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Macromycetes of oak forests in the Łagiewnicki Forest (Central Poland) – monitoring studies

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Mycological observations were carried out in the years 1994–1996 in two permanent plots in a ca. 90-year-old oak forest (*Calamagrostio-Quercetum petraeae*) in the Las Łagiewnicki Forest, a large forest complex within the borders of the city of Łódź. The study was conducted in the frame of the international project "Mycological monitoring in European oak forests". During the 3 years (15 observations) 124 species of macromycetes were identified: 50 mycorrhizal, 72 saprobic and 2 parasitic species. Among them, 7 species inscribed on the Red List of threatened macromycetes in Poland (Wojewoda and Ławrynowicz 1992) were found.

Key words: macromycetes, mycological monitoring, oak decline, Poland.

INTRODUCTION

The international project „Mycological monitoring in European oak forests" was carried out in a wide variety of oak forests, from virgin forest to plantation. The forests examined were subject to human impact of varying intensity, from the forest closed to the public in the Białowieża National Park to the city forest in Central Poland. The Łagiewnicki Forest is the most penetrated and exploited site among the oak forests selected for mycological monitoring in Poland. Permanent plots are situated in a large mixed forest complex within the borders of Łódź, the second largest city in Poland with 800 thousand inhabitants.

The present paper is the last in a series of successive publications on the results of mycological monitoring in 7 Polish localities: Białowieża National Park (Skirgiełło 1998), Dębina reserve (Lisiewska and Połczyńska 1998), Świętokrzyskie Mts. (Łuszczyński 1998), Niepołomicka Forest (Wojewoda, Heinrich and Komorowska 1999), Ińsko Landscape Park

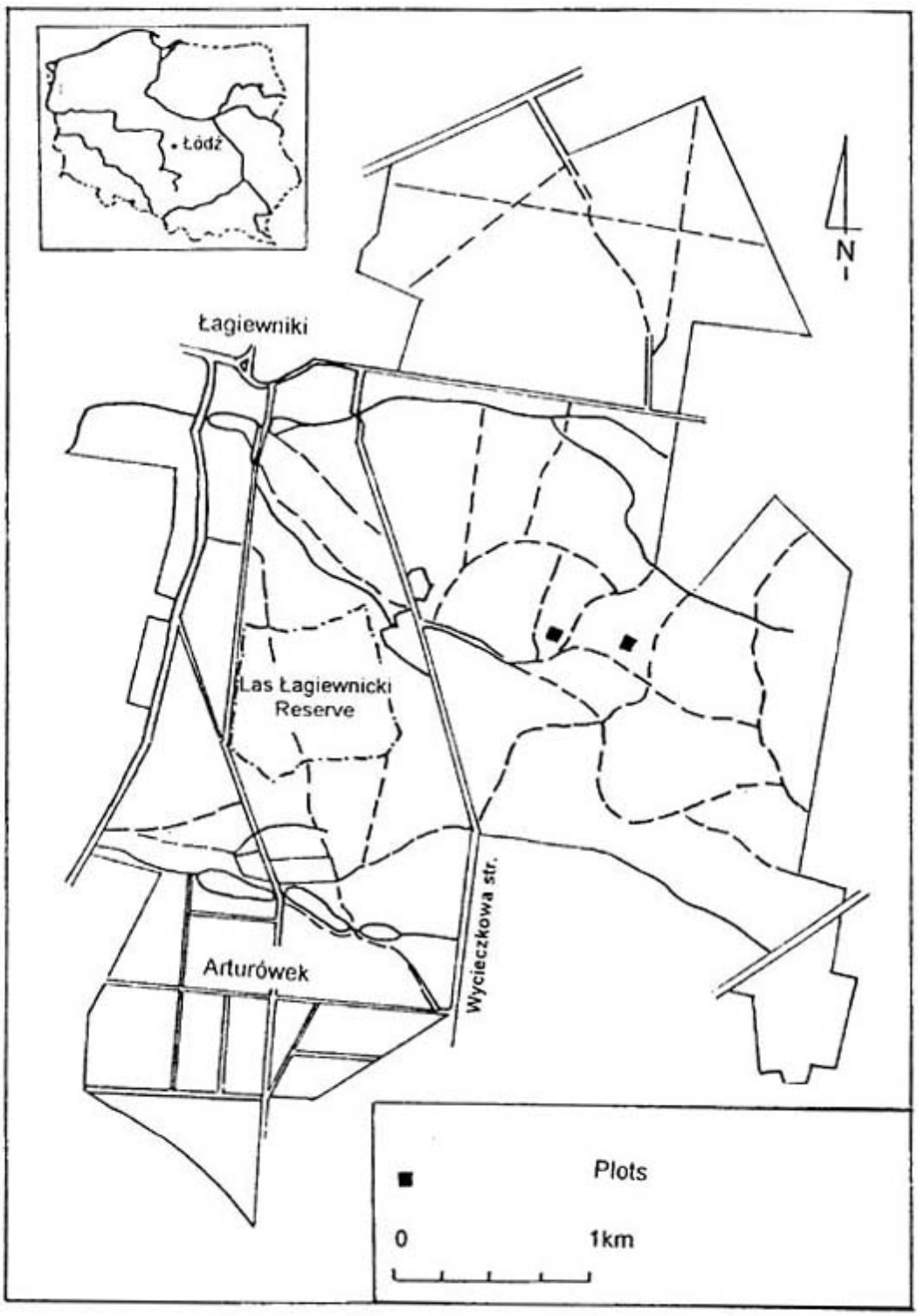

Fig 1. Location of the observation plots in the area of the Łagiewnicki Forest

(Ławrynowicz and Stasińska 2000), and Jurassic Landscape Park (Ławrynowicz 2001).

The introduction to and the aims of the Czech-Polish-Italian project, as well as preliminary the results were presented by Fellner and Arnolds (1991), Perini, Ławrynowicz and Fellner (1995), Perini et al. (2000), Ławrynowicz et al. (2001). A conclusive analysis of the data from the Polish plots and a comparison of all data, including Czech and Italian results, will be the next step of the project.

STUDY AREA

Łódź and its vicinity are situated in the watershed of the Vistula and Odra rivers. The Wzniesienia Łódzkie, ones of the highest hills in the Polish Lowland (up to 284 m above sea level) were covered in the past by the extinct Puszcza Łódzka Forest. As late as at the beginning of 19th century, forests of natural origin grew here. Because of the well preserved upland landscape, its natural, cultural and historical values, the area became protected in 1996 as the Wzniesienia Łódzkie Landscape Park. The Park also comprises the Łagiewnicki Forest – a forest complex over 1200 ha, situated in the northern part of the city of Łódź. It is one of the largest forest complexes within administrative city areas in Poland and in Europe (Fig. 1).

The most widespread forest community of the Łagiewnicki Forest is the rich oak-hornbeam forest *Tilio-Carpinetum typicum* and, mainly in the eastern part of the complex, communities approximating to the subatlantic acidic oak forest *Calamagrostio-Quercetum petraeae*. In the patches of the latter association, two permanent observation plots were established for the present research. Vegetation here grows on fluvioglacial sandy podzol with gravel admixture. Mean monthly temperatures and rainfall totals for the period 1994–1996 are presented in Tables 1 and 2.

Table 1

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

Year/ Month	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII	I-XII
1994	2.0	−1.9	4.2	9.1	12.6	16.1	22.3	18.7	14.5	6.7	3.8	1.2	9.1
1995	−1.4	3.0	2.7	7.9	12.5	16.7	20.8	18.7	13.0	10.5	0.3	−5.0	8.3
1996	−5.1	−4.8	−1.2	8.2	14.6	16.9	15.8	18.6	10.4	9.6	5.5	−5.6	6.9

Table 2

Monthly and annual precipitation totals for the meteorological station in Łódź [mm]

Year/ Month	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII	I-XII
1994	34	7	56	79	58	16	30	64	38	59	34	66	541
1995	34	46	39	33	47	56	37	68	68	17	19	19	483
1996	17	25	25	40	75	49	83	34	97	25	25	8	503

METHODS

The study was carried out in the oak forest *Calamagrostio-Quercetum petraeae* situated in the Łagiewnicki Forest in Łódź. Two permanent observation plots, 1000 m^2 (20 × 50 m) each, were established, both divided into 10 smaller 100 m^2 plots.

Mycological observations were carried out in the years 1994–1996. In 1994, the studies were launched in September and completed in November. Over the years 1995–1996 observations were performed once a month from May to October 1995 and November in 1996. Altogether, 15 observations were performed in each plot. During each survey, the number of sporocarps of each species in each subplot (square) was recorded, as well as the type of habitat.

A phytosociological survey of the plots was prepared by Jakubowska-Gabara (1996). All dead and alive trees, lying logs and thicker branches, as well as shrubs and moss patches were also charted.

The following works were used for the identification of species and as a source of nomenclature: Dennis (1968), Domański (1972), Domański, Orłoś and Skirgiełło (1973), Wojewoda (1977), Moser (1978), Jülich (1984), Kreisel (1987), Hawksworth et al. (1995). Names of vascular plants follow Mirek et al. (1995).

The herbarium collection of fungi has been deposited in the LOD herbarium in the Deptartment of Algology and Mycology, University of Łódź.

DESCRIPTION OF PERMANENT PLOTS

Plot I is situated in the forest division 15 t in an 90-year-old *Quercus petraea* stand (70% cover), accompanied by solitary *Carpinus betulus* and *Quercus robur*. The undergrowth consists of numerous young *Quercus petraea*, *Sorbus aucuparia*, *Fagus sylvatica* and of *Frangula alnus*. The forest floor is covered with leaf litter and numerous twigs and branches (Fig. 2) Phytosociological releves are given in Table 3.

Plot II is situated in the forest division 20 d in an 90-year-old *Quercus petraea* stand (80%), accompanied by solitary *Betula obscura* and *Pinus sylvestris*. The undergrowth consists of numerous *Quercus petraea*, *Sorbus aucuparia*, solitary *Picea abies* and of *Frangula alnus* and *Padus serotina*. The herb layer, dominated by *Vaccinium myrtillus*, is of higher coverage than on the plot I, while the amount of woody material lying on the forest floor is smaller. (Fig. 2). Phytosociological releves are given in Table 3.

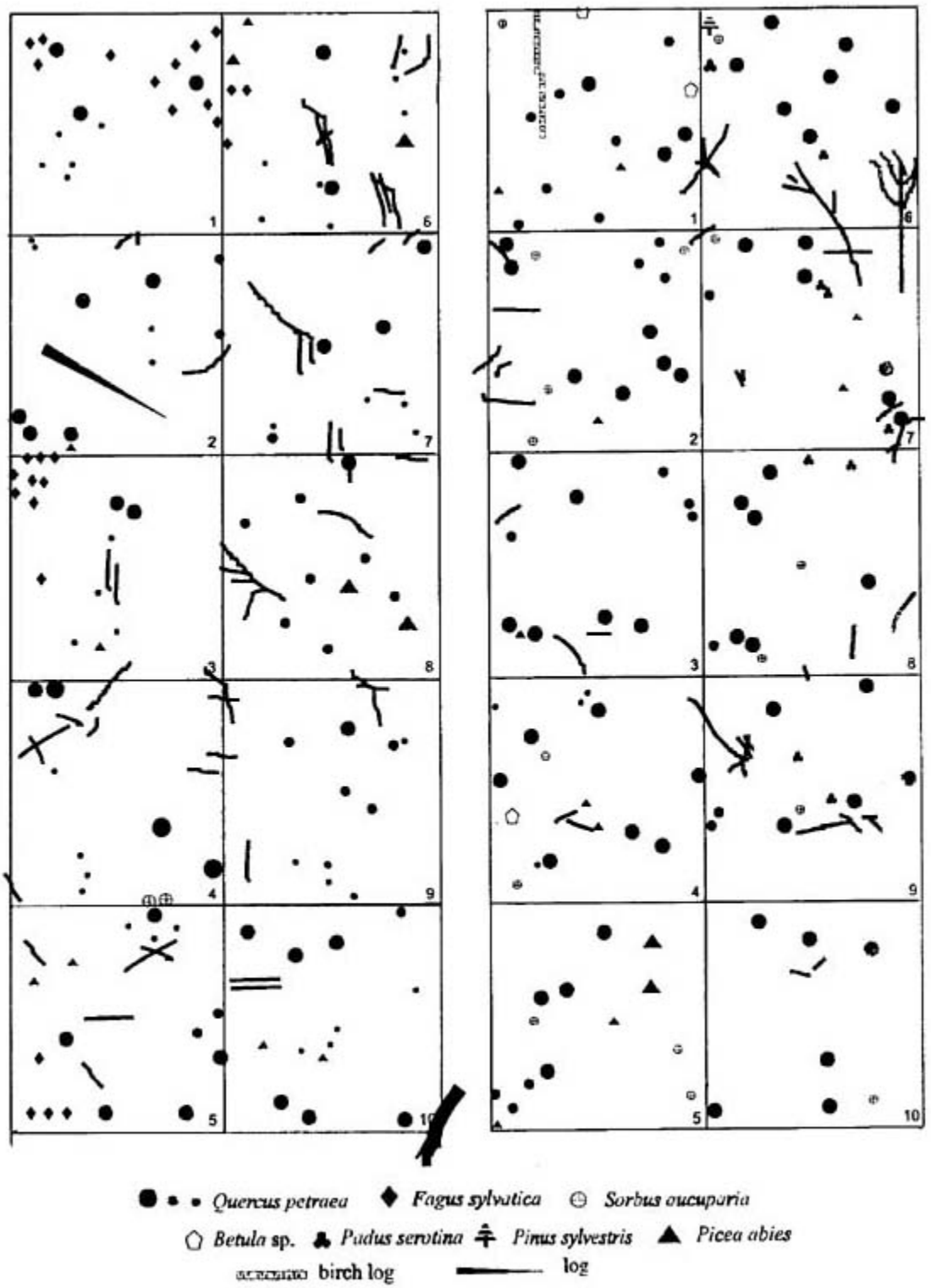

Fig. 2. The structure of the tree stand in the plots I and II

Table 3

Floristic composition in the plots examined in the Łagiewnicki oak forest (Jakubowska-Gabara 1996)

Locality 4			Łódź-Łagiewniki (PC)										
Associacion			*Calamagrostio - Quercetum petraeae* (Hartm. 1934) Scam. 1959										
Successive number			1	2	3	4	5	6	7	8	9	10	
Number of plot			I	I	I	I	I	II	II	II	II	II	C
Number of releve			1	2	3	4	5	6	7	8	9	10	o
Area of releve		m^2	200										n
Data			June 1995										s
Density of trees canopy	a_1	%	60	60	60	60	75	60	70	70	65	70	t
	a_2	%	30	20	–	10	10	–	10	–	–	–	a
Density of shrubs	b	%	10	20	20	20	25	15	20	30	20	20	n
Cover of herb lyer	c	%	30	40	60	60	40	70	60	60	70	70	c
Cover of mosses	d	%	15	10	5	5	3	3	2	5	5	2	y
Trees and shrubs:													
Quercus petraea	a_1		3	4	4	4	4	4	4	4	4	4	V
	a_2		2	2	.	1	1	.	1	.	.	.	III
	b		1	2	2	2	1	1	1	2	1	1	V
	c		1	2	2	1	2	2	1	1	1	2	V
Carpinus betulus	a_2		.	2	.	.	.	.	.	.	.	.	I
	c		+	+	+	+	+	+	+	+	+	.	V
Betula pubescens	a_2		.	.	.	.	.	.	+	.	.	.	I
Betula obscura	a_1		.	.	.	.	.	.	.	.	1	.	I
Quercus robur	a_1		1	.	.	.	.	.	.	.	.	.	I
Pinus sylvestris	a_1		.	.	.	.	.	.	1	.	.	.	I
Sorbus aucuparia	b		+	+	+	+	.	+	2	1	1	+	V
	c		+	1	+	+	+	+	+	+	+	+	V
Frangula alnus	b		+	+	.	1	.	+	+	+	+	+	IV

	c	+	+	+	+	+	+	+	+	+	+	V
Picea abies	b	.	.	.	.	+	.	.	.	.	1	I
	c	+	+	+	.	+	+	+	+	+	+	V
Padus serotina	b	.	.	.	.	+	+	+	+	+	+	III
	c	.	.	.	+	+	+	+	+	+	+	IV
Fagus sylvatica	b	+	1	1	.	2	.	.	.	.	.	II
	c	+	+	.	1	.	.	.	.	.	.	II
Prunus avium	c	.	.	.	.	.	.	.	.	+	.	I
Herbs and mosses:												
D *Calamagrostio - Quercetum*												
Vaccinum myrtillus		2	2	2	1	2	3	3	3	3	3	V
Pteridium aquilinum		1	.	2	3	2	.	2	1	+	.	IV
Clamagrostis arundinacea		.	.	1	+	+	.	.	+	.	+	III
Holcus mollis		.	.	+	.	.	+	.	.	+	+	II
Others												
Melampyrum pratense		1	1	2	1	1	1	2	1	1	1	V
Festuca ovina		+	+	1	+	1	2	1	1	1	1	V
Luzula pilosa		1	1	1	1	1	1	1	1	1	1	V
Anthoxanthum odoratum		+	+	1	+	1	1	+	+	+	+	V
Anemone nemorosa		+	+	.	+	.	+	1	+	+	.	IV
Carex pilulifera		+	+	+	+	+	+	.	.	.	+	IV
Melica nutans		+	+	+	.	+	.	+	.	+	.	III
Majanthemum bifolium		+	1	.	.	1	.	2	2	.	2	III
Vaccinum vitis-idea		.	+	+	.	.	+	.	+	+	.	III
Trientalis europaea		.	.	.	+	+	+	+	+	.	.	III
Polygonatum odoratum		+	.	+	.	+	.	.	+	.	.	II
Luzula pallescens		.	.	+	+	+	.	.	.	+	.	II
Veronica officinalis		.	+	+	.	+	+	.	.	+	.	III
Solidago virgaurea		.	.	.	.	+	+	.	+	.	.	II

Poa pratensis	+	.	.	.	.	+	.	.	+	+	II
Hieracium murorum	.	.	.	.	.	.	.	+	+	+	II
Taraxacum officinale	.	.	.	.	.	+	+	.	+	.	II
Viola riviniana	+	.	.	+	.	.	.	.	.	.	I
Poa nemoralis	+	.	.	.	.	.	.	+	.	.	I
Convallaria maialis	.	.	2	1	.	.	.	.	.	.	I
Impatiens parviflora	.	.	+	.	+	.	.	.	.	.	I
Carex pallescens	.	.	.	.	.	+	.	.	.	+	I
Hieracium vulgatum	.	.	.	.	.	+	+	.	.	.	I
Ajuga reptans	+	.	.	.	.	.	.	.	.	.	I
Luzula multiflora	.	.	.	.	.	+	.	.	.	.	I
Festuca amethystina subsp. *ritschili*	.	.	.	.	.	.	+	.	.	.	I
Hieracium sabaudum	.	.	.	.	.	.	.	+	.	.	I
Moehringa trinervia	.	.	.	.	.	.	.	.	.	+	I
Agrostis capillaris	.	.	.	.	.	.	.	.	.	+	I
Polytrichum formosum	1	1	1	+	1	+	+	+	1	+	I
Pholia nutans	1	+	+	.	.	.	+	.	+	.	III
Atrichum undulatum	1	+	+	.	.	+	.	.	+	.	III
Pleurozium schreberi	.	.	.	.	.	+	+	+	.	+	II
Dicranum scoparium	+	.	.	.	.	.	.	.	.	.	I
Leucobryum glaucum	.	.	.	.	+	.	.	.	.	.	I
Mnium sp. div.	.	.	.	.	.	.	+	.	.	.	I
Brachythecium sp. div.	.	.	.	.	.	.	.	.	.	+	I

RESULTS

Fifteen observations in the permanent plots were performed in the years 1994-1996. Altogether, 124 taxa of macromycetes were identified, including 50 mycorrhizal (40.3%), 72 saprobic (58.1%) and 3 parasitic species (1.6%). Most saprobic fungi grew on wood (42 species – 58.3%) or on litter (24 species – 33.3%), while fungi growing on soil were less numerous (6 species – 8.3%).

No essential differences in the occurrence of fungi and their species composition were observed between the plots. The only exception was the ratio between mycorrhizal and saprobic species: it equalled 1:1.73 in plot I and 1:1.09 in plot II. It probably results from a greater amount of decaying wood and more diverse litter in plot I and higher density of the tree stand in plot II. Also, microclimatic conditions in plot I seem to be more humid than those in plot II.

Plot I. Altogether 102 species of macrofungi were identified. Detailed data on the abundance of fruit-bodies, their spatial frequency (SF) and temporal frequency (TF) are given in Table 4.

Among dominating species (in terms of the abundance of carpophores, as well as spatial distribution) the following should be mentioned: *Laccaria amethystina, Mycena sanguinolenta, Lactarius quietus, Armillaria mellea, Lactarius thejogalus, Mycena zephirus, Collybia asema, Lactarius camphoratus, Russula fragilis*. The total number of the fruit-bodies of these species in each case exceeded 300. Their spatial frequency was also very high and reached 100% in most cases. All of them fruited every year. Some species producing a large number of very tiny fruit-bodies were also recorded, either in a few subplots, e.g. *Orbilia xanthostigma, Sphaerobolus stellatus, Bisporella citrina*, or in the majority of the subplots, e.g. *Calocera cornea*. Altogether 26 species were recorded with more than 100 carpophores during 3 years of observations.

Species whose number of fruit-bodies found during the 3 years was below 10 were considered sporadic. Forty-one such species were found, 36 of which were recorded only once or twice.

Some species were found regularly, every year (37 species), some were recorded during 2 seasons (22 species). 42% of fungi (43 species), however, were noted only during 1 season, most often only once in one or two subplots. On the other hand, 13 species were found in all 10 subplots, and 5 species – more than 7 times.

Plot II. Altogether 92 species of macrofungi were identified here. Detailed data on the abundance of fruit-bodies, their spatial frequency (SF) and temporal frequency (TF) are given in Table 5.

Dominant species in the plot II are *Laccaria amethystina, Lactarius quietus, Collybia asema* and *Mycena zephirus*. The number of their fruit-bodies during the 3 years exceeded 300. All of them were found in all 10 subplots and, except for the last one, every year. Similarly to plot I, there were also some species which fruited abundantly, producing tiny or resupinate carpophores – *Stereum hirsutum, Crepidotus variabilis* – in most plots, *Orbilia xanthostigma*

Table 4

Synoptical fungus table of the plot I

DCy – number of fruit-bodies, SF – spatial frequency, TF – total temporal frequency and mDCv – maximum number of fruit-bodies during individual survey of the plot

Years	1994			1995			1996			1994–1996			
Number of observations	3			5			7			15			
Number of species	70			60			68			102			
	DCy	SF	TF	DCy	SF	TF	DCy	SF	TF	DCy	mDCv	SF	TF
1	2	3	4	5	6	7	8	9	10	11	12	13	14
Amanita citrina	21	6	3	2	2	1	1	1	1	24	17	6	5
A. fulva	1	1	1	.	.	.	2	1	1	3	1	1	2
A. gemmata	1	1	1	.	.	.	.	.	.	1	1	1	1
A. muscaria	2	1	2	3	1	1	.	.	.	5	3	1	3
A. pantherina	6	3	2	1	1	1	.	.	.	7	4	3	3
A. porphyria	2	2	1	.	.	.	1	1	1	3	2	2	2
A. rubescens	10	6	2	.	.	.	9	5	2	19	8	8	4
A. vaginata	.	.	.	.	.	.	5	4	1	5	4	4	1
Arachnopeziza aurelia	.	.	.	15	1	1	.	.	.	15	15	1	1
Armillaria mellea	238	9	2	250	9	2	82	7	2	570	248	10	6
Ascocoryne sarcoides	1	1	1	.	.	.	.	.	.	1	1	1	1
Bisporella citrina	.	.	.	.	.	.	210	2	1	210	210	2	1
Bjerkandera adusta	49	2	3	4	1	1	.	.	.	53	32	2	4
Calocera cornea	125	5	3	191	3	2	200	3	3	516	184	6	8
C. viscosa	2	2	2	2	2	2	6	2	2	10	4	3	6
Cantharellus cibarius	1	1	1	.	.	.	.	.	.	1	1	1	1
Clitocybe clavipes	44	8	2	8	2	2	6	3	2	58	41	8	6
Collybia asema	272	10	3	175	10	2	33	8	1	480	267	10	4
C. butyracea	13	3	2	5	3	1	7	4	3	25	12	6	8
C. cirrhata	9	2	2	.	.	.	.	.	.	9	6	2	2
C. dryophila	25	7	2	15	4	1	30	6	3	70	15	9	6

C. extuberans	.	.	.	.	.	.	1	1	1	1	1	1	1
C. peronata	18	8	3	.	.	.	41	8	4	59	28	8	7
C. tuberosa	.	.	.	15	1	1	.	.	.	15	15	1	1
Cystoderma amiantinum	.	.	.	1	1	1	.	.	.	1	1	1	1
Dacrymyces stillatus	400	5	3	60	1	1	500	1	1	960	170	6	5
Daedalea quercina	1	1	1	.	.	.	.	.	.	1	1	1	1
Daedaleopsis confragosa	.	.	.	5	1	2	13	2	3	18	10	2	5
Exidia plana	.	.	.	.	.	.	2	1	1	2	2	1	1
E. glandulosa	.	.	.	.	.	.	85	4	3	85	62	4	3
Fomes fomentarius	1	1	1	.	.	.	6	2	3	7	4	2	4
Gymnopilus penetrans	20	2	1	16	1	2	.	.	.	36	20	2	3
Hapalopilus rutilans	2	1	1	.	.	.	30	3	3	32	24	3	4
Hirneola auricula-judae	6	1	1	.	.	.	.	.	.	6	6	1	1
Hygrophoropsis aurantiaca	.	.	.	1	1	1	.	.	.	1	1	1	1
Hygrophorus nemoreus	8	5	3	5	3	1	10	2	1	23	10	5	5
Hymenochaete rubiginosa	4	1	1	34	3	1	176	4	4	214	92	5	6
Hymenoscyphus fructigenus	.	.	.	.	.	.	1	1	1	1	1	1	1
Hyphoderma radula	.	.	.	.	.	.	7	1	1	7	7	1	1
Hypholoma capnoides	.	.	.	25	1	1	.	.	.	25	25	1	1
H. fasciculare	52	1	2	38	2	2	58	3	1	148	58	3	5
Laccaria amethystina	952	10	3	1097	10	2	169	10	4	2218	644	10	9
L. bicolor	.	.	.	.	.	.	3	3	1	3	3	3	1
L. laccata	111	10	3	30	7	2	30	7	3	171	57	10	8
Lactarius camphoratus	88	10	1	129	6	1	186	10	3	403	164	10	5
L. chrysorrheus	24	7	2	9	2	1	.	.	.	33	23	7	3
L. quietus	872	10	2	151	9	2	24	7	2	1047	812	10	6
L. rufus	.	.	.	.	.	.	37	2	1	37	37	2	1
L. thejogalus	329	8	1	185	7	2	46	4	1	560	329	9	4
Lepista nuda	.	.	.	1	1	1	.	.	.	1	1	1	1
Lycoperdon nigrescens	17	8	3	3	1	1	1	1	1	21	13	8	5

Tab. 4 cont.

1	2	3	4	5	6	7	8	9	10	11	12	13	14
L. perlatum	52	7	3	1	1	1	10	3	2	63	32	9	6
L. pyriforme	.	.	.	.	.	.	2	1	1	2	2	1	1
Macrolepiota procera	.	.	.	2	2	1	.	.	.	2	2	2	1
M. rhacodes	2	2	2	.	.	.	.	.	.	2	1	2	2
Marasmius androsaceus	.	.	.	2	1	1	.	.	.	2	2	1	1
Meruliopsis corium	.	.	.	.	.	.	12	1	2	12	8	1	2
Mycena aetites	7	1	1	.	.	.	.	.	.	7	7	1	1
M. atroalba	.	.	.	.	.	.	6	1	1	6	6	1	1
M. epipterygia	19	6	2	1	1	1	.	.	.	20	16	7	3
M. galericulata	98	6	2	24	4	2	10	2	1	132	82	7	5
M. galopoda	74	8	3	1	1	1	38	6	2	113	67	10	6
M. polygramma	.	.	.	.	.	.	3	1	1	3	3	1	1
M. pura	6	1	2	.	.	.	6	1	1	12	6	1	3
M. sanguinolenta	1549	10	2	21	7	1	66	8	2	1636	1485	10	5
M. zephirus	209	10	2	305	10	2	9	2	1	523	301	10	5
Orbilia xanthostigma	.	.	.	400	3	3	.	.	.	400	150	3	3
Paxillus involutus	9	4	2	4	3	2	3	2	2	16	8	7	6
Peniophora quercina	120	4	3	50	1	1	.	.	.	170	87	5	4
Phellinus robustus	3	2	2	.	.	.	.	.	.	3	2	2	2
Phlebia radiata	239	2	3	13	4	2	.	.	.	245	180	4	5
Phaeomarasmius erinaceus	.	.	.	.	.	.	1	1	1	1	1	1	1
Pholiota lenta	74	7	2	49	6	2	3	2	1	126	64	8	5
Piptoporus betulinus	.	.	.	.	.	.	2	1	1	2	2	1	1
Pluteus atricapillus	20	9	2	3	2	1	6	3	2	29	11	9	5
P. atromarginatus	.	.	.	.	.	.	1	1	1	1	1	1	1
Psathyrella hydrophila	45	1	3	27	1	1	.	.	.	72	27	1	4
Rickenella fibula	.	.	.	1	1	1	1	1	1	2	1	2	2

R. setipes	.	.	.	.	.	.	6	2	2	6	4	2	2
Russula chamaeleontina	92	10	2	10	6	2	6	1	1	108	79	10	5
R. cyanoxantha	23	5	1	8	4	2	9	4	3	40	23	8	6
R. emetica	7	1	1	3	2	2	39	9	3	49	23	9	6
R. fragilis	259	10	2	42	8	2	7	3	1	308	254	10	5
R. laurocerasi	2	1	1	4	2	3	.	.	.	6	2	3	4
R. nauseosa	4	2	1	.	.	.	.	.	.	4	4	2	1
R. ochroleuca	.	.	.	.	.	.	10	2	1	10	10	2	1
R. puellaris	135	10	1	11	6	1	3	1	1	149	135	10	3
R. velenovskyi	33	7	2	.	.	.	1	1	1	34	32	7	3
R. vesca	7	1	1	.	.	.	.	.	.	7	7	1	1
R. virescens	.	.	.	2	2	1	.	.	.	2	2	2	1
Schizopora paradoxa	197	10	3	64	7	3	9	6	2	270	106	10	8
Sclerotinia sp.	31	3	1	.	.	.	.	.	.	31	31	3	1
Sphaerobolus stellatus	205	3	2	40	1	1	.	.	.	245	145	4	3
Stereum hirsutum	77	4	3	29	1	2	38	3	2	144	37	5	7
Thelephora terrestris	3	3	2	3	1	1	43	3	2	49	39	4	5
Trametes hirsuta	15	1	2	.	.	.	6	1	1	21	12	1	3
T. versicolor	25	1	1	5	1	1	3	1	1	33	25	1	3
Tricholomopsis rutilans	.	.	.	.	.	.	1	1	1	1	1	1	1
Tylopilus felleus	.	.	.	.	.	.	2	2	1	2	2	2	1
Xerocomus badius	1	1	1	4	2	1	1	1	1	6	4	2	3
X. chrysenteron	9	4	1	3	2	1	1	1	1	13	9	5	3
X. subtomentosus	2	2	2	.	.	.	.	.	.	2	1	2	2

Table 5

Synoptical fungus table of the plot II

DCy – number of fruit-bodies, SF – spatial frequency, TF – total temporal frequency and mDCv – maximum number of fruit-bodies during individual survey of the plot

Years	1994			1995			1996			1994–1996			
Number of observations	3			5			7			15			
Number of species	62			46			53			92			
	DCy	SF	TF	DCy	SF	TF	DCy	SF	TF	DCy	mDCv	SF	TF
1	2	3	4	5	6	7	8	9	10	11	12	13	14
Amanita citrina	17	7	2	3	3	2	.	.	.	20	16	7	4
A. fulva	2	2	1	.	.	.	.	.	.	2	2	2	1
A. muscaria	15	5	3	4	2	2	4	3	1	23	7	6	6
A. pantherina	6	5	2	.	.	.	.	.	.	6	4	5	2
A. porphyria	1	1	1	.	.	.	.	.	.	1	1	1	1
A. rubescens	11	6	2	4	4	3	3	2	1	18	8	7	6
A. vaginata	.	.	.	.	.	.	2	2	1	2	2	2	1
Arachnopeziza aurelia	.	.	.	101	5	2	.	.	.	101	62	5	2
Armillaria mellea	126	10	2	61	9	2	10	5	1	197	76	10	5
Boletus edulis	.	.	.	.	.	.	3	2	2	3	2	2	2
Cantharellus cibarius	.	.	.	1	1	1	4	2	1	5	4	2	2
Clitocybe clavipes	58	9	3	.	.	.	12	7	2	70	49	10	5
Collybia asema	312	10	2	52	10	2	10	7	1	374	301	10	5
C. butyracea	12	2	1	2	2	1	.	.	.	14	12	4	2
C. cirrhata	.	.	.	11	2	1	.	.	.	11	11	2	1
C. dryophila	25	7	3	.	.	.	2	1	1	27	15	7	4
C. tuberosa	.	.	.	10	1	1	.	.	.	10	10	1	1
Cordyceps capitata	.	.	.	.	.	.	4	1	1	4	4	1	1
Cortinarius hemitrichus	.	.	.	.	.	.	1	1	1	1	1	1	1

Craterellus cornucopioides	4	2	2	.	.	.	154	3	2	158	112	4	4
Crepidotus variabilis	274	6	2	1	1	1	48	2	3	323	216	6	6
Cystoderma amiantinum	.	.	.	1	1	1	.	.	.	1	1	1	1
Dacrymyces stillatus	50	1	1	.	.	.	.	.	.	50	50	1	1
Elaphomyces muricatus	.	.	.	.	.	.	5	1	1	5	5	1	1
Exidia plana	.	.	.	.	.	.	38	2	2	38	22	2	2
E. glandulosa	.	.	.	.	.	.	7	1	1	7	7	1	1
Fomes fomentarius	.	.	.	.	.	.	1	1	1	1	1	1	1
Gymnopilus penetrans	.	.	.	1	1	1	.	.	.	1	1	1	1
Hapalopilus rutilans	5	1	2	.	.	.	3	1	1	8	4	1	3
Hirneola auricula-judae	36	2	1	.	.	.	.	.	.	36	36	2	1
Hygrophorus nemoreus	2	1	1	.	.	.	.	.	.	2	2	1	1
Hymenochaete rubiginosa	27	3	2	.	.	.	.	.	.	27	19	3	2
Hymenoscyphus fructigenus	10	1	1	.	.	.	.	.	.	10	10	1	1
Hypholoma fasciculare	11	2	2	6	2	1	.	.	.	17	10	3	3
H. sublateritium	30	1	1	7	1	1	.	.	.	37	30	2	2
Hypoxylon fuscum	.	.	.	100	1	1	.	.	.	100	100	1	1
Laccaria amethystina	652	10	3	567	10	2	23	9	3	1242	515	10	8
L. laccata	.	.	.	39	4	1	4	2	1	43	39	4	2
Lactarius camphoratus	18	5	2	.	.	.	17	6	2	35	16	7	4
L. chrysorrheus	59	6	2	7	3	2	1	1	1	67	55	6	5
L. necator	3	3	1	.	.	.	1	1	1	4	3	3	2
L. piperatus	1	1	1	.	.	.	.	.	.	1	1	1	1
L. quietus	522	10	2	130	10	2	5	3	2	657	504	10	6
L. rufus	.	.	.	.	.	.	1	1	1	1	1	1	1
L. thejogalus	.	.	.	10	5	1	.	.	.	10	10	5	1
L. torminosus	25	2	2	23	3	1	3	2	2	51	23	5	3
L. vellereus	.	.	.	.	.	.	6	3	1	6	6	3	1
Leccinum scabrum	2	1	1	.	.	.	3	1	3	5	2	1	4
Lepista inversa	3	2	1	.	.	.	.	.	.	3	3	2	1

Tab. 5 cont.

1	2	3	4	5	6	7	8	9	10	11	12	13	14
L. nuda	4	3	2	3	3	2	.	.	.	7	3	3	4
Lycoperdon molle	11	4	1	5	2	2	.	.	.	16	11	4	3
L. nigrescens	42	9	3	18	3	2	4	1	1	64	32	10	6
L. perlatum	76	10	2	18	6	2	2	2	1	96	39	10	5
M. scorodonius	1	1	1	.	.	.	.	.	.	1	1	1	1
Merulius tremellosus	.	.	.	7	2	2	10	1	1	17	10	2	3
Mycena aetites	.	.	.	.	.	.	5	1	1	5	5	1	1
M. epipterygia	5	2	2	.	.	.	.	.	.	5	4	2	2
M. galericulata	17	3	2	2	1	1	.	.	.	19	15	3	3
M. galopoda	13	2	2	.	.	.	20	2	2	23	18	4	4
M. polygramma	.	.	.	.	.	.	1	1	1	1	1	1	1
M. pura	.	.	.	1	1	1	3	1	1	4	3	2	2
M. sanguinolenta	.	.	.	.	.	.	2	2	1	2	2	2	1
M. zephirus	343	10	2	206	8	2	.	.	.	549	341	10	4
Orbilia xanthostigma	450	1	2	50	1	1	.	.	.	500	250	2	2
Paxillus involutus	5	1	1	5	2	1	1	1	1	11	5	3	3
Peniophora quercina	204	4	3	52	3	1	2	2	2	258	99	7	6
Phanerochaete sanguinea	.	.	.	.	.	.	6	1	1	6	6	1	1
Phellinus robustus	4	1	1	.	.	.	.	.	.	4	4	1	1
Phlebia radiata	6	1	1	.	.	.	100	1	1	106	100	1	2
Pholiota lenta	92	9	2	30	4	2	.	.	.	122	84	10	4
Piptoporus betulinus	1	1	1	4	3	1	10	3	2	15	5	5	4
Pluteus atricapillus	18	8	2	2	2	1	2	2	2	22	10	8	5
Psathyrella hydrophila	131	2	3	135	1	1	.	.	.	266	135	2	4
Rickenella fibula	.	.	.	.	.	.	1	1	1	1	1	1	1
Russula chamaeleontina	112	10	2	37	6	3	4	1	1	153	78	10	6
R. cyanoxantha	25	9	2	.	.	.	2	1	1	27	21	9	3
R. emetica	4	1	1	5	3	2	25	7	1	34	25	7	4

R. fragilis	260	10	2	10	5	2	.	.	.	270	254	10	4
R. laurocerasi	1	1	1	.	.	.	.	.	.	1	1	1	1
R. lepida	2	1	1	.	.	.	.	.	.	2	2	1	1
R. nitida	6	2	1	.	.	.	.	.	.	6	6	2	1
R. puellaris	45	8	1	3	1	1	16	3	2	64	45	9	4
R. velenovskyi	56	10	2	.	.	.	2	2	1	58	36	10	3
R. vesca	.	.	.	.	.	.	1	1	1	1	1	1	1
R. virescens	.	.	.	6	3	1	.	.	.	6	6	3	1
Schizopora paradoxa	170	5	3	21	6	2	7	5	2	198	91	8	7
Stereum hirsutum	28	3	2	192	6	2	123	6	4	343	172	8	8
S. sanguinolentum	.	.	.	.	.	.	45	1	1	45	45	1	1
Trametes versicolor	36	2	2	.	.	.	.	.	.	36	30	3	2
Tricholoma sulphureum	35	2	2	47	3	2	5	2	3	87	35	3	7
Xerocomus badius	.	.	.	1	1	1	.	.	.	1	1	1	1
X. chrysenteron	10	4	2	.	.	.	.	.	.	10	7	4	2

– in two subplots. Altogether, there were 17 species with the number of fruit-bodies exceeding 100 in plot II.

The number of sporadic species with less than 10 carpophores noted during the 3 years equalled 37; only 3 of them were found more than twice.

Twenty-one species were recorded every year, 27 were found during 2 seasons and 47.8% of all the fungi found here (44 species) were found only during 1 season. Most of them were collected only once in one or two subplots. On the other hand, 12 species were found on all 10 subplots. Only 2 species were recorded more than 7 times: *Laccaria amethystina* and *Stereum hirsutum*.

Trophic groups. In plot I 37 species of mycorrhizal fungi were found; 7 of them were recorded exclusively in this plot (Table 6). The group of saprotrophic fungi consisted of 64 species (25 collected exclusively in plot I). Among them, 37 grew on wood, 21 – on litter and only 6 on soil. One species of wood parasites, *Phellinus robustus*, was also recorded (Table 7).

Table 6

List of mycorrhizal species collected during three years of studies (1994–1996) in two permanent plots

Species	Number of fruit-bodies	Species	Number of fruit bodies
On the plots I and II			
Laccaria amethystina (Huds.: Hook.) Cke.	3460	*Lactarius rufus* (Scop.) Fr.	38
Lactarius quietus (Fr.) Fr.	1704*	*Amanita rubescens* (Pers.: Fr.) S.F. Gray	37
Russula fragilis (Fr.) Fr.	578	*Amanita muscaria* (L.) Pers.	28
Lactarius thejogalus (Bull.) Fr.	570	*Paxillus involutus* (Batsch: Fr.) Fr.	27
Lactarius camphoratus (Bull.) Fr.	438	*Hygrophorus nemoreus* (Pers.: Fr.) Fr.	25
Russula chamaeleontina Fr.	261	*Xerocomus chrysenteron* (Bull.) Quél.	23
Laccaria laccata (Scop.: Fr.) Berk. et Br.	214	*Amanita pantherina* (DC:Fr.) Krombh.	13
Russula puellaris Fr.	213	*Russula vesca* Fr.	8
Lycoperdon perlatum Pers.: Pers.	159	*Russula virescens* (Schaeff.) Fr.	8
Lactarius chrysorrheus Fr.	100*	*Amanita vaginata* (Bull.: Fr.) Quél.	7
Russula velenovskyi Melz. et Zv.	92	*Russula laurocerasi* Melzer	7*
Lycoperdon nigrescens Pers.: Pers.	85	*Xerocomus badius* (Fr.) Kühn.: Gilb.	7
Russula emetica (Schaeff.) Pers.: Fr.	83	*Cantharellus cibarius* Fr.	6
Russula cyanoxantha (Schaeff.) Fr.	67	*Amanita fulva* Sing.	5
Amanita citrina (Schaeff.) Pers.	44	*Amanita porphyria* Alb. et Schw.: Fr.	4
Only on the plot I			
Thelephora terrestris (Ehrhart: Willd.) Fr.	49	*Tylopilus felleus* (Bull.: Fr.) Karst.	2
Russula ochroleuca Pers.	10	*Xerocomus subtomentosus* (L.: Fr.) Quél.	2
Russula nauseosa (Pers.) Fr.	4	*Amanita gemmata* (Fr.) Gill.	1
Laccaria bicolor (R. Mre.) Orton	3		
Only on the plot II			
Craterellus cornucopioides (L.) Pers.	158	*Leccinum scabrum* (Bull.: Fr.) S.F. Gray	5
Tricholoma sulphureum (Bull.: Fr.) Kumm.	87	*Lactarius necator* (Bull. em. Pers.: Fr.) Karst.	4
Lactarius torminosus (Schaeff.: Fr.) Pers.	51	*Boletus edulis* Bull.: Fr.	3
Lycoperdon molle Pers.: Pers.	16	*Russula lepida* Fr.	2
Lactarius vellereus (Fr.) Fr.	6	*Cortinarius hemitrichus* Fr.	1
Russula nitida (Pers.: Fr.) Fr.	6	*Lactarius piperatus* (L.) S.F. Gray	1
Elaphomyces muricatus Fr.	5*		

* – the species of fungi associated with oak

Table 7

List of saprotrophic species collected during three year (1994–1996) research on two permanent plots

Species	Number of fruit-bodies	Substrate	Species	Number of fruit-bodies	Substrate
On the plots I and II					
1	2	3	1	2	3
Mycena sanguinolenta (Alb. et Schw.: Fr.) Karst.	1638	l	*Exidia glandulosa* (Bull.): Fr.	92	w
Mycena zephirus (Fr.: Fr.) Kumm.	1072	l	*Trametes versicolor* (L.) Pil.	69	w
Dacrymyces stillatus Nees: Fr.	1010	w	*Pluteus atricapillus* (Batsch) Fayod	51	w
Orbilia xanthostigma (Fr.) Fr.	900	w	*Hirneola auricula-judae* (Bull.) Berk.	42	w
Collybia asema (Bull.: Fr.) Kumm.	854	l	*Exidia plana* (Wigg. ex Schleich.) Donk	40	w
Armillaria mellea (Vahl.: Fr.) Kumm. s.l.	767	w	*Hapalopilus rutilans* (Pers.: Fr.) Karst.	40	w
Stereum hirsutum (Willd.:Fr.) Pers.	487	w	*Collybia butyracea* (Bull.: Fr.) Kumm.	39	l
Schizopora paradoxa (Schrad.:Fr.) Donk s.l.	468	w	*Gymnopilus penetrans* (Fr.: Fr.) Murr.	37	w
Peniophora quercina (Pers.:Fr.) Cke.	428*	w	*Collybia tuberosa* (Bull.:Fr.) Kumm.	25	l
Phlebia radiata Fr.	351*	w	*Mycena epipterygia* (Scop.) S.F. Gray	25	l
Psathyrella hydrophila (Bull. ex Merat) Mre.	338	w	*Collybia cirrhata* (Schum.:Fr.) Kumm.	20	l
Pholiota lenta (Pers.: Fr.) Sing.	248	w	*Piptoporus betulinus* (Bull.: Fr.) Karst.	17	w
Hymenochaete rubiginosa (Dicks.: Fr.) Lév.	241*	w	*Mycena pura* (Pers.: Fr.) Kumm.	16	l
Hypholoma fasciculare (Huds.: Fr.) Kumm.	165	w	*Hymenoscyphus fructigenus* (Bull.: Fr.) S. F. Gray	11*	l
Mycena galericulata (Scop.: Fr.) Quél.	151	w	*Fomes fomentarius* (L.) Fr.	8	w
Mycena galopoda (Pers.: Fr.) Kumm.	136	l	*Lepista nuda* (Bull.:Fr.) Cooke	8	s
Clitocybe clavipes (Pers.: Fr.) Kumm.	128	l	*Phellinus robustus* (Karst.) Bourd. et Galz.	7*	w
Arachnopeziza aurelia (Pers.) Fuckel	116	s	*Mycena aetites* (Fr.) Quél.	5	l
Collybia dryophila (Bull.:Fr.) Kumm.	97	l	*Mycena polygramma* (Bull.: Fr.) S. F. Gray	4	w
			Rickenella fibula (Bull.: Fr.) Raith.	3	l
			Cystoderma amiantinum (Scop.:Fr.) Fayod	2	s
Only on the plot I					
Calocera cornea (Batsch: Fr.) Fr.	516	w	*Rickenella setipes* (Fr.: Fr.) Raith.	6	l
Sphaerobolus stellatus Tode: Pers.	245	l	*Lycoperdon pyriforme* Schaeff.: Pers.	2	w
Bisporella citrina (Batsch: Fr.) Korf et Carpe	210	l	*Macrolepiota procera* (Scop.: Fr.) Sing.	2	s
Collybia peronata (Bolt.: Fr.) Kumm.	59	l	*Macrolepiota rhacodes* (Vitt.) Sing.	2	s
Bjerkandera adusta (Willd.: Fr.) Karst.	53	w	*Marasmius androsaceus* (L.: Fr.) Fr.	2	l
Sclerotinia sp.	31	l	*Ascocoryne sarcoides* (Jacq.: Fr.) Groves et Wilson	1	w
Hypholoma capnoides (Fr.: Fr.) Kumm.	25	w	*Collybia extuberans* Fr.	w	l
Trametes hirsuta (Wulf.: Fr.) Pil.	21	w	*Daedalea quercina* (L.) Pers.	1*	w
Daedaleopsis confragosa (Bolt.: Fr.) Schroet.	18	w	*Hygrophoropsis aurantiaca* (Wulf.:Fr.) Maire	1	s
Meruliopsis corium (Fr.) Ginns	12	w	*Phaeomarasmius erinaceus* (Fr.) Kühn.	1	w
Calocera viscosa (Pers.: Fr.) Fr.	10	w	*Pluteus atromarginatus* (Sing.) Kühn.	1	w
Hyphoderma radula (Fr.: Fr.) Donk	7	w	*Tricholomopsis rutilans* (Schaeff.: Fr.) Kumm.	1	w
Mycena atroalba (Bolt.: Fr.) Gill.	6	w			
Only on the plot II					
Crepidotus variabilis (Pers.: Fr.) Kumm.	323	l	*Phanerochaete sanguinea* (Fr.) Pouzar	6	w
Hypoxylon fuscum (Pers.: Fr.) Fr.	100	w	*Cordyceps capitata* (Holmskjold: Fr.) Link	4	l
Stereum sanguinolentum (A. et S.: Fr.) Fr.	45	w	*Lepista inversa* (Scop.) Pat.	3	l
Hypholoma sublateritium (Fr.) Quél.	37	w	*Marasmius scorodonius* (Fr.) Fr.	1	l
Merulius tremellosus Schrad.: Fr.	17	w			

* – the species of fungi associated with oak

Ecological groups: l – litter; w – wood; s – soil

In plot II, 43 species of mycorrhizal fungi were found; 13 of them were recorded exclusively in this plot. Among them, *Russula nitida, Lactarius torminosus, L. necator* and *Cortinarius hemitrichus* were associated with the *Betula* tree growing in the plot (Table 6). The group of saprotrophic fungi consisted of 47 species (8 collected exclusively in plot I). Among them, 27 grew on wood, 17 – on litter and only 3 on soil. Two parasitic species were recorded: *Phellinus robustus* on living oak and *Cordyceps capitata* on hypogeous *Elaphomyces muricatus* (Table 7).

Among the fungi found in the plots examined, 10 species were clearly connected with oak trees: 4 mycorrhizal species (*Elaphomyces muricatus, Lactarius chrysorrheus, L. quietus, Russula laurocerasi*), 5 saprobic species (*Hymenochaete rubiginosa, Hymenoscyphus fructigenus, Peniophora quercina, Phlebia radiata, Daedalea quercina*) and one parasitic species (*Phellinus robustus*) (Tables 6 and 7).

The presence of fungi inscribed on the Red List (Wojewoda and Ławrynowicz 1992) is worth noticing. Seven such species were recorded: *Boletus edulis* (category V), *Lactarius chrysorrheus and Phaeomarasmius erinaceus* (R), *Cantharellus cibarius, Collybia extuberans, Macrolepiota procera* and *M. rhacodes* (I).

DISCUSSION

The plots in the Łagiewnicki Forest, situated within a big city, is subject to the direct and indirect human impact on vegetation and especially on fungi. The direct impact includes heavy year-by-year penetration by people hunting for mushrooms during the season, which limits the number of fruit-bodies, especially of edible species. The indirect impact consists in air pollution and forest management, factors limiting fungal development.

Nevertheless, 124 species of macrofungi were identified during 15 surveys in the two observation plots. The number is quite low but is comparable with that found in some plots in the Niepołomice Forest near Kraków (Wojewoda et al. 1999). On the other hand, the species composition of fungi is similar to that in the Białowieża National Park (Skirgiełło 1998), which could be the indicative of the natural character of the forest now situated within the city of Łódź.

The assesment of the interdependence between the composition of fungal species and the presence of particular oak species, including different ecological and geographical conditions, was one of the chief aims of the European oak forest monitoring. The results of the studies in the Łagiewnicki Forest corroborate the observation that fungi show no preferences in relation to the oak species, either *Qu. robur* or *Qu. petraea* (Skirgiełło 1998; Lisiewska and Połczyńska 1998; Łuszczyński 1998; Wojewoda et. al. 1999; Ławrynowicz and Stasińska 2000; Ławrynowicz 2001). A group of fungi connected with oak, regardless of the

tree species, can be distinguished in all the plots studied in Poland. However, ecological conditions of the occurrence of both oak species are very similar. The influence of other tree species on the composition of macrofungi in the Łagiewnicki Forest was conspicuous, e.g. the presence of pine entailed the occurrence of *Lactarius rufus* in both plots, while birch in plot II was accompanied by *Russula nitida, Lactarius torminosus* and *L. necator.*

As already mentioned, the plots in the Łagiewnicki Forest are regularly influenced by people collecting edible mushroom. This was probably the reason of strikingly small number of fruit-bodies of some species.

A comparative analysis of the three year studies in 16 plots in 7 localities covering all the main types of oak forests in Poland will be published in a separate paper. As some interesting differences in the fungal composition of macromycetes connected with the *Quercus species: Qu. pubescens, Qu. cerris* and *Qu. robur, Qu. petraea*, were also revealed, a comprehensive analysis of the results from Poland, the Czech Republic and Italy will follow.

SUMMARY AND CONCLUSIONS

1. A monitoring study on macromycetes was carried out in ca. 90-year-old oak forest representing the association of *Calamagrostio-Quercetum petraeae* in the Łagiewnicki Forest, the city forest in Łódź (Central Poland), in the years 1994–1996.
2. Two permanent study plots were set up, 1000 m^2 each, divided into 10 (10 m × 10 m) subplots. Fifteen observations were performed in each of them.
3. During the 3 years of studies, 124 species of macromycetes were identified: 7 *Asco-* and 117 *Basidiomycota.* The number of fruit-bodies, as well as spatial and temporal frequency are given for each species.
4. Seven species inscribed on the Red List of threatened macromycetes in Poland were found: *Boletus edulis* (category V), *Lactarius chrysorrheus* and *Phaeomarasmius erinaceus* (R), *Cantharellus cibarius, Collybia extuberans, Macrolepiota procera* and *M. rhacodes* (I).
5. Ten species were clearly connected with oak trees: 4 mycorrhizal species (*Elaphomyces muricatus, Lactarius chrysorrheus, L. quietus, Russula laurocerasi*), 5 saprobic species (*Hymenochaete rubiginosa, Hymenoscyphus fructigenus, Peniophora quercina, Phlebia radiata, Daedalea quercina*) and one parasitic species (*Phellinus robustus*).
6. Among the species collected, 50 are mycorrhizal (40.3%), 72 are saprotrophic (58.1%) and 2 are parasitic species (1.6%).
7. Neither qualitative nor quantitative differences regarding the affinity between macromycetes and particular species of oak: *Quercus robur* or *Qu. petraea*, were found.
8. A group of dominant macromycetes was distinguished on the basis of the abundance and frequency. They are as follows: *Laccaria amethystina, Mycena sanguinolenta, Lactarius quietus, Armillaria mellea, Lactarius*

thejogalus, Mycena zephirus, Collybia asema, Lactarius camphoratus, Russula fragilis.

9. The number of species found is quite low but is comparable with some other plots in the project. This could be a result of human activity in the forest and its vicinity. On the other hand, the species composition of fungi bears resemblance to that in the Białowieża National Park (Skirgiełło 1998), which could be indicative of the natural origin of the forest now situated within the city of Łódź.
10. A relatively high number of mycorrhizal fungi (40.3%) proves that the influence of both increased air pollution and intensive penetration by people, brought about by the proximity of the forest to a big city, on the ratio of this group of fungi and the group of saprobic species is fairly insignificant. However, the number of recorded fruit-bodies of edible mushrooms was greatly reduced due to mushroom hunting.

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REFERENCES

Dennis R. W. G. 1968. British *Ascomycetes*. J. Cramer, Lehre.

Domański S. 1972. Fungi. *Polyporaceae* I (resupinatae). *Mucronoporaceae* I (resupinatae). For. Sci. Publ. Departm. Nat. Cent. Sci. Techn. Econ. Inform. Warsaw.

Domański S., Orłoś H., Skirgiełło A. 1973. Fungi. Polyporaceae II (pileatae), *Mucronoporaceae* II (pileatae), *Ganodermataceae, Bondarzewiaceae, Boletopsidaceae, Fistulinaceae*. For. Sci. Publ. Departm. Nat. Cent. Sci. Techn. Econ. Inform. Warsaw.

Fellner R., Arnolds E. 1991. Proposal for monitoring of macromycetes in European spruce (*Picea*) and oak (*Quercus*) forests. In: E. Arnolds, H. Kreisel (eds). Conservation of fungi in Europe. Proceedings of the second meeting of the ECCF 13–18 Sept. at Vilm, Greifswald: 85-86.

Hawksworth D. L., Kirk P. M., Sutton B. C., Pegler D. N. 1995. Ainsworth and Bisby's Dictionary of the fungi. 8 ed. JMJ Univ. Press, Cambridge.

Jakubowska-Gabara J. 1996. Phytosociological documentation of permanent plots in Poland. In: R. Fellner, M. Ławrynowicz, C. Perini (eds). Mycological monitoring in European oak forests – the pilot project (msc.).

Jülich W. 1984. Die Nichtblätterpilze, Gallertpilze und Bauchpilze (*Aphyllophorales, Heterobasidiomycetes, Gastromycetes*). In: H. Gams (ed.) Kleine Kryptogamenflora 2b/1. Basidiomyceten 1. VEB G. Fischer, Jena.

Kreisel H. (ed.) 1987. Pilzflora der Deutschen Democratischen Republik. *Basidiomycetes* (Gallert-, Hut- und Bauchpilze). VEB G. Fischer, Jena.

Lisiewska M., Połczyńska M. 1998. Changes in macromycetes of oak-hornbeam forest in the „Dębina reserve" (Northern Wielkopolska). Acta Mycol. 33 (2): 191–230.

Ławrynowicz M. 2001. Macromycetes of the oak forest in the Jurassic Landscape Park (Częstochowa Upland) – monitoring studies. Acta Mycol. 36 (1): 81–110.

Ławrynowicz M., Stasińska M. 2000. Macromycetes of the *Stellario-Carpinetum* in the Ińsko Landscape Park (NW Poland) – monitoring studies. Acta Mycol. 35 (2): 157–182.

Ławrynowicz M., Lisiewska M., Skirgiełło A., Wojewoda W. 2001. Monitoring mikologiczny w europejskich lasach dębowych. In: Botanika w dobie biologii

molekularnej. Materiały sesji i sympozjów 52 Zjazdu Polskiego Towarzystwa Botanicznego. Poznań 23–26 wrzesień: 182.

Łuszczyński J. 1998. Macromycetes of the *Potentillo albae-Quercetum* in the Świętokrzyskie Mts. – monitoring studies. Acta Mycol. 33 (2): 231–245.

Mirek Z., Piękoś-Mirkowa H., Zając A., Zając M. 1995. Vascular plants of Poland – a checklist W. Szafer Institute of Botany, Pol. Acad. Sci. Kraków.

Moser M. 1983. Die Röhrlinge und Blätterpilze (*Polyporales, Boletales, Agaricales, Russulales*). In: H. Gams (ed.) Kleine Kryptogamenflora 2b/2. Basidiomyceten. 2. VEB G. Fischer, Jena.

Perini C., Ławrynowicz M., Fellner R. 1995. Mycological monitoring in European oak forests: the pilot project for Italy, Poland and Czech Republik. XII Congress of European Mycologists, 3–7 September, Wageningen The Netherlands: 47–48.

Perini C., Salerini E., Lagana A., Barluzzi, V. De Dominicis, Ławrynowicz M., Fellner R. 2000. Monitoraggio de macromiceti in querceti europei: primi resultati di un progetto pilota. Micologia 2000: 415–421. A.M.B. Fondazione Centro Studi Micologici.

Skirgiełło A. 1998. Macromycetes of oak-hornbeam forests in Białowieża National Park – monitoring studies. Acta Mycol. 33 (2): 171–189.

Wojewoda W. 1977. Flora Polska. Grzyby (*Mycota*) 7: *Auricularilaes, Septobasidiales, Tremellales*. PWN, Warszawa-Kraków.

Wojewoda W., Ławrynowicz M. 1992. Red list of threatened macrofungi in Poland. In: K. Zarzycki, W. Wojewoda, Z. Heinrich (eds). List of threatened plants in Poland. 2 ed. W. Szafer Institute of Botany PAN, Kraków: 27–56.

Wojewoda W., Heinrich Z., Komorowska H. 1999. Macromycetes of oak-lime-hornbeam woods in the Niepołomice Forest near Kraków (S Poland) – monitoring studies. Acta Mycol. 34 (2): 201–266.

Makromycetes lasów dębowych w Lesie Łagiewnickim (Polska Środkowa) – studia monitoringowe

Streszczenie

Praca przedstawia wyniki badań grzybów makroskopowych w latach 1994–1996 w ramach międzynarodowego projektu badawczego „Mycological monitoring in European oak forests". Badania prowadzono na dwóch stałych powierzchniach obserwacyjnych założonych w Lesie Łagiewnickim – kompleksie leśnym położonym w granicach administracyjnych miasta Łodzi i jednocześnie na terenie Parku Krajobrazowego Wzniesień Łódzkich.

Powierzchnie założone w Lesie Łagiewnickim, oznaczone jako I i II, a w oryginale projektu P_9 i P_{10} (po 1000 m^2 każda z podziałem na 10 podpowierzchni) należą do grupy 16 powierzchni wytypowanych w Polsce i obejmujących reprezentatywne ekosystemy z udziałem dębów. Drzewostan prezentowanych powierzchni składał się głównie z ok. 90-letnich dębów *Quercus petraea* tworzących zbiorowisko zbliżone do kwaśnej subatlantyckiej dąbrowy *Calamagrostio-Quercetum petraeae*.

W ciągu trzech sezonów wegetacyjnych dokonano łącznie 15 obserwacji, w czasie których zbierano na powierzchniach wszystkie pojawiające się gatunki grzybów i liczono ich owocniki, oddzielnie na każdej podpowierzchni. Uzyskane dane zestawiono w tabele analityczne (tab. 4 i 5) oraz syntetyczne (tab. 6 i 7). Na dwóch powierzchniach (w sumie 2000 m^2) zidentyfikowano łącznie 124 gatunki grzybów makroskopowych.

Zebrane grzyby wykazują szerokie zróżnicowanie taksonomiczne i ekologiczne; 7 gatunków należy do *Ascomycota* a 117 do *Basidiomycota*. Reprezentują one różne grupy troficzne: 50 gatunków (40,3%) to grzyby mikoryzowe, 72 (58,1%) to gatunki saprotroficzne rozwijające się na glebie, w warstwie ściółki i na martwym drewnie. Tych ostatnich jest najwięcej: 42 gatunki (58,3%

grzybów saprotroficznych zebranych na badanych powierzchniach). Stwierdzono również występowanie 2 gatunków pasożytniczych (1,6%). Do grupy gatunków dominujących pod względem obfitości owocników jak również frekwencji czasowej i przestrzennej należą *Laccaria amethystina, Mycena sanguinolenta, Lactarius quietus, Armillaria mellea, Lactarius thejogalus, Mycena zephirus, Collybia asema, Lactarius camphoratus, Russula fragilis.*

Liczba gatunków stwierdzonych w Lesie Łagiewnickim, w porównaniu z innymi powierzchniami monitorowanymi w Polsce, jest raczej niska, podobna do liczby stwierdzonej na niektórych powierzchniach w Puszczy Niepołomickiej pod Krakowem. Natomiast skład gatunkowy makromycetes jest zbliżony do występującego na powierzchniach w Puszczy Białowieskiej, co może świadczyć o zbliżonym do naturalnego charakterze łódzkiego lasu miejskiego. Na uwagę zasługuje duży udział grzybów mikoryzowych (40,3%). Natomiast liczba stwierdzanych na powierzchniach owocników grzybów jadalnych jest uderzająco mała, co jest spowodowane intensywną penetracją przez amatorów grzybobrania.

Na badanych powierzchniach zanotowano występowanie 10 gatunków wyraźnie związanych z dębem. Stwierdzono również 7 gatunków znajdujących się na Czerwonej Liście gatunków zagrożonych w Polsce.