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Macromycetes of oak-lime-hornbeam woods in the Niepołomice Forest near Kraków (S Poland) – monitoring studies

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In the years 1994–1996 studies on macromycetes of the Niepołomice Forest near Kraków were made in four plots designated in deciduous forests (*Tilio-Carpinetum stachyetosum*) with a population of *Carpinus betulus*, *Quercus robur* and *Tilia cordata* (the size of each plot was 1000 m^2). The observations were made through an international project "Mycological monitoring in European oak forests". As many as 274 species were recorded, including 234 saprobic, 33 mycorrhizal, and 7 parasitic fungi. Moreover, 15 species of fungi are connected with oak, 24 species of fungi are threatened, and 16 species are new to Poland.

Key words: *Ascomycota*, *Basidiomycota*, ecology of fungi, oak, mycological monitoring, threatened fungi.

INTRODUCTION

In 1992 the European Council for the Conservation of Fungi initiated a project to monitor the disappearance of macromycetes in European oak forests. The project was included in the Copernicus Programme organized by the European Union. Its contributors were mycologists from the Czech Republic (coordinator Dr. Rostislav Fellner, Prague), Italy (coordinator Dr. Claudia Perini, University in Siena, which represented the project for the European Union in Brussels), and Poland (coordinator Prof. Maria Ławrynowicz, University of Łódź). A series of mycosociological studies made in 60's and 70's on permanent plots in the oak forests of Northern Poland favored Poland's participation in the project (N e s p i a k 1959; L i s i e w s k a 1965; L i s i e w s k a and B u j a k i e w i c z 1976). It was expected that studies repeated after 20 years would provide data on the changes caused by anthropopression in the specific composition of fungi.

In Poland, the studies including different regions of the country were performed: in the Iński Landscape Park (NW Poland) by Stasińska, in the Kraków–Częstochowa Upland (S Poland) by Ławrynowicz, in Wielkopolska (W Poland) by Lisiewska and Połczyńska (1998), in the Białowieża National Park by Skirgiełło (1998b) and in the Świętokrzyskie Mts. (Łuszczyński 1998). The results from the Niepołomice Forest near Kraków (S Poland) by Wojewoda and team are presented in this paper.

We are indebted to the following persons for their help: Prof. M. Ławrynowicz for coordination of these investigation Mrs. B. Pleban for her participation in the field studies and technical work as well as preparation of this manuscript for publication, Prof. J. Jakubowska-Gabara for making phytosociological tables, B. Szczepanowicz, M.Sc., for performing soil analyses, J. Cichocki, M.Sc. and S. Jurzecki, M.Sc. for delivering climatic data, Dr. A. Chlebicki for identification of some *Pyrenomycetes* species, M. Piątek, M.Sc. for assistance in field studies and graphic work performed for this paper, M. Matyjaszkiewicz, M.Sc. for preparing the drawings.

METHODS

The subject of the study were macromycetes (fungi whose fructifications are greater than 5 mm in diameter), *Asco-* and *Basidiomycota.*

Monitoring was aimed at the study of the population of macromycetes in an oak-lime-hornbeam wood in the Niepołomice Forest near Kraków, its specific composition, phenology, abundance, ecological function, and dependence on anthropopression.

Four study plots were selected (each of 1000 m^2). They were delineated in the field and each was divided into 10 subplots (each of 100 m^2). Prof. Jakubowska-Gabara (1996) performed phytosociological studies on all plots in Poland, including the Niepołomice Forest. On August 27, 1997 B. Szczepanowicz, M.Sc. collected soil samples from each plot from the horizons: A_0L, A_0H, and A1, and determined pH.

The Kraków branch of the Institute of Meteorology and Water Management provided annual mean temperature values and monthly rainfall totals for the period 1994–1996 from the records kept by the Climatic Station in Igołomia, located 8 km NE of study plots.

In 1994 the studies were launched in July and completed in November. Over the years 1995–1996 observations were made once or twice a month from spring to autumn. Altogether, 26 individual observations were performed. In each plot the following were sampled: the number of fructifications of selected species, substrate (terrestrial, lignicolous, and litter decomposing fungi), and trophism.

The fungi were determinated on the basis of monographic books. The authors are mentioned on the list of references. Dark-spore *Agaricales* were determinated by Z. Heinrich, white-spore *Agaricales* – by H. Komorowska, other groups of fungi – by W. Wojewoda. The names of orders were used mainly according to Hawksworth et al. (1995), names of species – according to Hansen and Knudsen (1992), Ryvarden and Gilbertson (1993–1994), Kreisel (1979, 1987), and Michael et al. (1986).

The herbarium collection of fungi has been deposited in the KRAM herbarium in the W. Szafer Institute of Botany, Polish Academy of Sciences in Kraków.

STUDY AREA

Description of the Niepołomice Forest. The selected four study plots were located in the northern forest complex of the Niepołomice Forest, 30 km from the center of Kraków (Fig. 1) in the subprovince of the Sandomierz Valley (Kondracki 1978, 1994). It is the largest forest in Kraków's neighborhood, a remnant of the primeval forests that once extended from the Carpathians to Małopolska Province. Originally, these were simply the forests growing between Kraków and the Dunajec river which, as a result of intensive logging, towards the end of the Middle Ages shrunk into a small forest area located at the junction of the Wisła and Raba rivers (Smólski 1981).

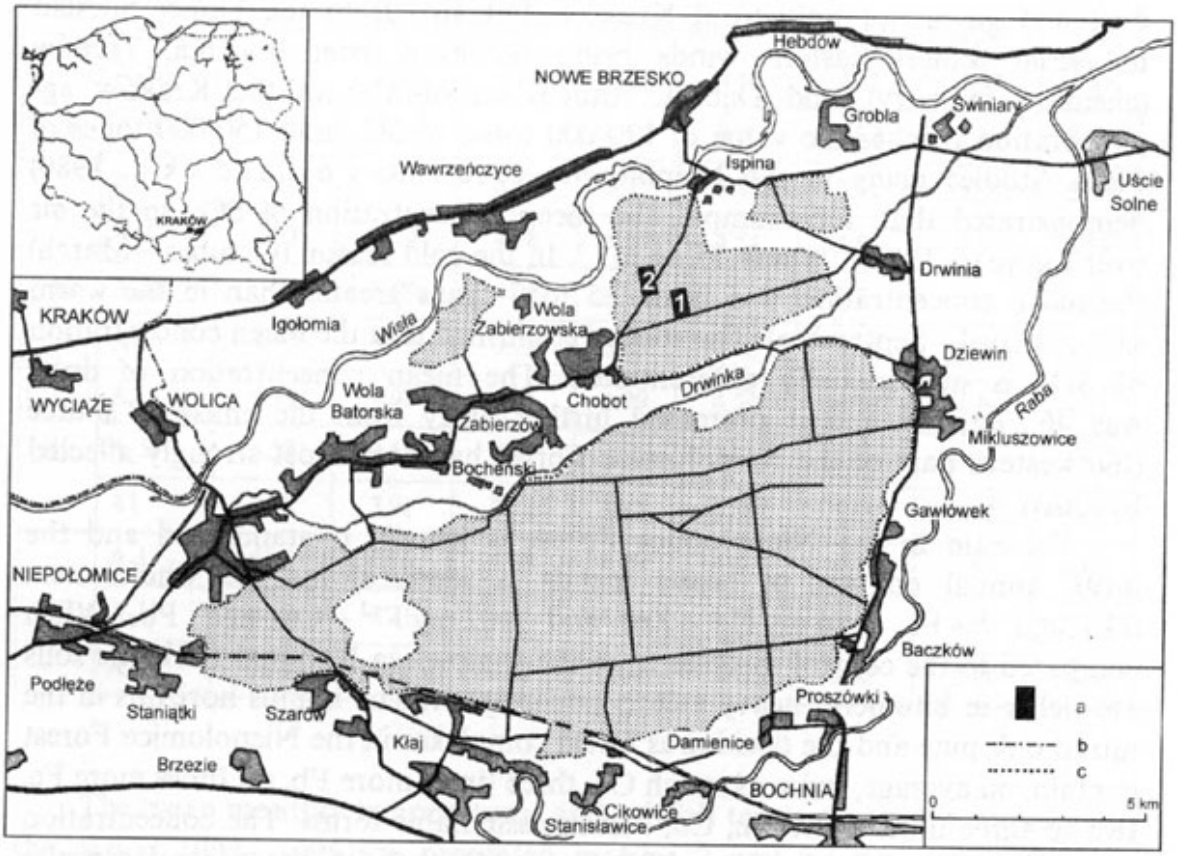

Fig. 1. Location of investigated plots in the Niepołomice Forest near Kraków: a – localities: 1 – forest section 460, the Lipówka reserve, locality 1 (plots I and II), 2 – forest section 447, locality 2 (plots III and IV), b – boundaries of Kraków city, c – boundaries of the Niepołomice Forest

Today's Niepołomice Forest is a forest area totally transformed in comparison to its primeval character and considerably rebuilt (D z i e w o l s k i 1976). The major forest-forming species are: *Pinus sylvestris* (71%), *Quercus robur*, *Q. petraea* (17%), and *Alnus glutinosa* (9%). A greater part of the forest area is occupied by mixed woods growing in the southern part of the complex. *Tilio-Carpinetum* associations, with only a few relics of primeval nature, grow in the north. These forests include a proportion of *Quercus robur*, *Tilia cordata*, *Carpinus betulus*, little mixture of *Pinus sylvestris* and fairly rare specimens of *Sambucus nigra*. In the forest undergrowth occur, among other things, *Aegopodium podagraria*, *Asperula odorata*, and *Stellaria holostea* (D z i e w o l s k i 1978; F e r c h m i n and M e d w e c k a-K o r n a ś 1976; M y c z k o w s k i 1981).

The age-old harmful activity of man in the given area intensified in the last 40 years by industrial emission by the agglomeration of Kraków. Many industrial works are located in that area. The most harmful are the T. Sendzimir Steelwork (the former Lenin Steelwork) and a huge electric power station. Apart from these two, thousands of chimneys and small coal-fuelled boiler houses in Kraków, Niepołomice, and other settlements pollute the environment. Winds blowing mainly from the west transport large quantities of dust and gases not only from Kraków, but also from the Upper Silesian industrial center. Eastern winds bring pollution from Bochnia, Tarnów (chemical industry), and Dębica. Annual emission from the Kraków agglomeration reaches the value of 170 000 tones of SO_2 and 150 000 tones of dusts. Studies made in the Niepołomice Forest (G r o d z i ń s k a 1980) demonstrated that, for example, the mean concentration of SO_2 in the air over the years 1977–78 was 25 $\mu g\ m^{-3}$. In the cold season (October–March) the mean concentration was from 2.5 to 7 times greater than in the warm season (April–September). The studies confirmed that the mean concentration of SO_2 is not spatially differentiated. The mean concentration of dusts was 46.2 $\mu g\ m^{-3}$ and it decreased further away from the emission source (the western part of the Niepołomice Forest has been most strongly affected by dust).

The rain in the Niepołomice Forest is heavily contaminated and the mean annual content of heavy metals is identical for the whole area: 0.13 $mg\ l^{-1}$ – Fe, 0.86 $mg\ l^{-1}$ – Zn, and 0.02 $mg\ l^{-1}$ – Cu and Pb. When compared to the control samples from the Białowieża National Park, the soils are richer in bitumens, heavy metals and sulphur. The humus horizons in the mixed oak-pine and the deciduous forest complexes in the Niepołomice Forest contain, on average, twice as much Cd, three times more Pb, six times more Fe, two to three times more Zn, Cu, Mn in assimilable forms. The concentration of sulphate ($S-SO_4$) is 2 to 4.5 times more than in the control samples (G r o d z i ń s k a 1982).

Economic changes occurring in Poland after 1989 caused a major decrease in the emission of gas and dust. However, permissible values for

the dustfall have been continuously exceeded (Grodzińska 1994). For example, in 1995 the Tadeusz Sendzimir Steelwork (the former Lenin Steelwork) emitted 10 000 tones of dusts and 13 000 tones of SO_2 into the air (Garścia 1996).

Macromycetes of this area were examined by Wojewoda (1978, 1979) over the period 1974–1976, and Komorowska (1980, 1986, 1991) over the period 1976–1986. These investigations overlap the study area of the project "Mycological monitoring in European oak forests".

Description of the study plots. All study plots are located in the northern part of the Niepołomice Forest, 30 km E of Kraków. The subassociation of *Tilio-Carpinetum stachyetosum* where study plots were delineated occupy the gleyed brown soils also called old warp soils (Adamczyk 1984). Characteristic of soils on investigated plots I–IV are shown in Table 1.

Table 1
Characteristics of soils on the plots I–IV

Plots	Horizons	pH in H_20				pH in KCL			
		sample 1	sample 2	sample 3	average	sample 1	sample 2	sample 3	average
I	A_0L	4.72	5.08	4.71	4.83	4.42	4.71	4.33	4.52
	A_0H	4.31	4.25	3.9	4.15	3.66	3.92	3.35	3.64
	A1	3.97	3.76	3.39	3.7	3.47	3.41	3.13	3.33
II	A_0L	5.03	5.14	4.98	5.05	4.54	4.67	4.57	4.59
	A_0H	–	4.09	4.08	4.85	–	3.7	3.8	3.75
	A1	4.15	3.78	3.73	3.88	3.41	3.47	3.46	3.44
III	A_0L	4.98	4.98	5.01	4.99	4.56	4.54	4.49	4.53
	A_0H	4.58	4.17	4.35	4.36	3.91	3.8	3.72	3.81
	A1	3.98	3.91	3.72	3.87	3.68	3.55	3.47	3.56
IV	A_0L	4.85	4.96	4.88	4.89	4.4	4.6	4.57	4.52
	A_0H	4.19	4.21	4.07	4.15	3.76	3.84	3.81	3.8
	A1	3.78	3.69	3.57	3.68	3.49	3.43	3.41	3.44

The mean monthly temperatures and rainfall totals of selected months for the period 1994–1996 are presented in Figs 2 and 3.

Locality 1 (plots I, II). This locality is situated in the strict reserve of Lipówka in the forest division 460 (Fig. 1) on the right side of the Niepołomice–Ispina road.

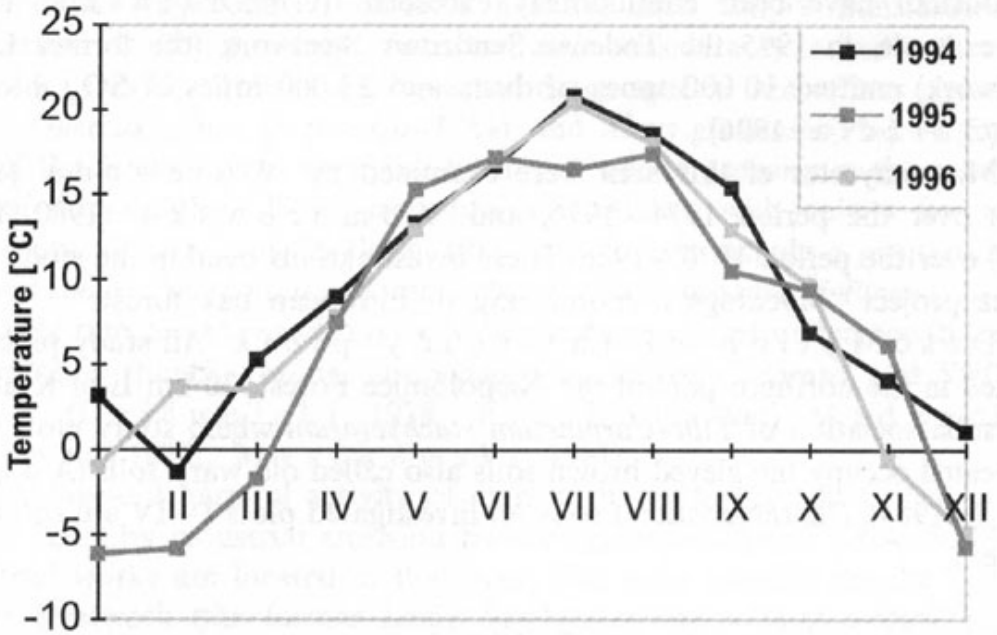

Fig. 2. Climatogram for the Igołomia meteorological station (8 km W of investigated plots) for the years 1994–1996: monthly average air temperatures

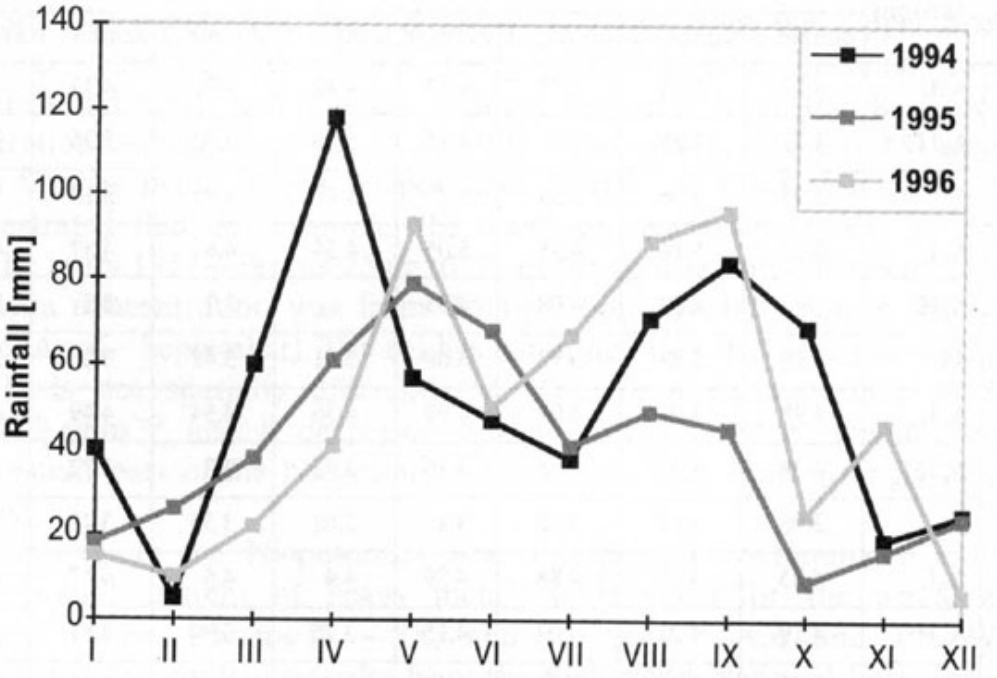

Fig. 3. Climatogram for the Igołomia meteorological station (8 km W of investigated plots) for the years 1994–1996: monthly rainfall total

The plots are adjacent. They are located in the forest with old trees of oak (*Quercus robur*), lime (*Tilia cordata*) and hornbeam (*Carpinus betulus*), marked with big empty circles in Fig. 4. The undergrowth with numerous young lime- and hornbeam-trees (with a trunk 2 to 15 cm in diameter, marked in Fig. 4 with small empty circles). The forest floor covered with numerous

trunks of dead trees (*Quercus*, *Tilia*, *Carpinus* and one *Pinus sylvestris* barkless trunk) and littler of branches and twigs (marked in grey in Fig. 4). Phytosociological analysis is given in Table 2.

The data on soil pH are shown in Table 1.

Locality 2 (plots III, IV). The locality is situated in an exploited forest area, forest division 447, on the left from the Niepołomice – Ispina road.

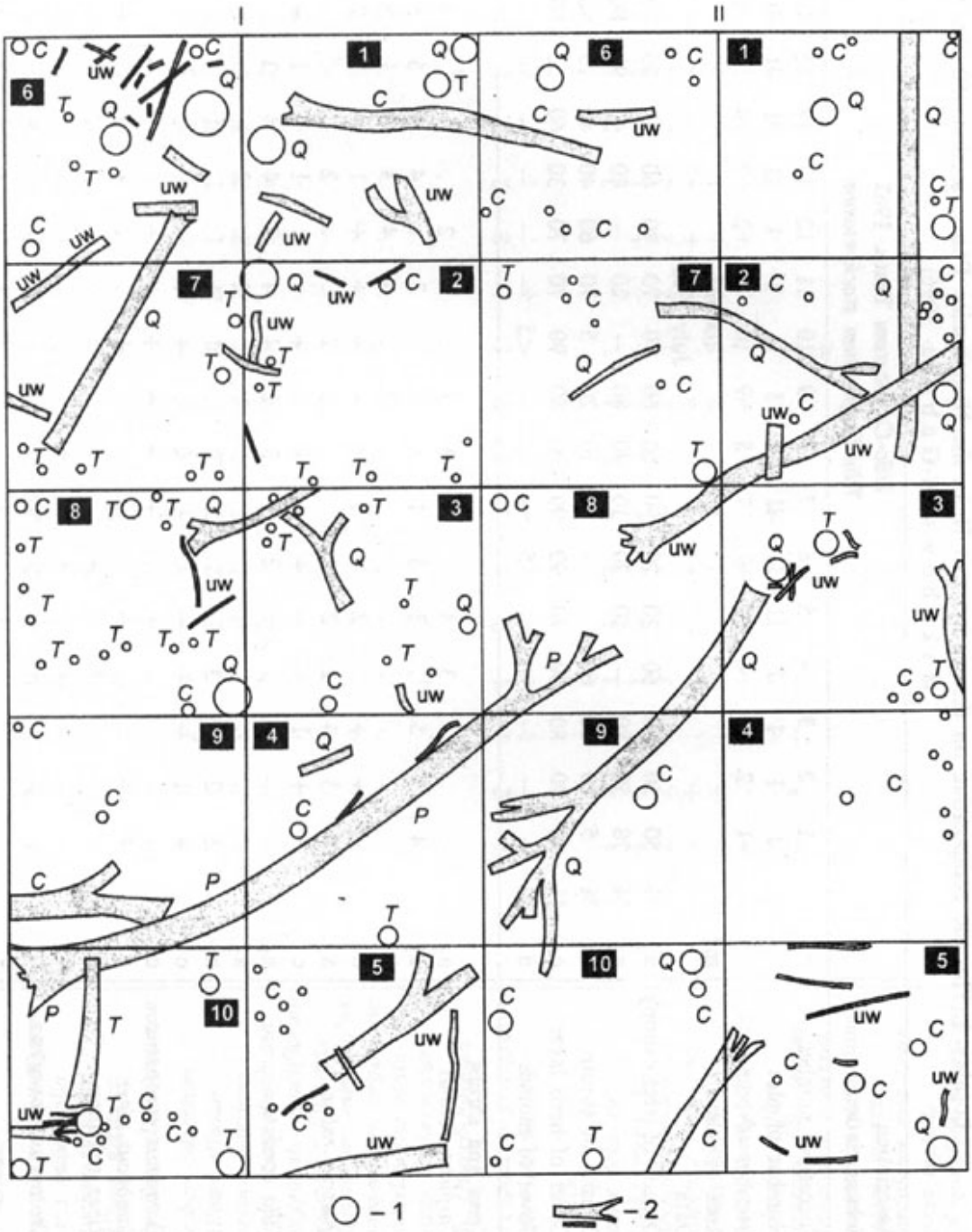

Fig. 4. Structure of the tree stand in the locality 1, plots I (subplots 1 – 10) and II (subplots 1 – 10). 1 – living trees, 2 – lying trunks and fallen branches, *C* – *Carpinus betulus*, *P* – *Pinus sylvestris*, *Q* – *Quercus robur*, *T* – *Tilia cordata*, uw – unidentified wood

Table 2

Locality 1. Floristic composition on the plots I and II, in the Niepołomice Forest, section 460, the Lipówka reserve (Jakubowska-Gabara 1996)

Association / **Subassociation**			*Tilio-Carpinetum* Tracz. 1962 / *Tilio-Carpinetum stachyetosum*																			
Successive number			1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	C
Number of plot			I	I	I	I	II	I1	II	I	I	I	I	I	II	II	II	II	II	II	II	II	o
Number of relevé			1	2	3	4	5	6	7	8	9	10	1	2	3	4	5	6	7	8	9	10	n
Area of relevé	m^2												100 m^2										s
Data													July 1995										t
Density of trees canopy	a_1	%	50	50	60	60	20	20	90	60	60	70	70	40	60	70	30	70	40	40	70	–	a
	a_2	%	70	50	80	–	50	30	10	40	80	–	20	–	80	40	90	80	90	80	–	–	n
Density of shrubs	b	%	5	20	10	60	–	–	–	10	20	5	70	60	40	40	15	40	–	70	15	10	c
Cover of herb layer	c	%	90	90	80	90	70	90	90	90	80	90	70	70	30	60	50	60	10	40	80	90	e
Cover of mosses	d	%	–	–	–	–	–	5	–	–	–	<5	–	–	–	–	–	–	–	–	–	<5	y
Trees and shrubs																							
Carpinus betulus	a_1		.	.	.	3	4	.	4	3	3	.	.	2	.	.	.	4	.	.	3	.	V
	a_2		4	3	5	.	3	3	1	3	5	.	2	.	4	3	5	5	5	5	.	.	V
	b		.	.	.	.	.	.	.	.	2	.	4	4	3	3	1	3	.	4	.	.	II
	c		+	+	+	.	2	+	1	+	+	+	+	+	1	+	1	2	1	+	1	+	V
Quercus robur	a_1		3	3	4	2	2	.	.	.	2	2	.	.	2	.	.	.	3	3	2	.	III
	c		+	+	1	+	+	+	+	+	+	+	.	.	1	.	1	+	1	1	+	+	V
Tilia cordata	a_1		.	.	.	.	.	2	2	3	2	4	4	2	4	4	3	.	.	.	.	.	III
	a_2		.	.	.	.	.	.	.	.	.	.	2	.	2	.	.	.	.	.	.	.	III
	b		1	2	2	3	.	.	.	2	.	1	1	.	.	1	.	.	.	.	2	1	III
	c		+	1	+	+	+	.	.	1	.	+	.	.	.	.	.	.	+	.	+	+	III
Euonymus europaeus	c		.	.	.	.	+	.	+	+	+	+	+	+	.	.	+	.	.	.	+	+	III
Sambucus niger	c		+	+	.	.	+	.	.	.	.	+	.	.	+	.	.	+	.	+	.	+	II
Ribes spicatum	b		.	.	.	1	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	+	I
	c		.	.	.	1	.	+	.	+	.	.	.	.	.	.	.	.	.	.	.	+	I
Crataegus monogyna	b		.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	I
	c		.	.	+	.	+	.	.	.		+	.	.	.	.	+	.	.	.	.	.	I
Crataegus laevigata	b		.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.	I

Herbs and mosses D. subass.																					
Impatiens noli-tangere	3	3	2	1	+	2	2	2	+	3	3	2	2	3	2	3	+	2	2	3	V
Paris quadrifolia	.	.	+	+	.	.	.	.	.	.	+	+	+	.	+	+	+	+	.	.	III
Stachys sylvatica	.	.	.	+	.	+	+	.	.	.	.	+	.	.	.	.	.	.	+	.	II
Festuca gigantea	.	.	.	.	.	+	+	.	.	.	.	.	.	.	.	.	.	.	.	.	I
Ch. *Fagetalia sylvaticae*																					
Galium odoratum	2	1	2	3	1	2	2	2	2	2	2	4	3	2	3	2	1	3	2	2	V
Milium effusum	1	1	1	1	2	2	2	2	2	2	2	1	1	1		2	2	+	1	2	V
Circaea lutetiana	1	2	1	2	+	1	1	2	2	2	1	2	2	1	2	+	.	1	2	2	V
Viola reichenbachiana	.	+	.	2	2	1	1	2	1	+	1	1	1	1	1	1	+	+	1	+	V
Polygonatum multiflorum	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	+	.	I
Dryopteris filix-mas	.	.	.	.	.	+	.	.	+	.	.	.	.	.	.	.	.	.	.	.	I
Lamiastrum galeobdolon	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	.	.	I
Eurhynchium angustirete	.	.	.	.	.	1	.	.	.	+	.	.	.	.	.	.	.	.	.	.	I
Dactylis glomerata subsp. *aschersoniana*	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	I
Ch. *Querco-Fagetea*																					
Aegopodium podagraria	2	2	1	1	2	2	2	1	1	1	1	2	2	1	2	+	+	1	2	1	V
Anemone nemorosa	.	.	1	.	+	1	+	.	.	.	+	.	.	.	+	.	+	.	.	.	II
Others																					
Carex brizoides	4	4	4	3	3	3	4	3	3	1	.	.	2	1	1	1	.	+	2	2	V
Oxalis acetosella	+	+	1	1	+	1	+	+	+	+	+	+	1	.	1	1	.	.	1	+	V
Glechoma hederacea	2	2	3	3	.	3	+	3	2	3	2	2	2	2	2	.	.	.	3	3	IV
Galeopsis pubescens	+	+	.	+	+	+	+	+	+	.	+	+	+	+	+	+	.	.	+	+	IV
Urtica dioica	+	+	.	+	.	2	+	1	2	1	.	+	1	.	1	+	.	+	1	1	IV
Majanthemum bifolium	+	.	1	+	+	+	.	+	+	.	.	+	+	+	1	1	.	.	+	+	IV
Galeopsis bifida	+	.	.	+	.	+	+	.	.	.	.	.	+	+	+	+	+	.	+	+	III
Athyrium filix-femina	+	+	+	+	.	+	.	.	.	.	.	.	.	.	+	.	.	.	.	+	III
Moehringia trinervia	.	.	.	.	.	.	+	.	.	+	.	.	.	.	.	.	+	.	1	.	II
Dryopteris carthusiana	+	+	.	.	.	.	.	+	.	.	.	.	.	.	+	.	.	.	.	.	II
Galium aparine	.	.	.	+	.	.	.	+	.	.	.	.	.	.	.	.	+	.	.	+	II
Cardamine impatiens	.	.	.	.	+	.	+	.	.	.	.	+	.	+	.	.	.	.	.	.	II
Ajuga reptans	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	I
Polygonatum odoratum	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.	I
Geum urbanum	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.	I

These plots are located at a small distance from each other (Fig. 5). The forest consisting mainly of oak (*Quercus robur*), lime (*Tilia cordata*), and hornbeam (*Carpinus betulus*), is dominated by old oak-trees. Coniferous trees are missing, except old *Pinus sylvestris* specimens occurring individually. Unlike previous plots, these plots are located in the forest, which is still exploited (during the studies the traces of forest workers' activities were noticeable – single cuts, forest floor clearings). There are no dead trees in the forest floor; fallen branches

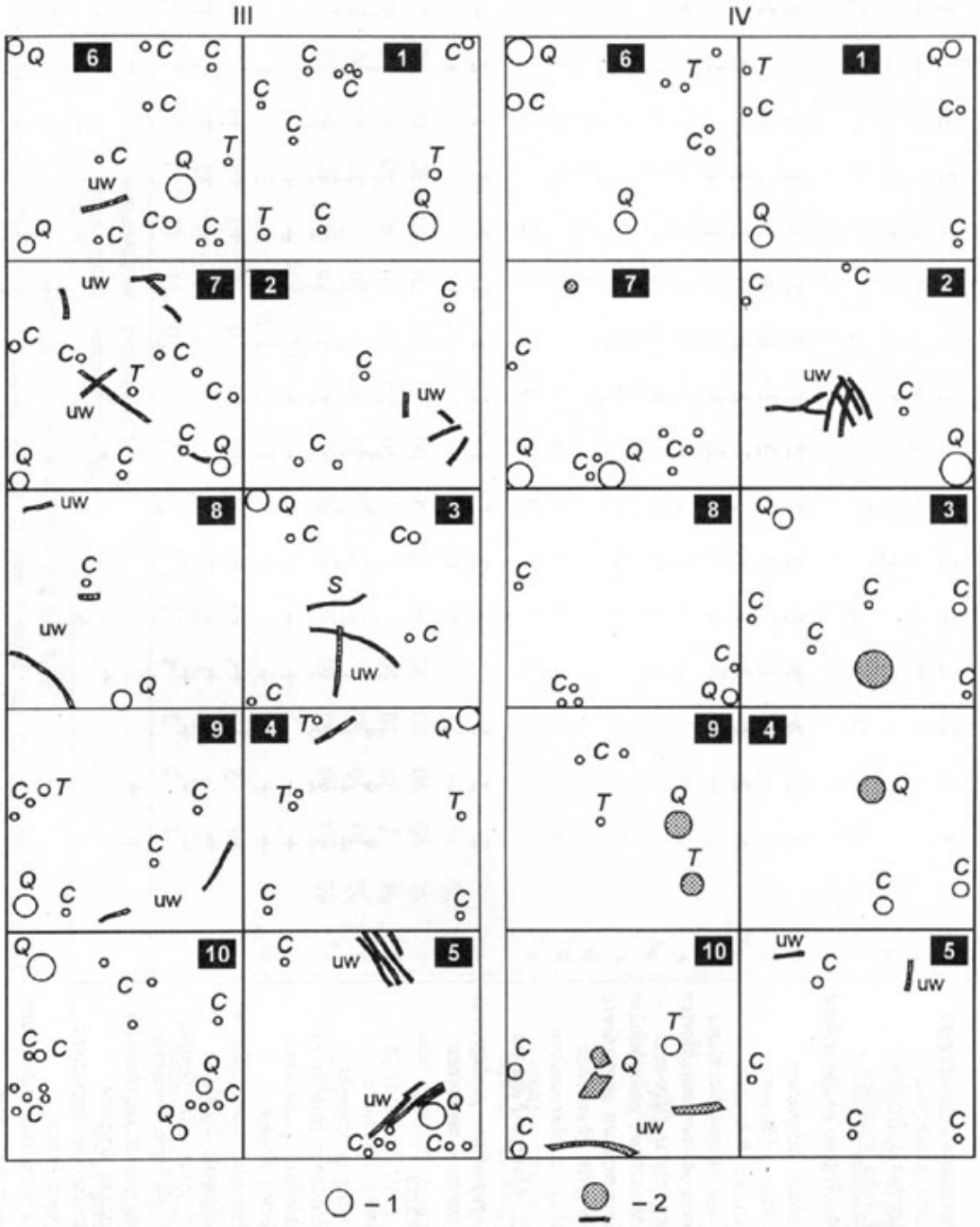

Fig 5. Structure of the tree stand in the locality 2, plots III (subplots 1 – 10) and IV (subplots 1 – 10). 1 – living trees, 2 – dead stumps, fallen branches and twigs, *C – Carpinus betulus*, *Q – Quercus robur*, *T – Tilia cordata*, uw – unidentified wood

Table 3

Locality 2. Floristic composition on the plots III and IV, in the Niepołomice Forest, section 447 (Jakubowska-Gabara 1996)

Association / **Subassociation**			***Tilio-Carpinetum* Tracz. 1962** / ***Tilio-Carpinetum stachyetosum***																			
Successive number			1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	C
Number of plot			III	III	III	III	III	III	III	III	III	III	IV	IV	IV	IV	IV	IV	IV	IV	IV	IV	o
Number of relevé			1	2	3	4	5	6	7	8	9	10	1	2	3	4	5	6	7	8	9	10	n
Area of relevé													100 m²										s
Data													July 1995										t
Density of trees canopy	a_1	%	30	30	30	20	30	60	30	50	60	70	40	30	40	80	80	50	40	40	40	75	a
	a_2	%	70	90	70	60	50	90	80	40	80	30	80	70	80	–	–	70	80	50	–	–	n
Density of shrubs	b	%	60	10	80	90	90	30	40	50	60	80	40	35	20	–	15	70	50	–	30	–	c
Cover of herb layer	c	%	30	10	15	5	5	15	20	60	15	10	20	60	30	70	60	20	60	80	70	80	y
Cover of mosses	d	%	–	–	–	–	–	–	–	<5	–	–	–	–	–	–	–	–	–	–	<5	–	
1			2																				3
Trees and shrubs																							
Carpinus betulus	a_1		.	.	.	.	.	.	.	.	.	.	.	.	.	5	5	.	.	.	3	2	I
	a_2		2	5	3	4	3	3	4	3	4	3	5	4	5	.	.	4	5	3	.	.	IV
	b		3	2	3	5	5	3	2	1	3	2	3	2	1	.	2	3	3	.	2	.	V
	c		1	1	1	1	+	1	1	+	1	+	1	1	1	1	2	1	1	+	1	+	IV
Quercus robur	a_1		3	3	3	2	3	4	3	3	4	4	3	3	3	.	.	3	3	3	.	.	IV
	c		.	+	.	+	.	.	.	+	.	+	+	+	+	+	+	.	+	+	+	+	IV
Tilia cordata	a_1		.	.	.	.	.	.	.	.	.	.	.	.	.	.	2	.	.	.	.	4	I
	a_2		4	.	2	.	.	5	3	.	3	.	.	2	.	.	.	.	.	.	.	.	II
	b		2	.	2	2	2	2	2	3	2	4	1	2	1	.	.	3	.	.	.	.	IV
	c		.	.	+	+	.	+	+	+	+	+	+	+	+	+	.	+	.	+	+	+	IV
Sambucus nigra	c		+	+	+	+	+	+	+	+	+	+	.	.	.	.	+	.	+	.	+	.	IV
Euonymus europaeus	c		+	+	.	.	+	.	+	.	.	.	+	+	1	.	.	.	+	1	+	+	III
Ribes spicatum	c		1	+	.	.	+	+	.	+	.	.	.	+	+	+	.	+	.	.	1	.	III
Prunus avium	b		.	.	.	.	.	.	.	.	1	2	.	.	.	.	.	.	.	.	.	.	I
	c		+	.	.	.	.	+	.	.	+	1	.	.	.	.	.	.	.	.	.	.	I
Crataegus monogyna	b		.	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	I
	c		.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	+	.	.	.	I
Crataegus laevigata	b		.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	I
Herbs and mosses																							
D. subass.																							
Impatiens noli-tangere			+	+	+	.	+	+	1	2	1	.	.	+	+	+	2	1	1	.	2	3	IV
Paris quadrifolia			+	.	+	+	.	+	+	.	.	.	.	.	.	.	.	.	.	.	.	.	II

Tab. 3 cont.

1	2																				3
Stachys sylvatica	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	1	2	I
Festuca gigantea	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.	I
Ch. Fagetalia sylvaticae																					
Milium effusum	2	1	+	+	+	1	1	+	+	+	+	1	+	2	2	1	1	3	3	2	V
Galium odoratum	1	+	.	.	+	+	.	2	1	+	1	2	1	2	1	1	1	2	2	2	V
Viola reichenbachiana	+	+	.	.	.	+	+	.	+	.	+	.	+	1	1	+	+	1	1	1	IV
Circaea lutetiana	+	.	.	+	.	+	.	.	.	.	.	.	.	+	.	.	+	+	1	+	II
Polygonatum multiflorum	.	.	.	.	.	.	.	.	.	.	+	+	.	.	.	+	+	+	.	.	II
Ranunculus lanuginosus	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	I
Carex sylvatica	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.	I
Scrophularia nodosa	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	I
Brachypodium sylvaticum	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	I
Eurhynchium angustirete	.	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.	+	.	I
Ch. Querco-Fagetea																					
Aegopodium podagraria	1	+	1	+	+	.	+	1	+	+	+	1	+	2	.	1	2	2	2	2	V
Anemone nemorosa	.	.	.	.	+	.	+	+	+	+	+	+	+	+	+	+	+	1	.	1	IV
Others																					
Carex brizoides	2	1	2	+	.	+	1	2	+	1	1	3	1	4	+	2	3	3	2	2	V
Oxalis acetosella	+	+	+	+	.	.	+	+	+	+	1	+	+	+	+	+	+	1	1	1	V
Majanthemum bifolium	+	+	+	+	+	1	+	1	+	+	+	.	+	1	+	+	+	.	+	.	V
Moehringia trinervia	.	+	+	+	.	+	+	+	+	+	+	+	+	+	1	+	+	1	.	1	V
Urtica dioica	+	+	+	.	.	+	+	+	+	.	.	1	.	+	+	.	+	+	+	1	IV
Athyrium filix-femina	+	+	+	+	+	.	+	+	.	.	+	+	+	+	.	+	.	+	1	.	IV
Glechoma hederacea	1	.	.	.	.	.	1	2	+	.	.	1	.	+	2	+	1	2	2	2	III
Galeopsis bifida	.	.	+	+	+	+	.	.	+	+	.	.	+	.	.	.	+	.	.	+	III
Cardamine impatiens	+	+	.	.	.	+	+	.	.	.	.	.	.	.	+	.	.	+	1	1	II
Stellaria nemorum	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	1	+	1	.	I
Geum urbanum	+	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	+	+	I
Dryopteris carthusiana	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	+	+	.	I
Ajuga reptans	.	.	.	.	.	.	.	+	.	.	+	+	.	.	.	.	.	.	.	.	I
Veronica montana	.	.	.	.	.	.	.	.	.	.	.	.	.	+	1	.	.	.	.	+	I
Galeopsis pubescens	.	.	+	.	.	.	.	.	.	.	+	.	.	.	.	.	.	+	.	.	I
Poa trivialis	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	I
Rubus plicatus	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.	I
Lapsana communis	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	+	I

are scarce. In one of the subplots a heap of branches accumulated but it was removed after some time. Dead wood was present only in the form of small twigs or single stumps (from 55 to 110 cm in diameter – marked in Fig. 5 with grey circles). A phytosociological analysis is given in Table 3.

The data on soil pH are shown in Table 1.

RESULTS

Systematic analysis. 274 species and one variety were collected from all study plots: 16 species of *Ascomycota* and 258 of *Basidiomycota*. The numbers of fungi in systematic groups (orders) are given in Table 4. The most abundant were the following genera: *Mycena* – 20, *Psathyrella* – 14, *Clitocybe*, *Pluteus* and *Phanerochaete* – 7 each, *Collybia*, *Hyphoderma* and *Russula* – 6 each, *Galerina*, *Athelia*, *Peniophora* – 5 each, *Hypholoma*, *Lepista*, *Marasmius*, *Stereum* – 4 species each. The list of species sampled in selected plots over 3 years is given in Tables 5 to 8.

Table 4

Fungi in systematic groups according to Hawksworth et al. (1995)

Phylum	Order	Number of species
Ascomycota	*Hypocreales*	2
	Leotiales	6
	Pezizales	2
	Xylariales	6
Basidiomycota	*Agaricales*	115
	Atractiellales	1
	Boletales	7
	Cantharellales	2
	Cortinariales	11
	Dacryomycetales	4
	Fistulinales	1
	Ganodermatales	1
	Gomphales	1
	Hericiales	1
	Hymenochaetales	6
	Lycoperdales	2
	Nidulariales	1
	Phallales	1
	Poriales	15
	Russulales	10
	Schizophyllales	1
	Sclerodermatales	2
	Stereales	61
	Thelephorales	4
	Tremellales	9
	Tulasnellales	2
Total:		274

Table 5

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 one visit on one subplot

Years	1994			1995			1996			1994 – 1996			
Number of observations	9			7			10			26			
Number of species	117			62			114			168			
	Dcy	SF	TF	Dcy	SF	TF	Dcy	SF	TF	Dcy	MDcv	SF	TF
Agrocybe praecox							15	2	2	15	12	2	2
Amanita fulva	1	1	1							1	1	1	1
A. vaginata							1	1	1	1	1	1	1
Armillaria mellea s. l.	1	1	1				5	1	1	6	5	2	2
Ascocoryne sarcoides	35	3	2				26	2	3	61	20	4	5
Athelia decipiens	3	2	1							3	2	2	1
A. epiphylla	1	1	1							1	1	1	1
Bjerkandera adusta				167	3	4	1073	4	10	1240	200	6	14
Boletus pulverulentus	1	1	1				8	2	4	9	2	3	5
Botryobasidium laeve	1	1	1	14	1	3	10	1	1	25	10	2	5
B. subcoronatum	1	1	1	9	2	3	5	1	1	15	5	3	5
Brevicellicium olivascens	1	1	1							1	1	1	1
Bulgaria inquinans	3	1	1							3	3	1	1
Byssomerulius corium	59	5	2	30	1	2	64	2	3	153	40	5	7
Calocera cornea	85	1	5							85	50	1	5
Calocybe carnea	1	1	1							1	1	1	1
Ciboria batschiana							112	5	1	112	80	5	1

Clavulina cinerea	13	1	2				10	3	1	23	7	4	3
Clitocybe clavipes	22	5	2	1	1	1	13	3	2	36	6	5	5
C. gibba	17	4	3				18	6	3	35	9	7	6
C. lignatilis	6	2	1							6	5	2	1
C. odora	1	1	1							1	1	1	1
C. sp.							4	3	1	4	2	3	1
Collybia butyracea = C. asema	295	9	5	6	2	1	98	9	3	399	77	10	9
C. dryophila	111	9	7	12	4	2	51	10	6	174	14	10	15
C. erythropus = C. marasmioides	21	2	1							21	13	2	1
C. fuscopurpurea							2	1	1	2	2	1	1
C. fusipes	2	1	1				22	2	3	24	13	2	4
C. peronata	4	1	2							4	3	1	2
Coniophora arida	9	2	4	2	1	1	10	1	1	21	10	3	6
C. puteana	3	2	2							3	2	2	2
Conocybe semiglobata							1	1	1	1	1	1	1
C. tenera							1	1	1	1	1	1	1
Cortinarius sp.	6	2	2							6	3	2	2
Crepidotus variabilis	370	5	6	42	2	1	11	1	2	423	80	5	9
Cyathus striatus	92	2	6							92	22	2	6
Cylindrobasidium evolvens	295	3	2				20	2	1	315	200	4	3
Dacryomyces minor	10	1	1	10	1	1	10	1	1	30	10	2	3
D. stillatus	60	1	1							60	60	1	1
D. tortus				3	1	1				3	3	1	1

Tab. 5 cont.

Years	1994			1995			1996			1994–1996			
Number of observations	9			7			10			26			
Number of species	117			62			114			168			
	Dcy	SF	TF	Dcy	SF	TF	Dcy	SF	TF	Dcy	MDcv	SF	TF
Delicatula integrella							2	1	1	2	2	1	1
Entoloma sp.							18	5	2	18	5	5	2
Exidia glandulosa = E. truncata	48	1	5							48	16	1	5
E. plana				2	1	1				2	2	1	1
Fistulina hepatica							2	1	1	2	2	1	1
Galerina cerina							6	1	1	6	6	1	1
G. fallax							33	2	2	33	15	2	2
G. triscopa							11	1	1	11	11	1	1
Ganoderma lipsiense	2	1	9	2	1	2	62	4	5	66	13	4	16
Hapalopilus rutilans	1	1	1							1	1	1	1
Hohenbuehelia myxotricha	46	2	2				5	1	1	51	35	3	3
Hymenochaete cinnamomea							15	1	2	15	10	1	2
H. rubiginosa	800	2	9	1953	2	7	5230	2	10	7983	500	2	26
Hymenoscyphus calyculus	16	1	1							16	16	1	1
Hyphoderma mutatum	8	2	2							8	5	2	2
H. pallidum							10	1	1	10	10	1	1
H. praetermissum	1	1	1	10	1	2	10	1	1	21	10	2	4
H. puberum	11	2	3	9	2	1				20	5	3	4
H. setigerum				25	1	2				25	20	1	2

Hyphodontia pallidula	12	2	8							12	6	2	8
H. sambuci	20	1	1				10	1	1	30	20	2	2
Hypholoma fasciculare				5	1	1				5	5	1	1
H. subviride	12	2	3	18	3	3	326	4	5	356	80	6	11
Hypoxylon howeanum	1740	6	9	1650	4	6	2230	5	8	5620	450	7	23
Inocybe cookei							1	1	1	1	1	1	1
Laccaria laccata	20	5	4				145	10	4	165	21	10	8
Lactarius mitissimus				3	1	1				3	1	1	1
L. quietus	4	2	3	1	1	1	5	3	2	10	2	4	6
L. sp.	1	1	1							1	1	1	1
Lepista flaccida = L. inversa = Clitocybe inversa	191	8	4				40	6	3	231	41	8	7
L. gilva = Clitocybe gilva							41	6	1	41	17	6	1
L. nuda	8	2	3				41	4	1	49	19	5	4
Lycoperdon perlatum	15	4	5	1	1	1	16	3	2	32	5	5	8
L. pyriforme	52	3	4	24	2	3	66	3	7	142	20	3	14
Macrolepiota procera	7	4	3	1	1	1				8	3	5	4
M. rhacodes	11	4	2	3	2	1				14	3	5	3
Marasmius bulliardii	6	1	1	6	1	1	1	1	1	13	6	2	3
M. rotula	9	2	2				6	1	2	15	5	3	4
M. torquescens							1	1	1	1	1	1	1
Megacollybia platyphylla	19	6	3	3	2	1	23	6	6	45	8	7	10
Mycena abramsii							1	1	1	1	1	1	1

Tab. 5 cont.

Years	1994			1995			1996			1994–1996			
Number of observations	9			7			10			26			
Number of species	117			62			114			168			
	Dcy	SF	TF	Dcy	SF	TF	Dcy	SF	TF	Dcy	MDcv	SF	TF
Mycena crocata							2	1	1	2	1	1	1
M. galericulata				8	3	1	11	4	4	19	6	5	5
M. galopus	54	6	4				61	8	6	115	24	9	10
M. galopus var. *nigra*							2	2	1	2	1	2	1
M. haematopus	10	1	1							10	10	1	1
M. inclinata	54	2	2				26	2	1	80	50	3	3
M. leptocephala							2	2	1	2	1	2	1
M. pelianthina	1	1	1	1	1	1	1	1	1	3	1	2	3
M. pura	199	7	5	11	4	1	36	5	4	246	45	7	10
M. sanguinolenta	51	7	3	8	2	1	15	3	4	74	10	8	8
M. stylobates	133	9	3				1	1	1	134	50	9	4
M. subcaerulea	2	2	1				4	2	2	6	3	3	3
M. vitilis	3	3	1	2	1	1	20	4	3	25	10	6	5
M. zephirus	72	5	4	13	2	1	36	3	2	121	14	5	7
Naucoria bohemica							1	1	1	1	1	1	1
Nectria cinnabarina	400	2	1							400	300	2	1
Oligoporus fragilis							5	1	1	5	5	1	1
O. leucomallellus							5	1	1	5	5	1	1
O. subcaesius	18	1	1				12	2	2	30	18	3	3

Panellus serotinus							1	1	1	1	1	1	1
Peniophora cinerea	215	3	4	20	2	2	245	7	7	480	100	7	13
P. incarnata				10	1	1				10	10	1	1
P. laeta							1	1	1	1	1	1	1
P. quercina	15	1	1				15	2	2	30	15	3	3
P. rufomarginata	40	1	1				45	2	2	85	40	3	3
Phallus impudicus	2	1	2				7	3	3	9	3	3	5
Phanerochaete filamentosa	1	1	1	5	1	1	10	1	1	16	10	2	3
P. martelliana	1	1	1							1	1	1	1
P. sanguinea	6	1	1							6	6	1	1
P. tuberculata	4	2	2							4	2	2	2
P. velutina	6	1	1							6	6	1	1
Phellinus contiguus	2	2	8	8	2	2	56	6	3	66	22	8	13
P. nigricans	1	1	9	2	1	7	3	3	10	6	3	3	26
P. robustus	1	1	1	1	1	7	1	1	1	3	1	1	9
Phlebia radiata	6	1	1							6	6	1	1
Phlebiella pseudotsugae	5	1	1	5	1	1	10	1	2	20	5	3	4
Phleogena faginea	300	1	3	500	2	2	90	1	2	890	300	2	7
Pholiota lenta	6	1	2				1	1	1	7	4	2	3
Physisporinus sanguinolentus	1	1	1				5	1	1	6	5	2	2
P. vitreus				1	1	1				1	1	1	1
Pluteus cervinus	1	1	1	4	2	1	7	3	4	12	3	4	6
P. leoninus							1	1	1	1	1	1	1

Tab. 5 cont.

Years	1994			1995			1996			1994–1996			
Number of observations	9			7			10			26			
Number of species	117			62			114			168			
	Dcy	SF	TF	Dcy	SF	TF	Dcy	SF	TF	Dcy	MDcv	SF	TF
Pluteus nanus				1	1	1				1	1	1	1
Polyporus badius				13	2	3	12	1	5	25	7	3	8
P. brumalis	33	3	4	6	1	1	3	1	1	42	13	3	6
P. varius							1	1	1	1	1	1	1
Psathyrella gracilis				1	1	1				1	1	1	1
P. impexa	3	1	1							3	3	1	1
P. panaeoloides	1	1	1							1	1	1	1
P. spadiceogrisea	3	1	1				4	1	1	7	4	2	2
Psilocybe inquilina var. *crobulus*	1	1	1				14	2	2	15	9	3	3
P. squamosa	19	6	3	15	6	1	33	6	1	57	12	10	5
Ramicola haustellaris							1	1	1	1	1	1	1
R. laevigata	2	1	1							2	2	1	1
Rickenella fibula	3	1	1	2	1	1	3	1	1	8	3	1	3
Ripartites metrodii	14	2	2							14	12	2	2
R. tricholoma	18	3	2				6	4	1	24	7	5	3
Russula cyanoxantha	4	1	1				10	6	4	14	4	6	5
R. nigricans	1	1	1				1	1	1	2	1	2	2
R. ochroleuca	12	3	2				13	5	1	25	7	6	3
R. pectinatoides							8	3	3	8	3	3	3

R. violeipes	1	1	1				20	5	2	21	9	5	3
Schizophyllum commune	39	2	4	11	2	2				50	14	4	6
Schizopora flavipora	5	1	1	2	1	1	35	3	2	42	20	3	4
S. paradoxa s. l.	132	4	9	6	2	2	227	7	5	365	100	10	16
Scopuloides hydnoides							2	1	1	2	2	1	1
Steccherinum ochraceum	15	1	1	20	1	1				35	20	2	2
Stereum gausapatum	35	1	2							35	20	1	2
S. hirsutum	4790	6	9	3190	7	7	3731	8	10	11711	500	9	26
S. rameale = S. ochraceoflavum							280	1	3	280	120	1	3
Stropharia aeruginosa				4	1	1				4	4	1	1
S. caerulea = S. cyanea	2	1	1							2	2	1	1
Thelephora terrestris							3	1	1	3	3	1	1
Tomentella fuscoferruginea	2	1	1							2	2	1	1
T. sp.	2	2	1							2	1	2	1
Trametes versicolor	4	1	1				80	1	1	84	80	2	2
Trechispora farinacea							10	1	1	10	10	1	1
Tremella mesenterica	11	3	3	7	1	1	15	1	2	33	10	4	6
Tulasnella thelephorea				1	1	1				1	1	1	1
Vuilleminia comedens	5	2	1				5	1	1	10	5	3	2
Xerocomus chrysenteron	25	7	6	36	6	2	15	9	4	76	18	10	12
Xerula radicata	1	1	1				1		1	2	1	1	2
Xylaria hypoxylon				41	3	2	68	3	2	109	40	4	4
X. longipes	442	4	8	430	4	5	173	4	7	1045	100	5	20
Xylobolus frustulatus	3	1	9	88	1	7	660	1	10	751	120	1	26

Table 6

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 one visit on one subplot

Years	1994			1995			1996			1994–1996			
Number of observations	9			7			10			26			
Number of species	107			65			115			163			
	Dcy	SF	TF	Dcy	SF	TF	Dcy	SF	TF	Dcy	MDcv	SF	TF
Agrocybe praecox				3	1	1	11	3	2	14	8	4	3
Armillaria mellea s.l.	9	3	1	68	2	1	100	1	1	177	100	3	3
Ascocoryne sarcoides	20	2	1							20	10	2	1
Athelia alnicola	3	1	1							3	3	1	1
A. decipiens	2	1	1							2	2	1	1
A. epiphylla	1	1	1	3	1	1				4	3	2	2
Basidiodendron caesiocinereum							10	1	1	10	10	1	1
Bjerkandera adusta	13	3	4	27	3	3	87	4	5	127	20	5	12
Botryobasidium laeve	3	2	2	9	3	3	7	3	2	19	5	5	7
B. subcoronatum				8	3	2	35	2	4	43	10	5	6
Brevicellicium olivascens							2	1	1	2	2	1	1
Byssomerulius corium	56	6	4	5	1	1	28	3	4	89	10	6	9
Calocera cornea	155	1	8	5	1	1	3	1	1	163	50	2	10
Ciboria batschiana	21	2	1				578	6	2	599	300	7	3
Clavulina cinerea							47	7	3	47	11	7	3
C. coralloides							2	1	1	2	2	1	1
Clitocybe candicans							1	1	1	1	1	1	1

Clitocybe clavipes	18	4	2				6	3	3	24	7	5	5
C. gibba	24	5	3				25	5	4	49	10	7	7
C. lignatilis	2	1	1							2	2	1	1
C. odora	1	1	1							1	1	1	1
Collybia butyracea = C. asema	416	8	4	1	1	1	181	8	2	597	90	9	7
C. dryophila	80	9	6	33	7	3	102	10	6	215	26	10	15
C. peronata	19	3	3	4	1	1	25	4	3	48	6	4	7
Coniophora arida	9	3	1	3	1	2	23	4	4	35	10	5	7
C. puteana							5	1	1	5	5	1	1
Crepidotus variabilis	331	3	7	116	3	3	74	2	4	521	58	4	14
Cyathus striatus	34	3	4				281	2	3	315	120	4	7
Cylindrobasidium evolvens	162	3	2	3	1	1	30	1	1	195	150	4	4
Dacryomyces minor	10	1	1	40	2	2				50	20	3	3
Daedalea quercina	9	1	9	5	1	1	7	1	1	21	9	1	11
Dentipellis fragilis							2	1	1	2	2	1	1
Entoloma sp.	1	1	1				10	4	2	11	3	5	3
Exidia glandulosa = E. truncata	13	1	2							13	10	1	2
E. plana	348	2	4	66	3	3	40	3	3	454	200	4	10
Fomes fomentarius	1	1	9							1	1	1	9
Galerina atkinsoniana							17	2	2	17	12	2	2
G. cerina							40	2	1	40	25	2	1
G. fallax							7	1	1	7	7	1	1
G. marginata	2	1	1							2	2	1	1

Tab. 6 cont.

Years	1994			1995			1996			1994–1996			
Number of observations	9			7			10			26			
Number of species	117			62			114			168			
	Dcy	SF	TF	Dcy	SF	TF	Dcy	SF	TF	Dcy	MDcv	SF	TF
Ganoderma lipsiense				2	1	1	1	1	1	3	2	1	2
Hapalopilus rutilans	1	1	1				18	2	3	19	12	3	4
Hohenbuehelia myxotricha	34	2	2							34	29	2	2
Hymenochaete rubiginosa	470	5	9	520	3	7	835	5	8	1825	250	7	24
Hymenoscyphus calyculus	30	1	1				50	1	1	80	50	2	2
H. fructigenus	10	1	1							10	10	1	1
Hyphoderma praetermissum	1	1	1				20	1	1	21	20	2	2
H. puberum	1	1	1							1	1	1	1
H. setigerum	2	1	1				12	2	2	14	10	2	3
Hyphodontia quercina							1	1	1	1	1	1	1
H. sambuci							2	1	1	2	2	1	1
Hypholoma fasciculare				32	1	2	25	2	2	57	30	2	4
H. subviride	420	3	8	214	3	4	379	4	7	1013	100	4	19
Hypochnicium geogenium	2	1	1							2	2	1	1
Hypoxylon deustum							10	1	1	10	10	1	1
H. fuscum	230	2	2							230	100	2	2
H. howeanum	380	1	7	140	2	2	180	3	4	700	80	5	13
Kuehneromyces mutabilis							2	1	2	2	1	1	2
Laccaria laccata	5	3	3				207	10	4	212	33	10	7

Lactarius camphoratus							12	1	2	12	6	1	2
L. quietus	1	1	1				17	6	3	18	3	6	4
Laetiporus sulphureus	60	1	7							60	15	1	7
Lepista flaccida = L. inversa = Clitocybe inversa	100	8	4				2	2	2	102	14	9	6
L. gilva							3	2	1	3	2	2	1
L. nuda	27	2	2	3	1	1	2	1	1	32	8	4	4
Lycoperdon perlatum	3	2	2	2	1	1	21	4	2	26	10	7	5
L. pyriforme	35	3	4	38	1	1	279	1	6	352	100	3	11
Macrolepiota procera	6	3	2	2	1	1	1	1	1	9	2	4	4
M. rhacodes	6	3	2	1	1	1				7	3	3	3
Marasmius bulliardii				34	1	1	1	1	1	35	34	2	2
M. quercophilus	10	1	1							10	10	1	1
M. rotula				5	2	1	7	3	3	12	4	4	4
M. torquescens	3	1	1				4	1	1	7	4	2	2
Megacollybia platyphylla	37	9	4	12	4	3	45	9	7	94	14	10	14
Mycena abramsii							3	1	1	3	3	1	1
M. amicta	1	1	1							1	1	1	1
M. filopes							2	1	1	2	2	1	1
M. galericulata				1	1	1	3	2	2	4	2	3	3
M. galopus	20	7	3	15	4	2	51	9	6	86	11	10	11
M. haematopus	9	2	2							9	8	2	2
M. inclinata	1019	4	4	333	3	2	174	4	3	1526	430	5	9
M. pura	188	10	5	35	7	1	27	7	4	250	43	10	10

Tab. 6 cont.

Years	1994			1995			1996			1994–1996			
Number of observations	9			7			10			26			
Number of species	117			62			114			168			
	Dcy	SF	TF	Dcy	SF	TF	Dcy	SF	TF	Dcy	MDcv	SF	TF
Mycena sanguinolenta	47	9	4	4	2	1	11	5	3	62	11	9	8
M. stylobates	62	7	2				2	4	1	64	39	9	3
M. subcaerulea	16	3	1	1	1	1	17	5	4	34	8	6	6
M. vitilis	8	4	2	6	3	2	13	6	3	27	3	9	7
M. zephirus							2	1	1	2	2	1	1
Mycenella salicina							2	1	1	2	2	1	1
Naucoria spadicea	1	1	1							1	1	1	1
Nectria cinnabarina							100	1	1	100	100	1	1
Oligoporus leucomallellus							44	1	4	44	27	1	4
O. subcaesius	3	1	1							3	3	1	1
Omphalina sp.	1	1	1							1	1	1	1
Paxillus involutus				2	1	1	1	1	1	3	2	1	2
Peniophora cinerea	79	4	6	54	3	3	170	4	4	303	100	8	13
P. quercina	29	2	2	13	1	1	25	2	2	67	20	4	5
P. rufomarginata	18	2	1				170	3	3	188	100	5	4
Peziza varia	1	1	1							1	1	1	1
P. sp.	3	1	1							3	3	1	1
Phallus impudicus				1	1	1	2	2	2	3	1	2	3
Phanerochaete laevis							13	2	2	13	8	2	2

P. martelliana	4	1	1							4	4	1	1
P. sordida	4	1	1				8	1	1	12	8	2	2
P. tuberculata							14	3	2	14	8	3	2
P. velutina	2	1	1	1	1	1	4	4	3	7	2	4	5
Phellinus contiguus	3	3	4	19	2	5	55	4	5	77	30	6	14
P. nigricans	1	1	9	2	1	6	2	1	10	5	2	1	25
Phlebiella pseudotsugae	5	2	2	2	1	1	25	2	2	32	10	3	5
P. vaga	5	1	1							5	5	1	1
P. sp.				10	1	1				10	10	1	1
Phleogena faginea	230	1	3	300	1	1	300	1	3	830	300	1	7
Pholiota flammans				2	1	1				2	2	1	1
Pluteus cervinus	7	3	2	1	1	1	6	4	2	14	3	6	5
P. inquilinus	1	1	1							1	1	1	1
P. pellitus							1	1	1	1	1	1	1
P. phlebophorus							2	1	1	2	2	1	1
P. salicinus	2	1	1							2	2	1	1
Polyporus badius	2	1	2				1	1	1	3	1	2	3
Psathyrella chondroderma	3	1	1							3	3	1	1
P. fulvescens							1	1	1	1	1	1	1
P. gossypina							1	1	1	1	1	1	1
P. obtusata	3	2	1							3	2	2	1
P. piluliformis	5	1	1							5	5	1	1
P. senex	1	1	1							1	1	1	1

Tab. 6 cont.

Years	1994			1995			1996			1994–1996			
Number of observations	9			7			10			26			
Number of species	117			62			114			168			
	Dcy	SF	TF	Dcy	SF	TF	Dcy	SF	TF	Dcy	MDcv	SF	TF
Psathyrella spadiceogrisea				3	1	1				3	3	1	1
P. spadiceogrisea f. *vernalis*							11	2	2	11	8	2	2
Pseudoclitocybe cyathiformis	2	1	1							2	2	1	1
Psilocybe inquilina var. *crobulus*	1	1	1				1	1	1	2	1	2	2
P. squamosa	14	6	3	60	7	1	73	8	1	147	29	10	5
Radulomyces confluens	27	3	2				25	2	1	52	20	4	3
R. molaris							12	1	2	12	10	1	2
R. rickii				10	1	1				10	10	1	1
Ramicola centunculus				8	1	1				8	8	1	1
Rickenella fibula	19	2	2				3	1	1	22	8	3	3
R. setipes = *R. swartzii*							5	1	1	5	5	1	1
Ripartites metrodii	3	2	2							3	2	2	2
R. tricholoma	1	1	1							1	1	1	1
Russula cyanoxantha	17	4	4				23	6	4	40	6	6	8
R. ochroleuca	3	3	2				11	3	2	14	6	5	4
R. pectinatoides							11	3	3	11	7	3	3
R. violeipes							5	4	3	5	1	4	3
Schizophyllum commune				23	1	1				23	23	1	1

Schizopora flavipora	1	1	1	5	1	1	30	2	3	36	10	3	5
S. paradoxa s. l.	318	7	9	251	5	7	585	9	9	1154	100	10	25
Sistotrema brinkmanii	1	1	1							1	1	1	1
Steccherinum ochraceum	23	2	2	67	2	4				90	22	4	6
Stereum hirsutum	1340	8	9	1460	7	7	3200	9	10	6000	200	10	26
S. rameale = S. ochraceoflavum	65	3	2	50	1	1				115	50	4	3
Stropharia aeruginosa	3	2	1				3	2	1	6	2	3	2
S. caerulea = S. cyanea	6	3	3							6	3	3	3
Tomentella neobourdotii							1	1	1	1	1	1	1
Trametes versicolor							500	1	2	500	300	1	2
Trechispora farinacea				3	1	1	5	1	1	8	5	2	2
T. mollusca							19	3	4	19	5	3	4
Tremella mesenterica	33	4	5				3	1	2	36	7	5	7
Tubaria furfuracea				6	1	1				6	6	1	1
Tulasnella eichleriana	3	1	1							3	3	1	1
Vuilleminia comedens							34	6	4	34	5	6	4
Xerocomus chrysenteron	47	10	6	63	10	3	30	8	4	140	10	10	13
Xerula radicata	1	1	1				1	1	1	2	1	2	2
Xylaria hypoxylon				332	6	3	525	7	5	857	150	10	8
X. longipes	417	6	9	323	9	4	187		5	927	84	9	18

Table 7

Synoptical fungus table of the plot III

Dcy – number of fruit-bodies, SF – spatial frequency, TF – total temporal frequency and MDcv – maximum number of fruit-bodies during one visit on one subplot

Years	1994			1995			1996			1994–1996			
Number of observations	9			7			10			26			
Number of species	79			59			76			125			
	Dcy	SF	TF	Dcy	SF	TF	Dcy	SF	TF	Dcy	MDcv	SF	TF
Armillaria mellea s. l.	2	2	1							2	1	2	1
Athelia epiphylla				2	1	1				2	2	1	1
Basidioradulum radula	3	1	2	35	2	1	1	1	1	39	30	3	4
Bjerkandera adusta	4	1	2				23	2	3	27	15	2	5
Boletus pulverulentus							2	2	2	2	1	2	2
Botryobasidium conspersum				1	1	1				1	1	1	1
Byssomerulius corium	98	4	5				62	3	4	160	30	7	9
Ciboria batschiana				9	1	1				9	9	1	1
Clavulina cinerea	9	2	1				2	1	1	11	7	2	2
C. coralloides							2	1	1	2	2	1	1
Clitocybe candicans	1	1	1				3	2	1	4	2	3	2
C. clavipes	3	2	1							3	2	2	1
C. gibba							17	5	2	17	8	5	2
C. hydrogramma = *C. phaeophthalma*				3	2	1	100	8	1	103	37	8	2
C. metachroa							1	1	1	1	1	1	1
C. sp.							5	1	1	5	5	1	1
Collybia butyracea = *C. asema*	119	10	5	2	2	1	69	8	3	190	24	10	9

C. dryophila	191	10	6	24	8	3	67	9	5	282	25	10	14
C. fusipes	1	1	1	47	1	2	13	1	1	61	35	2	4
C. peronata	19	6	4	11	1	2	104	5	4	134	22	6	10
Coniophora arida	3	1	1				10	1	1	13	10	2	2
Coprinus micaceus							14	1	1	14	14	1	1
C. sp.	5	1	1							5	5	1	1
Crepidotus variabilis	72	2	2	20	1	1	35	1	2	127	60	2	5
Cyathus striatus	158	4	6	86	2	2				244	90	4	8
Dacryomyces minor				17	2	1				17	12	2	1
Daedalea quercina	20	1	9				1	1	1	21	20	1	10
Entoloma sp.	2	2	2				2	2	1	4	1	4	3
Exidia glandulosa = E. truncata				5	1	1				5	5	1	1
E. plana							30	1	2	30	20	1	2
E. sp.				1	1	1				1	1	1	1
Hymenochaete rubiginosa				150	1	3	320	1	9	470	100	1	12
Hymenoscyphus fructigenus	10	1	1							10	10	1	1
Hyphoderma argillaceum	1	1	1							1	1	1	1
H. mutatum							25	1	2	25	20	1	2
H. praetermissum	1	1	1	17	3	3	2	1	1	20	10	4	5
H. puberum	1	1	1							1	1	1	1
H. setigerum				56	2	2				56	30	2	2
Hyphodontia sambuci	26	2	2	10	1	1	20	1	2	56	20	3	5
Hypholoma fasciculare				3	1	1				3	1	1	1

Tab. 7 cont.

Years	1994			1995			1996			1994–1996			
Number of observations	9			7			10			26			
Number of species	117			62			114			168			
	Dcy	SF	TF	Dcy	SF	TF	Dcy	SF	TF	Dcy	MDcv	SF	TF
Hypholoma subviride				7	1	1	2	1	1	9	7	1	2
Hypoxylon howeanum	395	3	3	1110	3	6	960	1	10	2465	350	4	19
Inonotus radiatus	30	1	2							30	20	1	2
Laccaria laccata	13	5	4				56	9	4	69	10	9	8
Lactarius quietus	5	2	3				17	7	2	22	7	8	5
Lepista flaccida = L. inversa = Clitocybe inversa	48	5	4				13	4	2	61	9	7	6
L. gilva							45	7	1	45	20	7	1
L. nuda	62	3	3	1	1	1	32	5	1	95	26	6	5
Lycoperdon perlatum	7	2	3				2	1	1	9	2	2	4
L. pyriforme	14	2	2							14	10	2	2
Macrolepiota procera	39	7	4	7	4	2	4	3	2	50	7	9	8
M. rhacodes	28	7	3	3	1	1	4	4	2	35	17	8	6
Marasmius bulliardii	332	5	3	11	1	1				343	134	5	4
M. quercophilus	100	2	1							100	97	2	1
M. rotula							25	1	1	25	25	1	1
Megacollybia platyphylla	9	4	4	6	1	1	5	3	3	20	6	6	8
Mollisia sp.				500	1	1				500	500	1	1
Mycena galericulata							1	1	1	1	1	1	1

M. galopus	107	10	3	3	1	1	27	7	4	137	17	10	8
M. galopus var. *nigra*							1	1	1	1	1	1	1
M. inclinata	710	2	2							710	490	2	2
M. mucor							1	1	1	1	1	1	1
M. pelianthina	1	1	1	1	1	1				2	1	2	2
M. pullata							1	1	1	1	1	1	1
M. pura	14	3	4				8	5	3	22	4	7	7
M. rorida	1	1	1							1	1	1	1
M. sanguinolenta	140	10	2	4	2	2	13	5	2	157	22	10	6
M. stylobates	127	10	3				2	2	2	129	23	10	5
M. vitilis	2	1	1	2	1	2	7	6	2	11	2	6	5
M. zephirus	2	1	2				2	1	1	4	2	1	3
Nectria cinnabarina	50	1	1				20	1	1	70	50	2	2
N. sp.							100	1	1	100	100	1	1
Oligoporus subcaesius	2	1	2							2	1	1	2
Peniophora cinerea	205	7	4	226	6	4	360	7	5	791	100	8	13
P. incarnata							1	1	1	1	1	1	1
P. quercina	140	4	4	63	4	3	30	2	1	233	50	8	8
P. rufomarginata				10	1	1				10	10	1	1
Phanerochaete laevis	1	1	1							1	1	1	1
P. velutina				8	1	1				8	8	1	1
P. sp.				4	1	1				4	4	1	1
Phellinus contiguus	5	3	8	75	6	5	5	2	2	85	10	7	15

Tab. 7 cont.

Years	1994			1995			1996			1994–1996			
Number of observations	9			7			10			26			
Number of species	117			62			114			168			
	Dcy	SF	TF	Dcy	SF	TF	Dcy	SF	TF	Dcy	MDcv	SF	TF
Phellinus robustus	2	2	8	2	2	6				4	1	2	14
Phlebia radiata							40	2	1	40	20	2	1
P. rufa				5	1	1	5	1	1	10	5	2	2
P. tremellosa	45	1	3	1	1	1	1	1	1	47	22	2	5
Phlebiella vaga	9	1	2				10	1	1	19	10	2	3
Pholiota lenta	31	3	2				8	2	1	39	15	4	3
Pluteus cervinus	1	1	1				1	1	1	2	1	2	2
Psathyrella candolleana				1	1	1				1	1	1	1
P. obtusata	4	1	1							4	4	1	1
P. ocellata	3	1	1							3	3	1	1
P. spadiceogrisea	5	2	2							5	2	2	2
Psilocybe squamosa	69	7	5	29	5	1	14	4	1	112	16	8	7
Radulomyces confluens	50	2	4	28	2	2	10	1	1	88	25	4	7
R. molaris	10	1	1	1	1	1				11	10	2	2
R. rickii				2	1	1				2	2	1	1
Ripartites metrodii	13	4	3							13	5	4	3
R. tricholoma							3	2	1	3	2	2	1
Rosellinia aquila	15	1	1							15	15	1	1
Russula cyanoxantha	9	2	2	1	1	1	1	1	1	11	8	4	4

R. ochroleuca							5	1	1	5	3	1	1
R. pectinatoides							4	3	2	4	1	3	2
R. violeipes	1	1	1	2	2	1	17	7	2	20	5	7	4
Schizophyllum commune							6	1	2	6	3	1	2
Schizopora flavipora				3	2	2				3	2	2	2
S. paradoxa s. l.	341	10	9	527	9	7	334	8	8	1202	90	10	24
Scleroderma areolatum							4	1	1	4	4	1	1
Sebacina calospora				1	1	1				1	1	1	1
Sistotrema brinkmanii	1	1	1							1	1	1	1
S. oblongisporum	7	2	3	2	1	1				9	3	3	4
Sistotremastrum niveocremeum	5	1	1	2	1	1				7	5	2	2
Steccherinum ochraceum	11	2	2				70	3	2	81	20	5	4
Stereum gausapatum	65	1	3							65	30	1	3
S. hirsutum	30	2	2	22	3	3	10	1	2	62	20	4	7
Stropharia aeruginosa	3	1	1				2	1	1	5	3	2	2
S. caerulea = *S. cyanea*	6	3	2							6	2	3	2
Subulicystidium longisporum				4	1	2				4	3	1	2
Stypella grilletii = *Myxarium podlachicum*				2	1	1				2	2	1	1
Trechispora farinacea	3	1	1							3	3	1	1
Tremella mesenterica	2	1	1							2	2	1	1
Tubaria conspersa	1	1	1							1	1	1	1
Vuilleminia comedens	42	7	4	18	5	2	70	5	4	130	20	9	10
Xerocomus chrysenteron	44	9	5	29	6	1	41	8	5	114	11	10	11
Xylaria hypoxylon	200	3	4	36	2	2	200	4	7	436	30	7	13
X. longipes	7	2	2	8	1	1	13	1	2	28	10	3	5

Table 8

Synoptical fungus table of the plot IV

Dcy – number of fruit-bodies, SF – spatial frequency, TF – total temporal frequency and MDcv – maximum number of fruit-bodies during one visit on one subplot

Years	1994			1995			1996			1994–1996			
Number of observations	9			7			10			26			
Number of species	101			46			79			137			
	Dcy	SF	TF	Dcy	SF	TF	Dcy	SF	TF	Dcy	MDcv	SF	TF
Agaricus sylvicola = A. essetei = A. abruptibulbus	3	1	1							3	3	1	1
Armillaria mellea s. l.	27	4	2							27	20	4	2
Athelia acrospora	3	1	1							3	3	1	1
A. alnicola	3	1	1							3	3	1	1
A. salicum	1	1	1							1	1	1	1
Basidiodendron caesiocinereum	6	1	2	12	1	2	5	1	1	23	10	1	5
Botryobasidium laeve	2	1	1	2	1	1				4	2	2	2
B. subcoronatum				4	1	1				4	4	1	1
Byssomerulius corium	45	6	4				129	6	6	174	20	8	10
Ciboria batschiana	13	2	1	4	1	1	11	1	1	28	11	3	3
Clavulina cinerea	6	1	2				6	3	2	12	4	4	4
C. coralloides	1	1	1							1	1	1	1
Clitocybe candicans							2	1	1	2	2	1	1
C. clavipes	4	1	2				11	2	2	15	8	2	4
C. gibba	2	2	1				14	5	3	16	6	5	4

C. metachroa							14	3	1	14	8	3	1
C. sp.							72	7	1	72	22	7	1
Collybia butyracea = C. asema	337	10	5	1	1	1	141	9	3	479	50	10	9
C. dryophila	29	6	6	13	5	3	32	9	6	74	8	10	15
C. fusipes							4	1	1	4	4	1	1
C. peronata	43	7	5	26	2	2	69	5	3	138	23	7	10
Conocybe tenera	2	1	1							2	2	1	1
Cortinarius cfr. *alnetorum*							2	1	1	2	2	1	1
C. sp.	22	3	1							22	10	3	1
Crepidotus variabilis	278	4	5	22	2	3	37	3	2	337	60	6	10
Cyathus striatus	75	2	5				10	1	1	85	10	3	6
Dacryomyces minor	40	1	1	10	1	1				50	40	2	2
D. stillatus	30	1	1							30	30	1	1
Entoloma sp.	3	2	1				4	2	2	7	2	4	3
Gymnopilus stabilis	53	1	1							53	53	1	1
Hapalopilus rutilans							4	1	1	4	4	1	1
Hebeloma claviceps							1	1	1	1	1	1	1
H. clavulipes	2	2	1							2	1	2	1
H. sacchariolens	12	1	1							12	9	1	1
Hymenochaete rubiginosa				40	1	2	50	1	1	90	50	1	3
Hymenoscyphus calyculus	45	2	2							45	25	2	2
Hyphoderma praetermissum	10	1	1	5	1	1	20	1	1	35	20	3	3
H. puberum	1	1	1	3	1	1				4	3	1	2

Tab. 8 cont.

Years	1994			1995			1996			1994–1996			
Number of observations	9			7			10			26			
Number of species	117			62			114			168			
	Dcy	SF	TF	Dcy	SF	TF	Dcy	SF	TF	Dcy	MDcv	SF	TF
Hyphodontia pallidula				3	1	1	5	1	1	8	5	2	2
Hypholoma capnoides	2	1	1							2	2	1	1
H. fasciculare				15	1	1	10	1	1	25	15	2	2
H. lateritium	9	2	2	12	2	2				21	8	3	4
H. subviride	106	1	1	100	2	2	106	4	5	312	106	4	8
Hypochnicium erikssonii	3	1	2							3	2	1	2
H. geogenium	7	1	1							7	7	1	1
Hypoxylon howeanum	365	2	7	80	2	2				445	120	3	9
Inocybe geophylla var. *lilacina*	3	2	2				4	1	2	7	3	2	4
I. quietiodor							8	1	1	8	8	1	1
Laccaria amethystina							2	1	2	2	1	1	2
L. laccata	87	6	4				143	8	4	230	32	9	8
Lactarius quietus	3	2	2	1	1	1	26	5	3	30	7	5	6
Lepista flaccida = *L. inversa* = *Clitocybe inversa*	16	4	2				7	2	2	23	7	5	4
L. gilva							7	4	1	7	3	4	1
L. irina	14	1	1							14	14	1	1
L. nuda	51	6	2				77	7	1	128	41	9	3

Lycoperdon perlatum	2	1	1				16	3	3	18	8	4	4
L. pyriforme	1006	4	6	103	1	2	318	2	7	1427	200	5	15
Macrolepiota procera	3	3	3	6	5	1				9	2	5	4
M. rhacodes	5	2	3				6	2	1	11	5	3	4
Marasmiellus ramealis							7	1	1	7	1	1	1
Marasmius bulliardii	18	3	2							18	7	3	2
Marasmius quercophilus	4	1	1							4	1	1	1
M. rotula				5	1	1				5	5	1	1
Megacollybia platyphylla	10	4	3	6	2	1	15	7	3	31	4	9	7
Mycena amicta	1	1	1							1	1	1	1
M. bulbosa							1	1	1	1	1	1	1
M. filopes							1	1	1	1	1	1	1
M. galericulata							10	1	1	10	10	1	1
M. galopus	94	10	3	12	2	1	22	8	4	128	13	10	8
M. inclinata	32	1	1	13	1	1				45	32	2	2
M. leptocephala	2	1	1							2	2	1	1
M. pelianthina	1	1	1							1	1	1	1
M. pura	14	6	4	1	1	1	2	2	2	17	4	6	7
M. rorida	5	3	1							5	3	3	1
M. sanguinolenta	120	9	2	1	1	1	48	4	3	169	32	9	6
M. stylobates	286	9	2				17	4	2	303	70	10	4
M. vitilis	21	8	4	3	2	2	7	3	2	31	3	9	8
M. zephirus	38	2	3				18	1	1	56	30	2	4

Tab. 8 cont.

Years	1994			1995			1996			1994–1996			
Number of observations	9			7			10			26			
Number of species	117			62			114			168			
	Dcy	SF	TF	Dcy	SF	TF	Dcy	SF	TF	Dcy	MDcv	SF	TF
Nectria cinnabarina	90	1	1				50	1	1	140	90	1	2
Oligoporus subcaesius	5	1	1				2	1	1	7	5	2	2
Paxillus involutus	1	1	1				5	4	3	6	2	4	4
Peniophora cinerea	150	2	6	30	1	1	185	5	2	365	80	5	9
P. incarnata	2	1	1							2	2	1	1
P. laeta							3	1	1	3	3	1	1
P. quercina	85	4	3	30	1	1	80	3	3	195	30	6	7
Phanerochaete sanguinea	1	1	1							1	1	1	1
P. tuberculata				5	1	1				5	1	1	1
P. sp.	1	1	1							1	1	1	1
Phellinus contiguus	5	2	2				16	2	3	21	7	3	5
P. nigricans	1	1	3	1	1	5	1	1	1	3	1	1	9
Pholiota lenta	1	1	1							1	1	1	1
Pluteus cervinus	1	1	1	2	2	2	2	2	2	5	1	2	5
Psathyrella gracilis	3	1	1							3	1	1	1
P. obtusata	4	1	1							4	1	1	1
P. ocellata				7	1	1				7	7	1	1
P. prona	3	1	1							3	1	1	1

P. spadiceogrisea				1	1	1				1	1	1	1
Psilocybe inquilina var. *crobulus*				2	1	1	1	1	1	3	1	2	2
P. squamosa	54	6	4	11	5	1	19	7	1	84	21	8	6
Radulomyces confluens	111	5	4	14	2	1	33	3	3	158	25	6	8
R. molaris	23	3	3							23	10	3	3
Ramaria eumorpha	3	1	1							3	1	1	1
Ramicola centunculus				11	2	1				11	9	2	1
Ripartites metrodii	1	1	1							1	1	1	1
R. tricholoma	7	4	2				2	2	1	9	2	6	3
Russula cyanoxantha	31	6	3				6	4	4	37	3	8	7
R. foetens							1	1	1	1	1	1	1
R. nigricans							3	1	1	3	3	1	1
R. ochroleuca							2	1	2	2	1	1	2
R. pectinatoides							11	5	3	11	3	5	3
R. violeipes	7	3	2	4	1	1	26	7	2	37	9	7	5
Schizophyllum commune	30	1	2				40	1	2	70	20	2	4
Schizopora flavipora	6	1	1							6	6	1	1
S. paradoxa s. l.	434	8	9	318	8	7	253	6	6	1005	55	9	22
Scleroderma bovista	1	1	1							1	1	1	1
Scopuloides hydnoides							1	1	1	1	1	1	1
Sebacina incrustans							33	3	1	33	20	3	1
Sistotrema brinkmanii	2	2	1							2	1	2	1
S. oblongisporum	1	1	1							1	1	1	1

Tab. 8 cont.

Years	1994			1995			1996			1994–1996			
Number of observations	9			7			10			26			
Number of species	117			62			114			168			
	Dcy	SF	TF	Dcy	SF	TF	Dcy	SF	TF	Dcy	MDcv	SF	TF
Sceletocutis nivea	5	1	2							5	4	1	2
Steccherinum ochraceum	15	1	1	110	1	3	15	1	1	140	70	1	5
Stereum gausapatum							20	1	1	20	20	1	1
S. sanguinolentum	5	1	1							5	5	1	1
Strobilurus tenacellus							2	1	2	2	2	1	2
Stropharia aeruginosa							1	1	1	1	1	1	1
Tomentella sp.	2	2	1							2	1	2	1
Trechispora farinacea	4	1	1							4	4	1	1
Tremella encephala	5	1	1							5	5	1	1
T. mesenterica	14	3	2				3	1	1	17	7	3	3
Tubaria conspersa	4	1	1							4	4	1	1
Vuilleminia comedens	16	4	4	14	3	2	53	7	5	83	13	8	11
Xerocomus chrysenteron	48	10	4	57	8	1	33	9	4	138	14	10	9
X. rubellus	1	1	1							1	1	1	1
X. subtomentosum							1	1	1	1	1	1	1
Xerula pudens				1	1	1				1	1	1	1
Xylaria hypoxylon	100	3	4	90	2	2	102	2	3	292	60	5	9
X. longipes	12	1	1	12	1	1	47	3	4	71	12	4	6

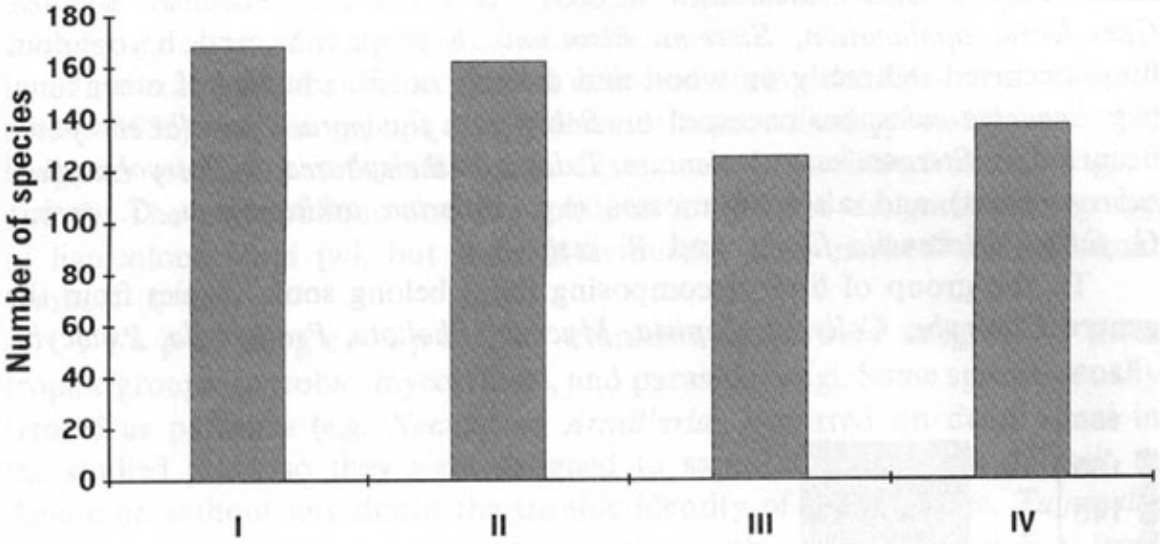

Fig. 6. Number of fungi collected during the years 1994–1996 on the plots I–IV

The richest in species were plots I (168 species) and II (162 species), slightly less abundant in species were plots III (125) and IV (137) – Fig. 6.

In the studied plots 16 species new to Poland were found. These were: *Athelia acrospora*, *A. decipiens*, *Galerina cerina*, *Hebeloma clavulipes*, *Inocybe quietiodor*, *Mycena subcaerulea*, *Mycenella salicina*, *Phanerochaete martelliana*, *Psathyrella impexa*, *P. ocellata*, *P. senex*, *Ramicola laevigata*, *Sebacina calospora*, *Sistotrema oblongisporum*, *Tomentella fuscoferruginea*, and *T. neobourdotii*.

A part of these species are rare or very rare species for Poland. *Mycena bulbosa* is known in Poland from the Niepołomice Forest only (K o m o r o w s k a 1991). Some of them, e.g. *Athelia salicum*, *Stypella grilletii* and *Tulasnella eichleriana* had not been recorded in Poland for over one hundred years. These species were collected for the last time in the environs of Międzyrzec Podlaski in northeastern Poland by B. Eichler (B r e s a d o l a 1903).

E c o l o g i c a l a n a l y s i s. For each plot the following data were calculated: the total numbers of fruit-bodies of each species in the subsequent years (Dcy), the numbers of subplots in which fruit-bodies were recorded in each year (SF), the numbers of visits during which a species was recorded (TF), and maximum numbers of fruit-bodies recorded during one visit (MDcv). The results are given in Tables 5 to 8.

S u b s t r a t e. During each visit on the plot data on direct and indirect substrate of each fungus were recorded. Fungi formed fruit-bodies on wood, on litter (on plant fragments), on the ground, and some (infrequently) on fruit-bodies of other fungi and mosses growing on wood.

Lignicolous fungi occurred on standing, fallen, live, and dead logs and on hanging as well as fallen, dead or live, tree and shrub branches. The majority of these fungi formed fruit-bodies directly on wood (e.g. *Fistulina hepatica*, *Ganoderma applanatum*, *Stereum hirsutum*). Mycophilous and bryophilous fungi occurred indirectly on wood and directly on fruit bodies of other fungi (e.g. *Sebacina calospora* occurred on *Schizopora flavipora*, *Tremella encephala* occurred on *Stereum sanguinolentum*, *Tulasnella thelephorea* on *Botryobasidium subcoronatum*) and also on mosses (e.g. *Galerina atkinsoniana*, *G. cerina*, *G. fallax*, *Rickenella fibula*, and *R. setipes*).

To the group of litter-decomposing fungi belong some species from the genera *Clitocybe*, *Collybia*, *Lepista*, *Mycena*, *Pholiota*, *Psathyrella*, *Psilocybe*,

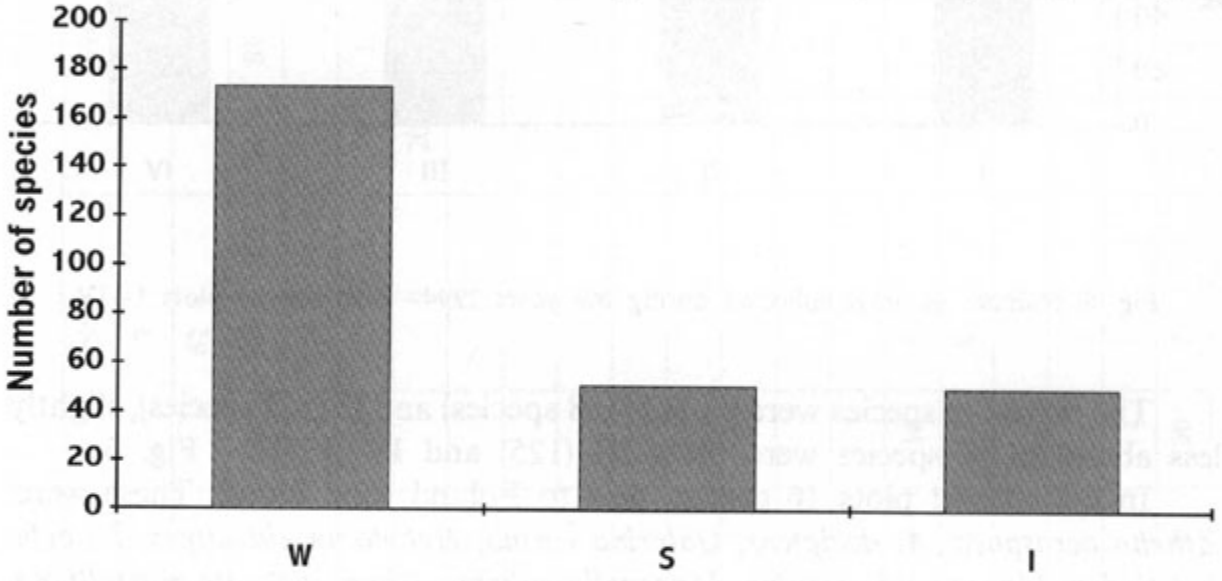

Fig. 7. Total number of fungal species on different substrates: l—litter, s—soil, w—wood

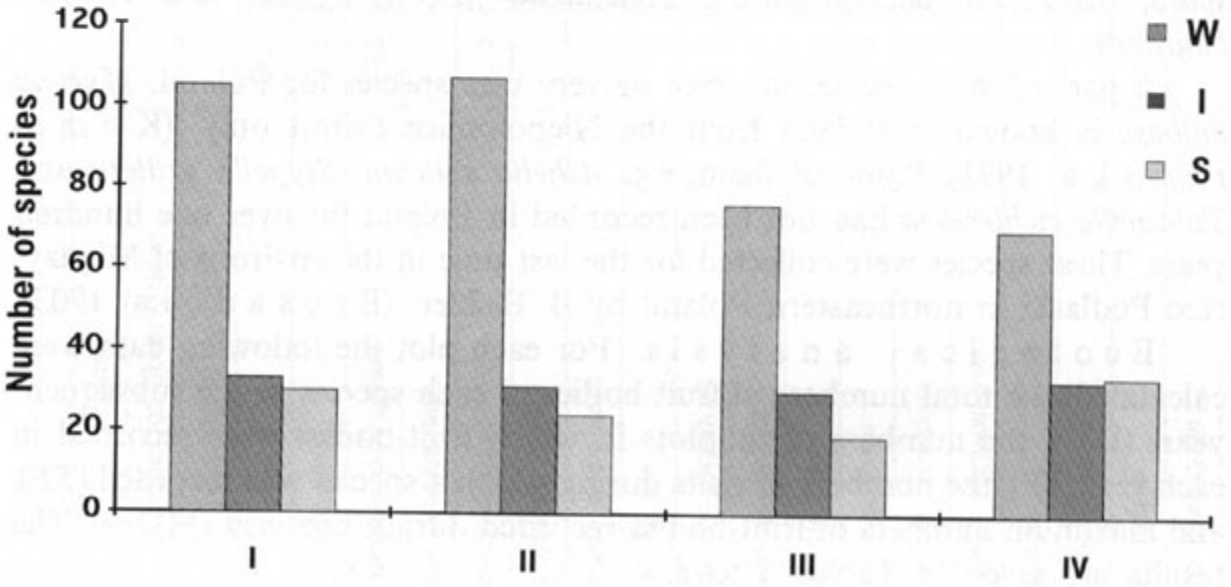

Fig. 8. Number of fungal species on each plot on different substrates: l—litter, s—soil, w—wood

and *Strobilurus*. The last genus in the present study has been assigned to litter and not wood.

On bare ground occur fruit-bodies of terrestrial fungi, e.g. *Hebeloma*, *Inocybe*, *Laccaria*, *Lactarius*, and *Russula*.

In the alphabetical list of species collected during the three-year research (1994–1996) trophic groups are indicated: mycorrhizal, parasitic, saprobic fungi, as well as a substrate: fungi, litter, mosses, soil and wood (Figs 7 and 8). The mycophilous and bryophilous fungi were assigned to a group of lignicolous fungi (w), but their individuality was marked with different symbols (f, m).

Trophic groups. The examined fungi were assigned to three trophic groups: saprobic, mycorrhizal, and parasitic fungi. Some species usually treated as parasites (e.g. *Nectria* or *Armillaria*), occurred on dead wood in the studied plots, so they were assigned to saprobic fungi. It is difficult to determine without any doubt the trophic identity of some species. *Tulasnella thelephorea* grows on wood mostly together with corticoid fungi (e.g. from the genus *Botryobasidium*), but it is unknown whether it is a parasite on these fungi or it decomposes their dying fruit-bodies, or at last, whether it decomposes wood.

The numbers of fungi occurring in the above-given groups in all plots are given in Fig. 9, while individual numbers of fungi for each of the four plots are given in Fig. 10.

Saprobes were the most abundant fungi in the collected material and their total number reached 234, there were also 33 mycorrhizal, and as few as 7 parasitic fungi found in this study. The most abundant in saprobes were plots I (144) and II (148), while mycorrhizal fungi were most numerous in plot IV (22) – Figs 9 and 10.

Weather impact. The numbers of recorded species were changing over the three years of studies. In the first year, in spite of the fact that studies were launched as late as in July, the highest number of 193 species was recorded. In the second year the number of species was 118, and in the third year it was 184 for all the plots. The richest in species was September 1994. The number of species for all the plots was 134, they were equally abundant in October: 105 (Fig. 11). In the plots I and II subsequently 64 and 68 species were recorded (Fig. 12). September was the richest in species also in the later years (Fig. 11). The numbers of fungi in particular plots differed from each other, for example in July 1996, the plots I and II had respectively 51 and 53 species, in September plot III had 41 species and in October plot IV had 36 species (Fig. 12). The comparison of these numbers with meteorological data demonstrates dependence of the number of species upon the amount of rainfall. Similar dependencies can be noticed between the numbers of fructifications and the amount of rainfall.

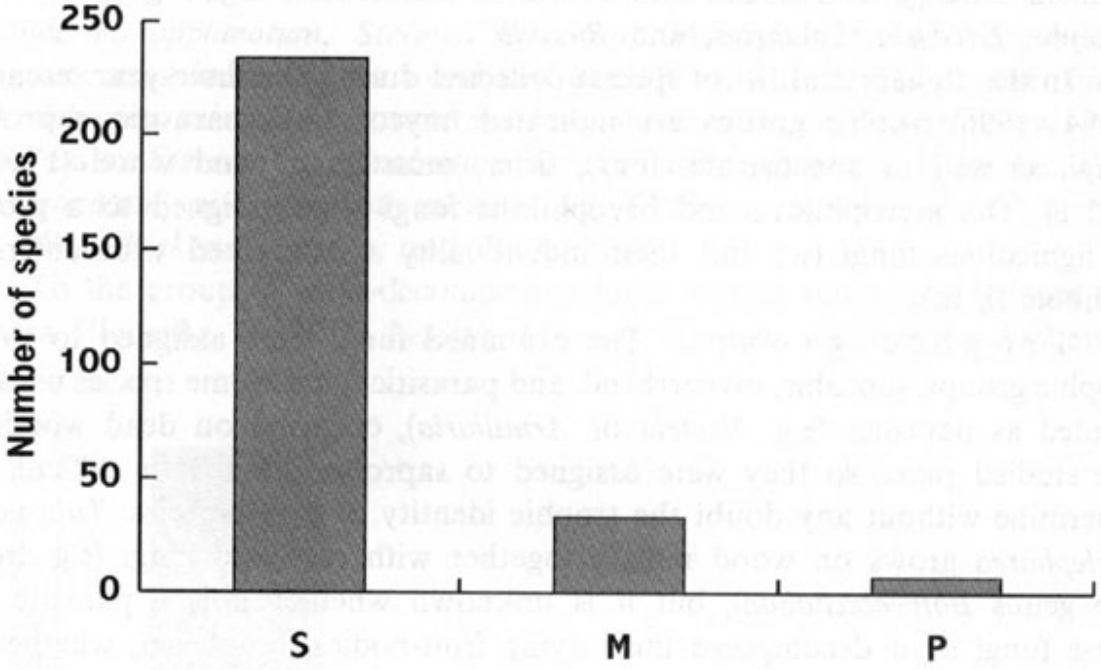

Fig. 9. Total number of species in the trophic groups of fungi: M – mycorrhizal, P – parasitic, S – saprobic

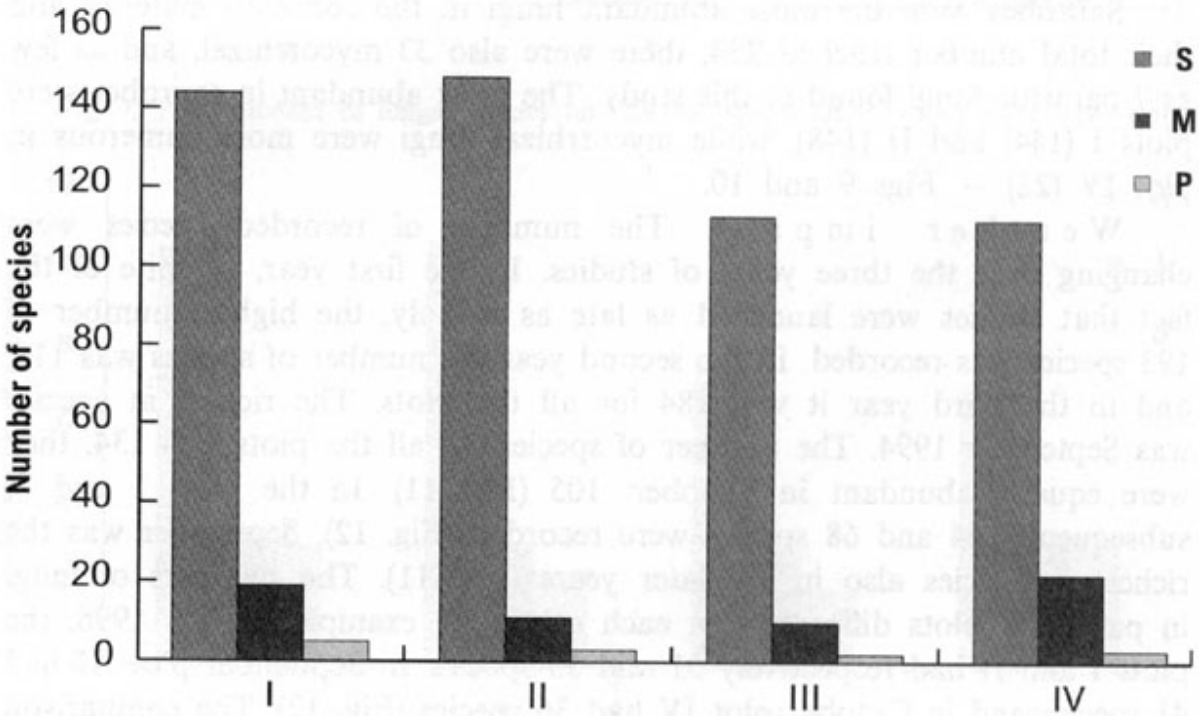

Fig. 10. Number of species on each plot in the trophic groups of fungi: M – mycorrhizal, P – parasitic, S – saprobic

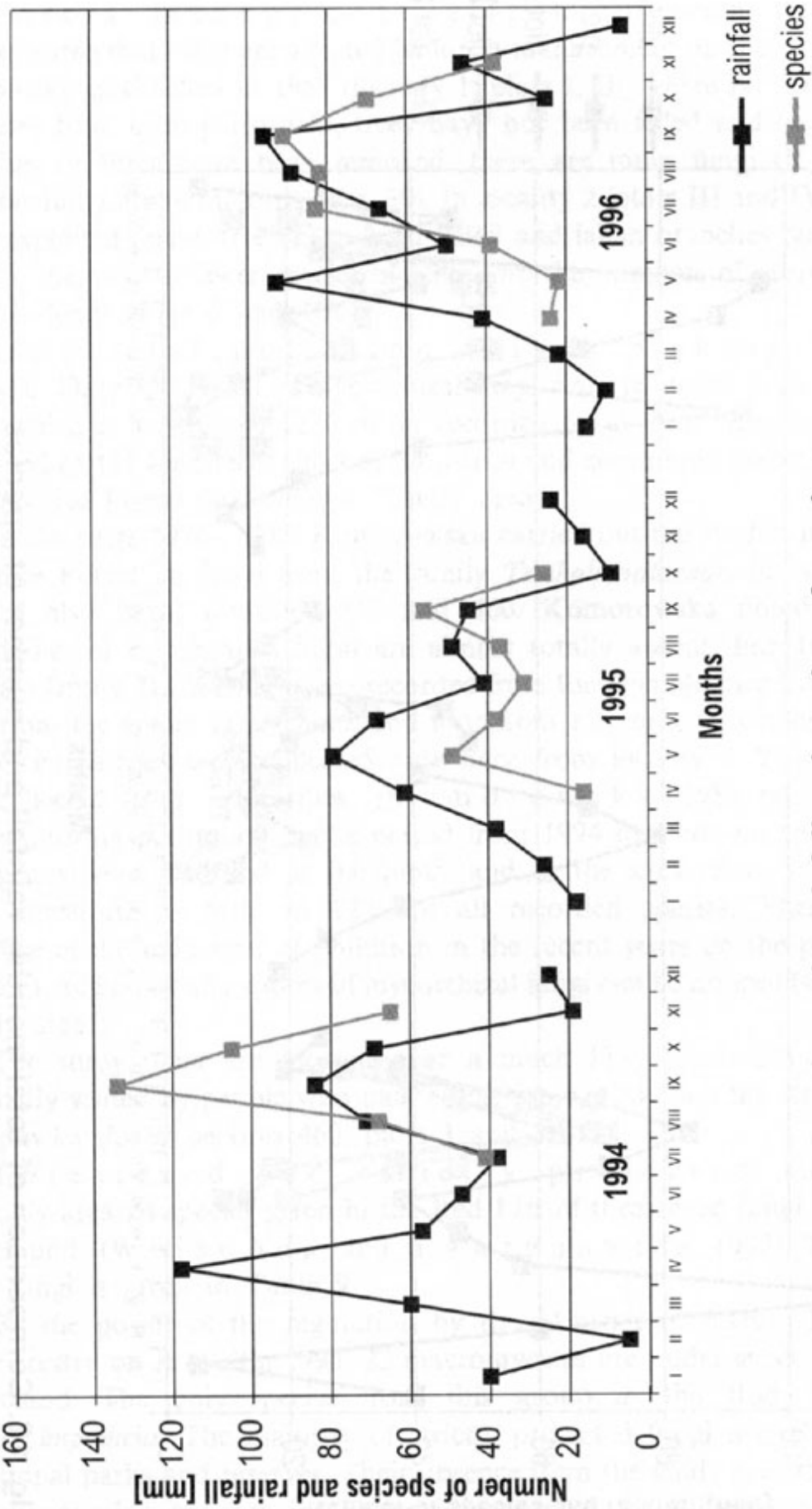

Fig. 11. Comparison of total months rainfall and number of species collected in each year on all plots.

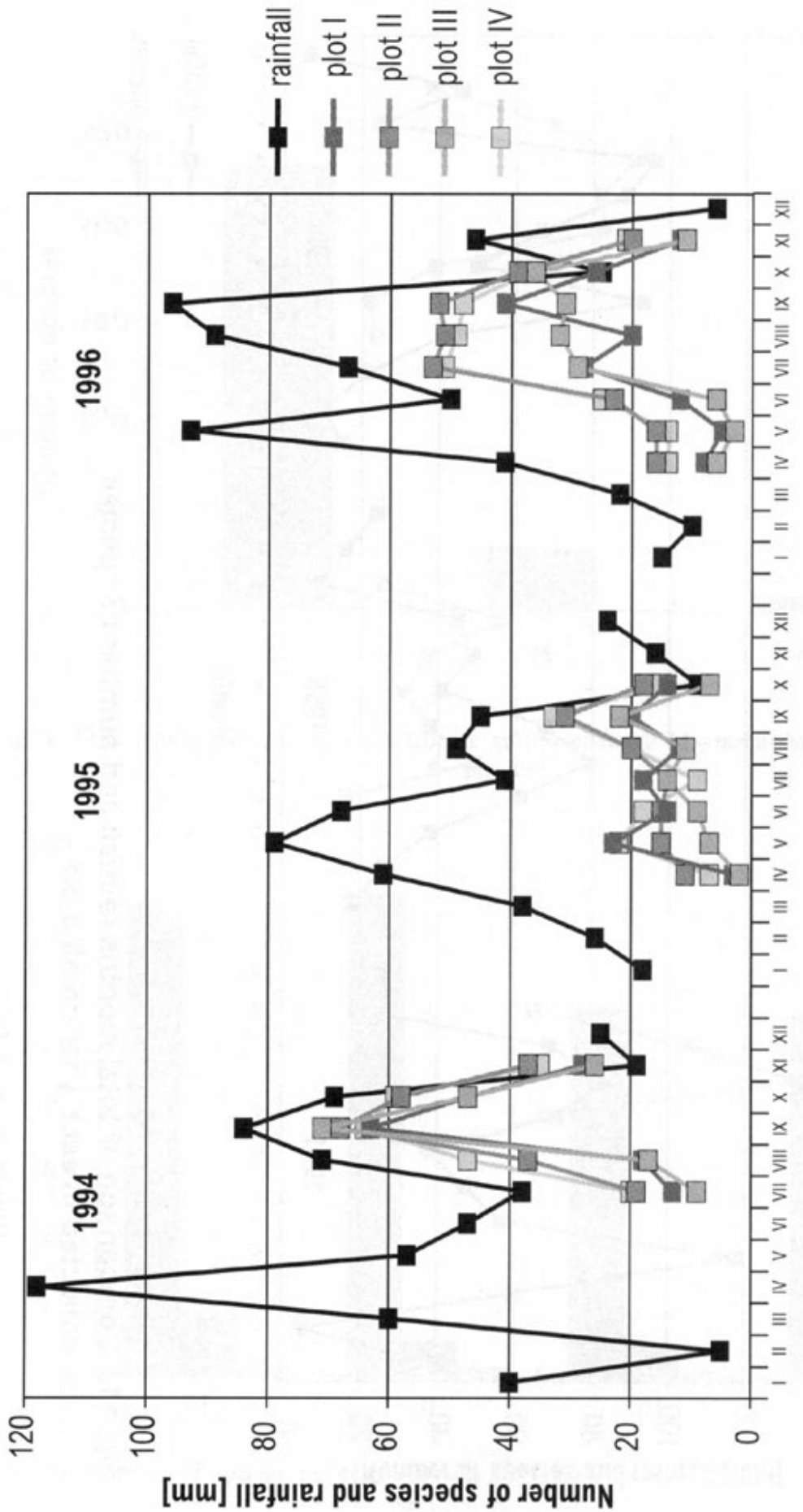

Fig. 12. Comparison of total monthly rainfall and number of species collected in each year on each plot.

Forest management effect. The present studies have demonstrated that fungi are affected by forest management. In the strict reserve of Lipówka established in 1958 (locality 1; plots I, II), where no management measures have been performed, trees have not been felled and neither logs, branches or litter have been removed, there are more fungi (Fig. 6) and saprobic fungi are in majority (Fig. 10). In locality 2 (plots III and IV), located in an exploited forest, trees have been felled and fallen branches removed. In this site there occur fewer species of fungi and the numbers of saprobic fungi are also fewer (Figs 6 and 10).

Industrial pollution versus picking edible fungi. Only 33 species of mycorrhizal fungi were recorded from the study plots, which is as little as 12% of all recorded fungi. This situation may be explained by the long-term effect of industrial and communal pollution on the Niepołomice Forest (see chapter "Study area").

In the years 1976–1980 Komorowska carried out the studies in the Niepołomice Forest on fungi from the family *Tricholomataceae*, the study area covered also forest divisions 447 and 460. Komorowska noted that the fruit-bodies of mycorrhizal fungi are almost totally absent. For 166 species from the family *Tricholomataceae* recorded from the Niepołomice Forest, three were from the genus *Tricholoma*, and four from *Laccaria*. *Tricholoma fulvum* and *T. imbricatum* were collected only once from locality 1. *T. sulphureum* was collected from 7 localities (Komorowska 1986 msc.). During the monitoring performed in the period from 1994 to 1996, no species from that genus were recorded in the plots, and at the same time, mycorrhizal fungi constitute as little as 12% of all recorded species. Therefore, no influence of the reduction of pollution in the recent years on the production of spores, and especially spores of mycorrhizal fungi can be noticed (see chapter "Study area").

The study plots are located near a much busy road. They are also frequently visited by people who pick edible fungi, also from the strict reserve of Lipówka (forest section 460, plots I and II).

Threatened and strictly protected fungi. In the study area 24 species given in the Red List of threatened fungi in Poland were found (Wojewoda and Ławrynowicz 1992). The list of these fungi is given in Table 9.

By the power of the regulation by the Minister of Nature Protection and Forestry on June 4th, 1995, 22 macromycetes are under strict protection in Poland. The only species from this group in the study area was *Phallus impudicus*. The majority of strictly protected fungi occur in Poland in national parks and reserves. Their absence from the study area demonstrates unfavourable changes in the environment of the Niepołomice Forest, as a result of which fungi with greater ecological demand are being eliminated.

Table 9

Fungi of the Red List of threatened fungi in Poland, collected on investigated plots in the Niepołomice Forest

Species	Plots				The red data book categories			
	I	II	III	IV	E	V	R	I
1. *Botryobasidium laeve*	+	+		+			+	
2. *Clitocybe candicans*		+	+	+				+
3. *Dacryomyces tortus*	+							+
4. *Fistulina hepatica*	+					+		
5. *Galerina triscopa*	+							+
6. *Hebeloma claviceps*				+			+	
7. *Hohenbuehelia myxotricha*	+	+					+	
8. *Hymenochaete cinnamomea*	+							+
9. *Macrolepiota procera*	+	+	+	+				+
10. *Marasmius bulliardii*	+	+	+	+				+
11. *Mycena abramsii*	+	+					+	
12. *M. crocata*	+						+	
13. *M. pelianthina*	+		+	+				+
14. *M. pullata*			+			+		
15. *Phlebia rufa*			+					+
16. *Phleogena faginea*	+	+			+			
17. *Physisporinus vitreus*	+					+		
18. *Psilocybe squamosa*	+	+	+	+				+
19. *Radulomyces molaris*	+	+	+	+			+	
20. *Russula violeipes*	+	+	+	+			+	
21. *Stypella grilletii*			+		+			
22. *Trechispora mollusca*		+					+	
23. *Xerula pudens*				+		+		
24. *Xylobolus frustulatus*	+						+	
Total:	17	11	10	10	2	4	9	9

MONITORING DATA FROM OTHER REGIONS OF POLAND

Mycorrhizal fungi. As mentioned above, the studies performed in the Niepołomice Forest were a part of monitoring studies made in forests with the proportion of oak in different regions of Poland. Results of the present studies may be compared with the already published data. The comparison of mycorrhizal data seems especially interesting (Fig. 13). In the Białowieża National Park (Skirgiełło 1998b) 45 species of mycorrhizal fungi were found in the study area, which makes about 21% of all fungi found there. In Wielkopolska (Lisiewska and Połczyńska 1998) in the Dębina reserve 43 mycorrhizal fungi were recorded, which makes 20% of all fungi found there. In the Świętokrzyskie Mountains (Łuszczyński 1998) the highest number of 58 species of mycorrhizal fungi was recorded which makes 31% of all fungi found there. In the Niepołomice Forest 33 species of mycorrhizal fungi were recorded, which makes as little as 12% of all fungi found there.

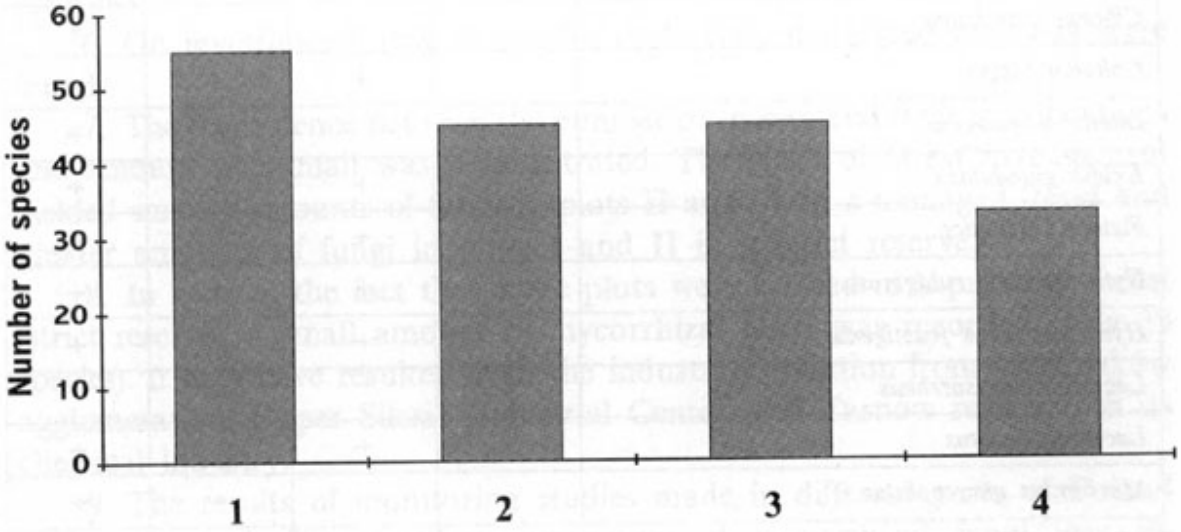

Fig. 13. Mycological monitoring in oak forests in Poland during the years 1994–1996. Comparison of mycorrhizal fungi in various localities: 1 – the Świętokrzyskie Mts., 2 – Wielkopolska, 3 – the Białowieża National Park, 4 – the Niepołomice Forest

Fungi connected with oak. Considering the topic of the present study, the authors were especially focused on the fungi connected with oak. Although oak occurred in the all study plots in the Niepołomice Forest, only 15 species connected exclusively or mainly with oak were recorded. Among the species listed here only two mycorrhizal fungi were found: *Lactarius quietus* and *Xerocomus rubellus*. The other fungi connected with

oak are mainly saprobic fungi, 2 are parasitic fungi: *Fistulina hepatica* and *Phellinus robustus*.

In the Białowieża National Park (S k i r g i e ł ł o 1998b) four species connected with oak were recorded. In Wielkopolska (L i s i e w s k a and P o ł c z y ń s k a 1998) ten such species were found. In the Świętokrzyskie Mountains Ł u s z c z y ń s k i (1998) listed 33 species connected with oak. Some of them (22) are not exclusively connected with oak, they can form a mycorrhiza with different tree species or they grow on wood of a variety of trees and shrubs. Only eleven species may be considered oak-associated. Only two species, *Hymenochaete rubiginosa* and *Lactarus quietus* were collected in the all monitoring plots in Poland (Table 10).

T a b l e 10

List of species connected with oak on various investigated plots in Poland BNP – the Białowieża National Park (S k i r g i e ł ł o 1998b), W – Wielkopolska (L i s i e w s k a and P o ł c z y ń s k a 1998), GŚ – the Świętokrzyskie Mts. (Ł u s z c z y ń s k i 1998), NF – the Niepołomice Forest

Species	Regions			
	BNP	W	GŚ	NF
Ciboria batschiana		+		+
Collybia fusipes		+	+	+
Daedalea quercina			+	+
Exidia glandulosa		+	+	+
Fistulina hepatica		+	+	+
Hymenochaete rubiginosa	+	+	+	+
Hymenoscyphus fructigenus	+	+		+
Lactarius chrysorrheus			+	
Lactarius quietus	+	+	+	+
Marasmius quercophilus				+
Mycena inclinata		+	+	+
Peniophora quercina		+	+	+
Phellinus robustus			+	+
Stereum gausapatum				+
Xerocomus rubellus		+	+	+
Xylobolus frustulatus	+			+
Total: 16	4	10	11	15

SUMMARY OF RESULTS AND CONCLUSIONS

1. The present monitoring studies were carried out in the years 1994–1996 in four plots – each plot 1000 m^2 in size and divided into 10 subplots of 100 m^2 – in the *Tilio-Carpinetum stachyetosum* association in the Niepołomice Forest near Kraków (the Sandomierz Basin). As many as 26 observations were performed.

2. Altogether 274 species and one variety, including 16 species of *Ascomycota* and 258 species of *Basidiomycota* were recorded, 16 species are new to Poland (Table 11).

3. The applied method of detailed observations performed in small subplots, made it possible to sample many species with tiny fructifications which otherwise could have been easily overlooked, among other things, 13 species new to Poland and a few very rare species which have not been recorded from Poland for over 100 year.

4. The occurrence of 173 lignicolous, 51 terrestrial, and 50 species of litter-decomposing fungi was recorded. Four species of mycophilous fungi and four species of bryophilous fungi were assigned to lignicolous fungi.

5. On all plots 234 saprobic, 33 mycorrhizal, and 7 parasitic fungi were recorded.

6. On investigated area 15 species exclusively connected with oak were found.

7. The dependence between the number of species and their fructifications and amount of rainfall was demonstrated. The effect of forest management yielded smaller amounts of fungi in plots II and IV in a managed forest and greater amounts of fungi in plots I and II in a strict reserve.

8. In spite of the fact that some plots were located in a primeval forest (strict reserve), a small amount of mycorrhizal fungi was recorded (only 33 species). It may have resulted from the industrial pollution from the Kraków agglomeration, Upper Silesia Industrial Center, and Tarnów region with its chemical industry.

9. The results of monitoring studies made in different parts of Poland were compared. The smallest proportion of mycorrhizal fungi was recorded in the Niepołomice Forest: 12%, in Wielkopolska: 20%, in the Białowieża National Park: 21%, and in the Świętokrzyskie Mountains: 31%.

10. The studied plots of the Niepołomice Forest are located in the most polluted, heavily industrialized and densely populated region of Poland. This situation is undoubtedly affecting the specific composition of forest fungi. Saprobic fungi are relatively resistant to such a strong anthropopression, while mycorrhizal fungi much less so.

The field observations were financed in the frame of the international project "Mycological monitoring in European oak forests" (Copernicus Programme).

Table 11

List of species (in alphabetical order) collected during the three-year research (1994–1996) f – fungi, l – litter, m – mosses, M – mycorrhizal fungi, P – parasitic fungi, s – soil, S – saprobic fungi, w – wood

Species	Trophic Groups	Substrate
1	2	3
Agaricus sylvicola (Vitt.) Peck ss. auct. = *A. essetei* Bon = *A. abruptibulbus* Peck ss. auct. Europ., non Peck 1905	S	s
Agrocybe praecox (Pers.: Fr.) Fayod	S	s
Amanita fulva Sing.	M	s
Amanita vaginata (Bull.: Fr.) Vitt.	M	s
Armillaria mellea (Vahl: Fr.) Kumm. s. l.	S	w
Ascocoryne sarcoides (Jacq.: Fr.) Groves et Wilson	S	w
Athelia acrospora Jül.	S	w
Athelia alnicola (Bourd. et Galz.) Jül.	S	w
Athelia decipiens (Höhn. et Litsch.) J. Erikss.	S	w
Athelia epiphylla Pers.	S	w
Athelia salicum Pers.	S	w
Basidiodendron caesiocinereum (Höhn. et Litsch.) Luck-Allen	S	w
Basidioradulum radula (Fr.: Fr.) Nobles = *Hyphoderma radula* (Fr.: Fr.) Donk	S	w
Bjerkandera adusta (Willd.: Fr.) Karst.	S	w
Boletus pulverulentus Opat.	M	s
Botryobasidium conspersum J. Erikss.	S	w
Botryobasidium laeve (J. Erikss.) Parm.	S	w
Botryobasidium subcoronatum (Höhn. et Litsch.) Donk	S	w
Brevicellicium olivascens (Bres.) Larsson et Hjortst.	S	w
Bulgaria inquinans (Pers.: Fr.) = *B. polymorpha* (Lightfoot) Wettst.	S	w
Byssomerulius corium (Pers.: Fr.) Parm. = *Meruliopsis corium* (Pers.: Fr.) Ginns	S	w
Calocera cornea (Batsch: Fr.) Fr.	S	w
Calocybe carnea (Bull.: Fr.) Kumm.	S	l
Ciboria batschiana (Zopf in Zopf et Sydow) Buchw.	S	w
Clavulina cinerea (Bull.: Fr.) Schroet.	S	s
Clavulina coralloides (L.: Fr.) Schroet. = *C. cristata* (Holmsk.: Fr.) Schroet.	S	s
Clitocybe candicans (Pers.: Fr.) Kumm.	S	l
Clitocybe clavipes (Pers.: Fr.) Kumm.	S	l

Clitocybe gibba (Pers.: Fr.) Kumm. = *C. infundibuliformis* (Schaeff.) Quél.	S	l
Clitocybe hydrogramma (Bull.: Fr.) Kumm. = *C. phaeophthalma* (Pers.) Kuyper	S	l
Clitocybe lignatilis (Pers.: Fr.) Karst. = *Ossicaulis lignatilis* (Pers.: Fr.) Redhead et Ginns	S	w
Clitocybe metachroa (Fr.) Kumm. ss. Kuyper	S	l
Clitocybe odora (Bull.: Fr.) Kumm. = *Lepista odora* (Bull.: Fr.) Harmaja	S	l
Clitocybe sp.	S	l
Collybia butyracea (Bull.: Fr.) Kumm. var. *asema* (Fr.: Fr.) Quél. = *C. asema* (Fr.: Fr.) Kumm. = *Rhodocollybia butyracea* f. *asema* (Fr.: Fr.) Antonín et al.	S	l
Collybia dryophila (Bull.: Fr.) Kumm. = *Gymnopus dryophilus* (Bull.: Fr.) Murrill	S	l
Collybia erythropus (Pers.: Fr.) Kumm. = *C. marasmioides* (Britz.) Bresinsky et Stangl = *Gymnopus erythropus* (Pers.: Fr.) Antonín et al.	S	w
Collybia fuscopurpurea (Pers.: Fr.) Kumm. = *Gymnopus fuscopurpureus* (Pers.: Fr.) Antonín et al.	S	l
Collybia fusipes (Bull.: Fr.) Quél. = *Gymnopus fusipes* (Bull.: Fr.) S. F. Gray	S	w
Collybia peronata (Bolt.: Fr.) Kumm. = *Gymnopus peronatus* (Bolt.: Fr.) Antonín et al.	S	l
Coniophora arida (Fr.) Karst.	S	w
Coniophora puteana (Schum.: Fr.) Karst.	S	w
Conocybe semiglobata (Kühner) ex Kühner et Watl.	S	s
Conocybe tenera (Schaeff.: Fr.) Kumm.	S	s
Coprinus micaceus (Bull.: Fr.) Fr.	S	w
Coprinus sp.	S	s
Cortinarius cfr. *alnetorum* (Vel.) Moser	M	s
Cortinarius sp.	M	s
Crepidotus variabilis (Pers.: Fr.) Kumm.	S	w
Cyathus striatus (Huds.) Willd.: Pers.	S	w
Cylindrobasidium evolvens (Fr.: Fr.) Jül. = *C. laeve* (Pers.: Fr.) Chamuris	S	w
Dacryomyces minor Peck	S	w
Dacryomyces stillatus Nees: Fr.	S	w
Dacryomyces tortus (Willd.): Fr.	S	w
Daedalea quercina (L.) Pers.	S	w
Delicatula integrella (Pers.: Fr.) Fayod	S	l
Dentipellis fragilis (Pers.: Fr.) Donk	S	w
Entoloma sp.	M	s

Tab. 11 cont.

1	2	3
Exidia glandulosa (Bull.): Fr. = *E. truncata* Fr.	S	w
Exidia plana (Wiggers) Donk	S	w
Exidia sp.	S	w
Fistulina hepatica (Schaeff.): Fr.	P	w
Fomes fomentarius (L.: Fr.) Fr.	S	w
Galerina atkinsoniana A. H. Smith	S	w(m)
Galerina cerina Smith et Sing.	S	w(m)
Galerina fallax Smith et Sing.	S	w(m)
Galerina marginata (Batsch) Kühn.	S	w
Galerina triscopa (Fr.) Kühn.	S	w
Ganoderma lipsiense (Batsch) Atk. = *G. applanatum* (Pers.) Pat.	S	w
Gymnopilus stabilis (Weinm.) Kühn. et Romagn.	S	w
Hapalopilus rutilans (Pers.: Fr.) Karst. = *H. nidulans* (Fr.) Karst.	S	w
Hebeloma claviceps (Fr.) Kumm. = *H. crustuliniforme* (Bull.) Quél. ss. Bruchet	M	s
Hebeloma clavulipes Romagn.	M	s
Hebeloma sacchariolens Quél.	M	s
Hohenbuehelia myxotricha (Lév.) Sing. = *H. fluxilis* (Fr.) Orton ss. auct.	S	w
Hymenochaete cinnamomea (Pers.: Fr.) Bres.	S	w
Hymenochaete rubiginosa (Dickson: Fr.) Lév.	S	w
Hymenoscyphus calyculus (Sow.: Fr.) Phillips	S	w
Hymenoscyphus fructigenus (Bull.: Fr.) S. F. Gray	S	w
Hyphoderma argillaceum (Bres.) Donk	S	w
Hyphoderma mutatum (Peck) Donk	S	w
Hyphoderma pallidum (Bres.) Donk	S	w
Hyphoderma praetermissum (Karst.) J. Erikss. et Strid.	S	w
Hyphoderma puberum (Fr.) Wallr.	S	w
Hyphoderma setigerum (Fr.) Donk	S	w
Hyphodontia pallidula (Bres.) J. Erikss.	S	w
Hyphodontia quercina (Pers.: Fr.) J. Erikss.	S	w
Hyphodontia sambuci (Pers.) J. Erikss.	S	w
Hypholoma capnoides (Fr.: Fr.) Kumm.	S	w
Hypholoma fasciculare (Huds.: Fr.) Kumm.	S	w
Hypholoma lateritium (Schaeff.: Fr.) Schroet. = *H. sublateritium* (Fr.) Quél.	S	w

Hypholoma subviride (Berk. et Curt.) Dennis	S	w
Hypochnicium erikssonii Hallenb. et Hjorst. = *H. sphaerosporum* (Höhn. et Litsch.) J. Erikss. ss. J. Erikss. et Ryv.	S	w
Hypochnicium geogenium (Bres.) J. Erikss.	S	w
Hypoxylon deustum (Hoffm.: Fr.) Grev. = *Ustulina deusta* (Hoffm.: Fr.) Petrak	S	w
Hypoxylon fuscum (Pers.: Fr.) Fr.	S	w
Hypoxylon howeanum Peck	S	w
Inocybe cookei Bres.	M	s
Inocybe geophylla (Sow.: Fr.) Kumm. var *lilacina* Gill.	M	s
Inocybe quietiodor Bon	M	s
Inonotus radiatus (Sow.: Fr.) Karst.	S	w
Kuehneromyces mutabilis (Schaeff.: Fr.) Sing. et A. H. Smith	S	w
Laccaria amethystina Cooke	M	s
Laccaria laccata (Scop.: Fr.) Berk. et Br.	M	s
Lactarius camphoratus (Bull.) Fr.	M	s
Lactarius mitissimus (Fr.) Fr.	M	s
Lactarius quietus (Fr.) Fr.	M	s
Lactarius sp.	M	s
Laetiporus sulphureus (Bull.: Fr.) Murrill	P	w
Lepista gilva (Pers.: Fr.) Pat. = *Clitocybe gilva* (Pers.: Fr.) Kumm.	S	l
Lepista flaccida (Sow.: Fr.) Pat. = *L. inversa* (Scop.) Pat. = *Clitocybe inversa* (Scop.) Quél.	S	l
Lepista irina (Fr.) Bigelow	S	l
Lepista nuda (Bull.: Fr.) Cke.	S	s
Lycoperdon perlatum Pers.: Pers.	S	s
Lycoperdon pyriforme Schaeff.: Pers.	S	w
Macrolepiota procera (Scop.: Fr.) Sing.	S	s
Macrolepiota rhacodes (Vitt.) Sing.	S	s
Marasmiellus ramealis (Bull.: Fr.) Sing.	S	w
Marasmius bulliardii Quél.	S	l
Marasmius quercophilus Pouz. = *M. splachnoides* (Hornem.: Fr.) Fr. ss. auct.	S	l
Marasmius rotula (Scop.: Fr.) Fr.	S	l
Marasmius torquescens Quél.	S	l
Megacollybia platyphylla (Pers.: Fr.) Kotl. et Pouz.	S	w
Mollisia sp.	S	w

Tab. 11 cont.

1	2	3
Mycena abramsii (Murr.) Murr. = *M. praecox* Vel.	S	s
Mycena amicta (Fr.) Quél.	S	s
Mycena bulbosa (Cejp) Kühn.	S	l
Mycena crocata (Schrad.: Fr.) Kumm.	S	l
Mycena filopes (Bull.: Fr.) Kumm.	S	l
Mycena galericulata (Scop.: Fr.) Quél.	S	w
Mycena galopus (Pers.: Fr.) Kumm. var. *galopus* et var. *nigra* ss. Rea	S	l
Mycena haematopus (Pers.: Fr.) Kumm.	S	w
Mycena inclinata (Fr.) Quél.	S	w
Mycena leptocephala (Pers.: Fr.) Gill.	S	w
Mycena mucor (Batsch: Fr.) Gill.	S	l
Mycena pelianthina (Fr.) Quél.	S	s
Mycena pullata (Berk. et Cke.) Sacc.	S	l
Mycena pura (Pers.: Fr.) Kumm.	S	l
Mycena rorida (Fr.) Quél.	S	l
Mycena sanguinolenta (Alb. et Schw.: Fr.) Kumm.	S	l, w
Mycena stylobates (Pers.: Fr.) Kumm.	S	l
Mycena subcaerulea (Peck) Sacc.	S	w
Mycena vitilis (Fr.) Quél.	S	l
Mycena zephirus (Fr.: Fr.) Kumm.	S	l
Mycenella salicina (Vel.) Sing.	S	w
Naucoria bohemica Vel.	M	s
Naucoria spadicea Reid = *N. langei* Kühn. = *Alnicola langei* (Kühn.) Sing.	M	s
Nectria cinnabarina (Tode: Fr.) Fr.	S	w
Nectria sp.	S	w
Oligoporus fragilis (Fr.) Gilbn. et Ryv. = *Postia fragilis* (Fr.) Jül.	S	w
Oligoporus leucomallellus (Murr.) Gilbn. et Ryv. = *Postia leucomallella* (Murr.) Jül.	S	w
Oligoporus subcaesius (David) Ryv. et Gilbn. = *Postia subcaesia* (David) Jül.	S	w
Omphalina sp.	S	l
Panellus serotinus (Schrad.: Fr.) Kühn. = *Sarcomyxa serotina* (Schrad.: Fr.) Karst.	S	w
Paxillus involutus (Batsch.: Fr.) Fr.	M	s

Peniophora cinerea (Pers.: Fr.) Cke.	S	w
Peniophora incarnata (Pers.: Fr.) Karst.	S	w
Peniophora laeta (Fr.) Donk	S	w
Peniophora quercina (Pers.: Fr.) Cke.	S	w
Peniophora rufomarginata (Pers.) Litsch. in Keissler	S	w
Peziza varia (Hedw.): Fr.	S	w
Peziza sp.	S	s
Phallus impudicus L.: Pers.	S	s
Phanerochaete filamentosa (Berk. et Curt.) Burds.	S	w
Phanerochaete laevis (Fr.) J. Erikss. et Ryv.	S	w
Phanerochaete martelliana (Bres.) J. Erikss. et Ryv.	S	w
Phanerochaete sanguinea (Fr.) Pouz. = *Ph. calotricha* (Karst.) J. Erikss.	S	w
Phanerochaete sordida (Karst.) J. Erikss. et Ryv.	S	w
Phanerochaete tuberculata (Karst.) Parm.	S	w
Phanerochaete velutina (DC.: Fr.) Karst.	S	w
Phanerochaete sp.	S	w
Phellinus contiguus (Pers.: Fr.) Fiasson et Niemelä	S	w
Phellinus nigricans (Fr.) Karst. ss. Černý, Vampola (1993) = *Ph. igniarius* (L.) Quél. s.l.	P	w
Phellinus robustus (Karst.) Bourd. et Galz.	P	w
Phlebia radiata Fr. = *Ph. merismoides* (Fr.): Fr.	S	w
Phlebia rufa (Pers.: Fr.) Christ.	S	w
Phlebia tremellosa (Schrad.: Fr.) Nakas. et Burds. = *Merulius tremellosus* Schrad.: Fr.	S	w
Phlebiella pseudotsugae (Burt.) Larrs. et Hjortst.	S	w
Phlebiella vaga (Fr.) Karst.	S	w
Phlebiella sp.	S	w
Phleogena faginea (Fr.: Fr.) Link	S	w
Pholiota flammans (Fr.) Kumm.	S	w
Pholiota lenta (Pers.: Fr.) Sing.	S	l
Physisporinus sanguinolentus (Alb. et Schw.: Fr.) Pil.	S	w
Physisporinus vitreus (Pers.: Fr.) Karst.	S	w
Pluteus cervinus (Schaeff.) Kumm. = *P. atricapillus* (Batsch) Fayod	S	w
Pluteus inquilinus Romagn. = *P. semibulbosus* ss. J. Lge.	S	w
Pluteus leoninus (Schaeff.: Fr.) Kumm.	S	w
Pluteus nanus (Pers.: Fr.) Kumm.	S	w

Tab. 11 cont.

1	2	3
Pluteus pellitus (Pers.: Fr.) Kumm.	S	w
Pluteus phlebophorus (Ditmar: Fr.) Kumm.	S	w
Pluteus salicinus (Pers.: Fr.) Kumm.	S	w
Polyporus badius (S. F. Gray) Schw.	S	w
Polyporus brumalis (Pers.): Fr.	S	w
Polyporus varius (Pers.): Fr.	S	w
Psathyrella candolleana (Fr.: Fr.) Maire	S	w
Psathyrella chondroderma (Berk. et Br.) Karst.	S	l
Psathyrella fulvescens (Romagn.) A. H. Smith	S	w
Psathyrella gossypina (Bull.: Fr.) Pearson et Dennis	S	w
Psathyrella gracilis (Fr.) Quél.	S	l
Psathyrella impexa (Romagn.) Bon	S	l
Psathyrella obtusata (Fr.) A. H. Smith	S	l
Psathyrella ocellata (Romagn.) Mos.	S	w
Psathyrella panaeoloides (Maire) Arnolds	S	l
Psathyrella piluliformis (Bull.: Fr.) Orton	S	l
Psathyrella prona (Fr.) Gill.	S	l
Psathyrella senex (Peck) A. H. Smith	S	l
Psathyrella spadiceogrisea (Schaeff.) Maire	S	w
Psathyrella spadiceogrisea f. *vernalis* (Lge.) Mos.	S	w
Pseudoclitocybe cyathiformis (Bull.: Fr.) Sing.	S	w
Psilocybe inquilina (Fr.: Fr.) Bres. var. *crobulus* (Fr.) Hoiland = *Psilocybe crobulus* (Fr.) M. Lange ex Sing.	S	l
Psilocybe squamosa (Pers.: Fr.) Orton = *Stropharia squamosa* (Pers.: Fr.) Quél.	S	l
Radulomyces confluens (Fr.: Fr.) M. P. Christ. = *Cerocorticium confluens* (Fr.: Fr.) Jül. et Stalp.	S	w
Radulomyces molaris (Chall.: Fr.) M. P. Christ. = *Cerocorticium molare* (Chaill.: Fr.) Jül. et Stalp.	S	w
Radulomyces rickii (Bres.) M. P. Christ. = *Cerocorticium rickii* (Bres.) Boid., Gilles et Hugueney	S	w
Ramaria eumorpha (Karst.) Corner	S	s
Ramicola centunculus (Fr.: Fr.) Watl. = *Simocybe centunculus* (Fr.) Sing.	S	s
Ramicola haustellaris (Fr.: Fr.) Watl. = *R. rubi* (Berk.) Watl. = *Simocybe rubi* (Berk.) Sing.	S	w
Ramicola laevigata (Favre) Watl. = *Simocybe laevigata* (Favre) Orton	S	l

Rickenella fibula (Bull.: Fr.) Raith. = *Gerronema fibula* (Bull.: Fr.) Sing. = *Omphalina fibula* (Bull.: Fr.) Quél.	S	w(m)
Rickenella setipes (Fr.: Fr.) Raith = *R. swartzii* (Fr.) Kuyper = *Omphalina setipes* (Fr.: Fr.) Quél.	S	w(m)
Ripartites metrodii Huijsman	S	l
Ripartites tricholoma (Alb. et Schw.: Fr.) Karst.	S	l
Rosellinia aquila (Fr.: Fr.) De Not.	S	w
Russula cyanoxantha (Schaeff.) Fr.	M	s
Russula foetens (Pers.): Fr.	M	s
Russula nigricans Fr.	M	s
Russula ochroleuca Pers.	M	s
Russula pectinatoides Peck	M	s
Russula violeipes Quél.	M	s
Schizophyllum commune Fr.: Fr.	S	w
Schizopora flavipora (Cooke) Ryv.	S	w
Schizopora paradoxa (Schrad.: Fr.) Donk s.l.	S	w
Scleroderma areolatum Ehrenb.	M	s
Scleroderma bovista Fr.	M	s
Scopuloides hydnoides (Cke. et Massee in Cke.) Hjortst. et Ryv. = *S. rimosa* (Cke.) Jül.	S	w
Sebacina calospora Bourd. et Galz.	S	w(f)
Sebacina incrustans (Pers.: Fr.) Tul.	S	w
Sistotrema brinkmanii (Bres.) J. Erikss.	S	w
Sistotrema oblongisporum M. P. Christ. et K. Hauersl.	S	w
Sistotremastrum niveocremeum (Höhn. et Litsch.) J. Erikss.	S	w
Skeletocutis nivea (Jungh.) Keller	S	w
Steccherinum ochraceum (Pers.: Fr.) S. F. Gray	S	w
Stereum gausapatum (Fr.) Fr.	S	w
Stereum hirsutum (Willd.: Fr.) Pers.	S	w
Stereum rameale (Schw.) Burt = *S. ochraceoflavum* (Schw.) Ell.	S	w
Stereum sanguinolentum (Alb. et Schw.: Fr.) Fr.	S	w
Strobilurus tenacellus (Pers.: Fr.) Sing.	S	l
Stropharia aeruginosa (Curt.: Fr.) Quél.	S	l
Stropharia caerulea Kreisel = *S. cyanea* (Bolt.) Tuomikoski	S	s, l
Stypella grilletii (Bond.) P. Roberts = *Myxarium podlachicum* (Bres.) Raitv. in Parmasto	S	w
Subulicystidium longisporum (Pat.) Parm.	S	w

Tab. 11 cont.

1	2	3
Thelephora terrestris Ehrhart ex Willd.: Fr.	M	s
Tomentella fuscoferruginea (Bres.) Litsch.	S	w
Tomentella neobourdotii M. J. Larsen	S	w
Tomentella sp.	S	w
Trametes versicolor (L.: Fr.) Pil.	S	w
Trechispora farinacea (Pers.: Fr.) Liberta s. l.	S	w
Trechispora mollusca (Pers.: Fr.) Liberta	S	w
Tremella encephala Pers.	P	w(f)
Tremella mesenterica Retz.: Fr.	P	w(f)
Tubaria conspersa (Pers.: Fr.) Fayod	S	w
Tubaria furfuracea (Pers.: Fr.) Gill.	S	l
Tulasnella eichleriana Bres.	S	w
Tulasnella thelephorea (Juel) Juel = *T. inclusa* (M. P. Christ.) Donk	P	w(f)
Vuilleminia comedens (Nees: Fr.) Maire	S	w
Xerocomus chrysenteron (Bull.) Quél. = *Boletus pascuus* (Pers.) Krombh.	M	s
Xerocomus rubellus (Krombh.) Mos. = *Boletus rubellus* Krombh.	M	s
Xerocomus subtomentosum (L.: Fr.) Quél. = *Boletus subtomentosus* L.: Fr.	M	s
Xerula pudens (Pers.) Sing. = *Oudemansiella longipes* (Quél.) Mos.	S	w
Xerula radicata (Relh.: Fr.) Dörfelt = *Oudemansiella pseudoradicata* Mos.	S	w
Xylaria hypoxylon (L.: Fr.) Grev.	S	w
Xylaria longipes Nitschke	S	w
Xylobolus frustulatus (Pers.: Fr.) Boid.	S	w

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Macromycetes lasu dębowo-lipowo-grabowego w Puszczy Niepołomickiej – badania monitoringowe

Streszczenie

W latach 1994–1996, w ramach międzynarodowego programu „Mycological monitoring in European oak forests", którego koordynatorem w Polsce była prof. M. Ławrynowicz, przeprowadzono badania grzybów wielkoowocnikowych w Puszczy Niepołomickiej k. Krakowa. Badania wykonano w lesie należącym do zbiorowiska *Tilio-Carpinetum stachyetosum* (ryc. 1, 4, 5), na czterech powierzchniach badawczych (każda o wymiarach 1000 m^2), podzielonych na 10 podpowierzchni (każda o wymiarach 100 m^2), na dwóch stanowiskach (w oddziałach leśnych 447 i 460).

Obserwacje (w liczbie 26) prowadzono od wiosny do jesieni, raz lub dwa razy w miesiącu. Na każdej podpowierzchni notowano: liczbę owocników poszczególnych gatunków oraz określano ich podłoże i trofizm.

Stwierdzono 274 gatunki, w tym 16 gatunków z *Ascomycota* i 158 z *Basidiomycota*. Zastosowana metoda bardzo dokładnych obserwacji na małych podpowierzchniach, pozwoliła na znalezienie wielu gatunków o drobnych owocnikach, które łatwo można przeoczyć. Stwierdzono m. in. 16 gatunków nowych dla Polski i kilka bardzo rzadkich, nie notowanych w Polsce od ok. 100 lat. W zebranym materiale 173 gatunki grzybów występowały na drewnie, 51 na ziemi oraz 50 na ściółce (ryc. 7). Do grzybów nadrzewnych zaliczono 4 gatunki grzybów mikofilnych i 5 briofilnych pośrednio rosnących na drewnie (uproszczenie to ułatwiło graficzne przedstawienie uzyskanych wyników). Zebrano 234 gatunki grzybów saprobowych, 33 mikoryzowych i 7 pasożytniczych (ryc. 9). Znaleziono 15 gatunków związanych wyłącznie lub głównie z dębem. Wykazano zależność liczby gatunków od opadów atmosferycznych (ryc. 11, 12). Wpływ gospodarki leśnej zaznaczył się mniejszą liczbą grzybów w lesie zagospodarowanym (na powierzchniach III i IV), a większą w rezerwacie ścisłym Lipówka (na powierzchniach I i II).

Wymieniona liczba 33 gatunków grzybów mikoryzowych (ryc. 9, 10), jest bardzo mała, co można tłumaczyć wpływem zanieczyszczeń przemysłowych aglomeracji Krakowa, Górnośląskiego Okręgu Przemysłowego i Tarnowa z przemysłem chemicznym, bliskim sąsiedztwem ruchliwej szosy i zbieraniem grzybów do celów konsumpcyjnych. Na tak silną antropopresję stosunkowo odporne są grzyby saprobowe.

Porównanie wyników monitoringu z różnych regionów Polski, w tym samym okresie (1994–1996) wykazało najmniejszy udział grzybów mikoryzowych w Puszczy Niepołomickiej – 12% wszystkich stwierdzonych gatunków, w Wielkopolsce – 20% (Lisiewska i Połczyńska 1998), w Białowieskim Parku Narodowym – 21% (Skirgiełło 1998b), a w Górach Świętokrzyskich – 31% (Łuszczyński 1998).