częściej w górach niż na niżu, np.: *Datronia mollis*, *Hebeloma radicosum*, *Neobulgaria pura*, *Panellus serotinus*, *Polyporus varius* i *Strobilomyces strobilaceus*. Niektóre spośród stwierdzonych gatunków m.in. *Hericium erinaceus*, *Phaeolus schweinitzii* i *Polyporus tuberaster*, znane są w Polsce tylko z nielicznych stanowisk.

Spośród ekologicznych grup grzybów wyróżnionych w badanych zespołach leśnych najliczniejszą grupę stanowią grzyby naziemne – 129 gatunków, a najuboższą grzyby naściółkowe – 26 gatunków. Grzyby naziemne liczebnością gatunków przewyższają rośliny naczyniowe wchodzące w skład badanych płatów (Fig. 3). Dominują wśród nich grzyby mikoryzowe, które stanową blisko 70% liczby gatunków notowanych na ziemi. Grzyby nadrzewne, które są drugą pod względem liczebności gatunków grupą ekologiczną (112 gatunków), wykazują zależność nie tylko od obfitości i dostępności substratu, na którym się rozwijają, ale także od rodzaju i stopnia jego rozkładu.

Duży udział grzybów mikoryzowych w zbiorowiskach leśnych IPK świadczy o dobrej kondycji drzewostanów, o prawidłowych i pozostających w równowadze stosunkach biologicznych, panujących w tych fitocenozach. Grzyby pasożytnicze (około 17% liczby gatunków nadrzewnych), wśród których najliczniej występują: *Armillaria mella*, *Fomes fomentarius*, *Fomitopsis pinicola*, *Ganoderma applanatum* i *Heterobasidion annosum*, są przejawem osłabienia kondycji zdrowotnej pojedynczych drzew, nie stanowią jednak zagrożenia dla całości drzewostanów parku.

Obserwacje dotyczące występowania grzybów związanych z *Pinus sylvestris* sugerują, że jest ona eliminowana przez *Fagus sylvatica* i nie odgrywa większej roli w badanych zespołach leśnych.

Grzyby, będąc organizmami bardzo czułymi na zmiany warunków siedliskowych, mogą odgrywać również rolę organizmów wskaźnikowych i pośrednio, ale stosunkowo wcześnie, informować o zmianie tych warunków lub zachwianiu stanu równowagi ekologicznej.