ACTA MYCOLOGICA
Vol. 33 (2): 191–230
1998

Changes in macromycetes of the oak-hornbeam forests in the "Dębina" reserve (Northern Wielkopolska)

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

In the years 1994–1996 macrofungi on two permanent plots situated in the phytocoenoses of *Galio-Carpinetum typicum* and *Galio-Carpinetum corydaletosum* in the "Dębina" reserve near Wągrowiec were monitored. 213 fungal taxa were found, mainly *Agaricales* (165 saprotrophic, 43 mycorrhizal and 5 parasitic fungi).

Comparison of the results with the mycocoenological observations made 30 years ago revealed significant quantitative and qualitative changes in the ecological groups of macromycetes.

Key words: mycological changes, macromycetes, *Galio-Carpinetum typicum*, *Galio-Carpinetum corydaletosum*, Wielkopolska region.

INTRODUCTION

The "Dębina" reserve preserves fragments of the ca 260-year-old oak-hornbeam forest of natural character. For many years it has been an object of interest of botanists and zoologists; several works stressing its attractiveness has been published. The first publication concerning the reserve was the one by Celiński and Filipek (1955), it comprised a phytosociological description of the reserve. In the years 1967–1978 the object was thoroughly studied under the auspices of the Committee of Conservation of Nature and Its Resources of the Polish Academy of Sciences. Floristic investigations concerned: vascular plants, algae, fungi, lichens, mosses and liverworts. The results were published in the 29th volume of the „Badania fizjograficzne nad Polską Zachodnią" (Physiographical Researches on Western Poland), Series B (1976). The microclimate of the reserve was also

studied (B a l c e r k i e w i c z, K r a s k a and K r o t o s k a 1977). The investigations on the occurrence of higher fungi in the oak-hornbeam forests of the "Dębina" reserve, carried out in the years 1960–1962, proved the affinity of some fungal species with particular phytocoenon – association or subassociation. They revealed also the relationship between the occurrence of fruit-bodies and weather conditions, and phenological periods.

The aims of the present work are as follows:

– to show the occurrence of macromycetes in the studied oak-hornbeam communities in the years 1994–1996,

– to analyse ecological groups of fungi with regard to the forest subassociation, habitat conditions and climatic factors,

– to present changes in the species composition and abundance of fungi after 30 years, and to point their reasons,

– to draw the attention to the human impact on fungi.

The authors thankfully acknowledge Prof. dr hab. Janina Jakubowska-Gabara from the University of Łódź for phytosociological relevés of studied permanent plots and Forest Inspector mgr inż. Janusz Sikorski for an access to unpublished materials.

THE STUDY AREA

The reserve was established on the basis of the disposition of the Minister of Forestry and Timber Industry no. 170 from April 30th, 1957.

As the physiogeographical division of Poland is concerned (K o n d r a c k i 1977), the "Dębina" reserve is situated in the Pojezierze Chodzieskie mesoregion, which extends between the Noteć and Wełna River valleys. The reserve is administrated by the Durowo Forest Inspectorate and is situated in the south-western part of the Dębina Forest Range (147 b-j, 151 a-i), 4 km from Wągrowiec. It comprises 32.21 ha (Fig. 1). The reserve is surrounded with fields and meadows in the north and west, and with an old oak forest in the south and east.

An even surface of the reserve lowers towards the Rudka River valley to the north and west and has two narrow depressions up to 1m comparing with the neighbouring areas (H e r n i k 1966).

The soils of the "Dębina" reserve originated from the fluvioglacial, sand-gravel deposits, which cover hardly permeable, carbonate boulder clays. High ground water level depends on precipitation and temperatures, which regulate the soil humidity (K o w a l k o w s k i 1976). In the reserve grey-brown soils are prevailing. There are also leached brown soils in the uppermost areas and black muck soils in the lowest parts, former watercourses. Each of the soils corresponds with different type of the forest (Tab. 1).

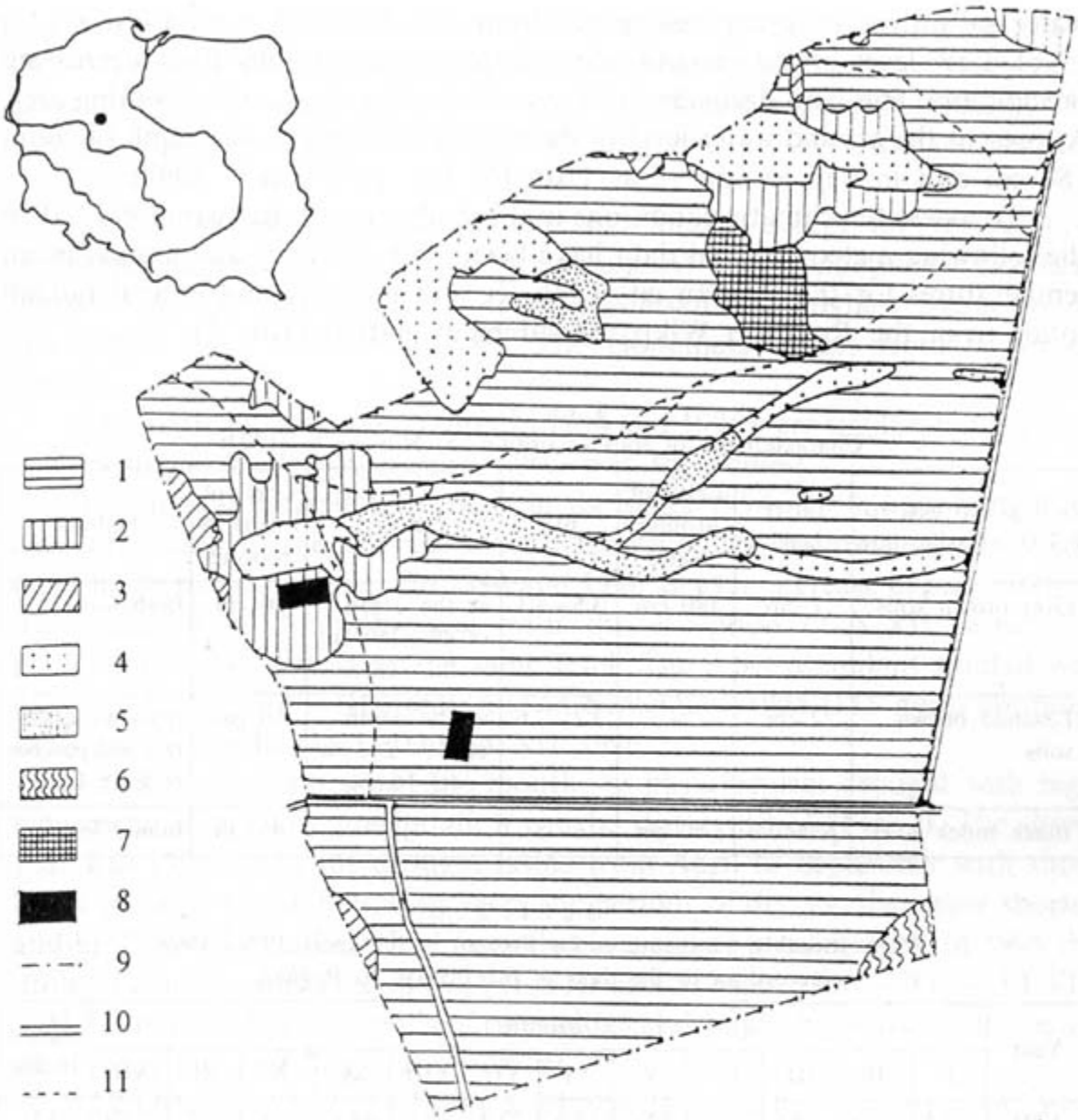

Fig. 1. Forest communities of the "Dębina" reserve (according to the map by Wojterski, (1976), (modified):
1 – *Galio-Carpinetum typicum*, 2 – *Galio-Carpinetum corydaletosum*, 3 – *Galio-Carpinetum lathyretosum verni*, 4 – *Fraxino-Ulmetum*, 5 – *Circaeo-Alnetum*, 6 – *Potentillo albae-Quercetum*, 7 – heron nests, 8 – observation plot, 9 – border of the reserve, 10 – road, 11 – path

There are no water reservoirs in the "Dębina" reserve. Water conditions of the area are affected by its location in the Wełna proglacial stream valley and the ground water level, which fluctuates depending on the season and surface features. The amplitude of these fluctuations increases with the distance from the Wełna riverbed. The highest level of ground waters occurs in the spring in depressions, the lowest – in the summer/autumn period in elevations. In the autumn

water saturation of soil pores ranges from 10–25% (K o w a l k o w s k i 1976). Low level of the ground water in the reserve results from decreasing precipitation and land drainage causing water outflow in the neighbouring area. At present the ground water level in the reserve is mainly at the depth of about 180 cm and in depressions – at 110–150 cm (N o w a k 1992).

To assess the climatic conditions in the study area in the years 1994–1996 the following meteorological data have been used: monthly and annual mean temperatures for the Poznań city (Tab. 2), and monthly and annual rainfall totals from the Rogoźno Wlkp measurement station (Tab. 3).

T a b l e 1
Characteristics of soils according to N o w a k (1992)

Soil group acc. to P.T.G. classification	Litter layer	Level of ground water	pH	$CaCO_3$	Level of intensive rooting	Habitat
Grey-brown soils	1 cm	180 cm	3.5–8.1	at the depth of 40–250 cm 0.1–2.9%	60 cm	fresh forest
Leached brown soils	2 cm	–	3.2–7.6	at the depth of 110–200 cm 4.3–6.6%	80 cm	fresh mixed forest and patches of fresh forest
Black muck soils	periodic	80 cm	6–8	–	45 cm	humid ferest

T a b l e 2
Mean monthly temperatures for Poznań in the years 1994–1996
(according to the data of the IMGW in Poznań)

Year	Months												Annual mean
	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII	
1994	2.5	–2.4	4.8	9.2	12.8	15.9	22.2	18.5	14.1	6.6	4.7	2.4	9.3
1995	–0.3	3.7	3.1	8.4	13.0	16.2	20.9	19.1	13.0	10.5	1.3	–4.4	8.7
1996	–5.2	–4.7	–0.6	8.0	12.5	16.8	16.0	18.2	10.6	9.5	5.5	–3.6	6.9

T a b l e 3
Monthly precipitation totals in mm for Rogoźno in the years 1994–1996
(according to the data of the IMGW in Poznań)

Year	Months												Annual total
	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII	
1994	59	12	67	17	55	42	70	40	53	31	19	59	524
1995	28	32	53	16	63	75	31	60	118	23	23	20	542
1996	6	32	4	11	88	41	160	51	68	27	21	6	515

The presented data are close to the average norms characteristic of Poland (K o s t r o w i c k i 1961). Vegetation period with the mean daily temperature $t \geqslant 5°C$ lasts from 28.03 – 4.04 to the first decade of November. The average annual temperature of the air in the study area ranges between 7.5 – 8.4°C.

The most important components of climate, except for temperature and precipitation, are winds and cloudiness. At the Wielkopolska Lowland weak winds are the most common; they attain the highest frequency in the period from July to October. The cloudiness ranges from 64 to 67 percent.

The mean annual temperatures in 1994 and 1995 were similar, but the year 1996 with its mean temperature 6.9°C was the coolest.

The annual precipitation totals in the years 1994 – 1996 approximate to each other and to the regional means. However, the monthly rainfall totals differ in the particular years. In 1994 and 1996 an even increase in precipitation was recorded in 3-month-cycles with the exception of X-XII, when the precipitation was almost at the same level. The most abundant rainfall was observed in July 1996 (160 mm) and in September 1995 (118 mm). Sporadic rains were recorded in I, III and XII 1996.

In the period concerned the months of physiological drought with high temperatures and low precipitation can be distinguished (Fig. 2). The driest year was 1994, when the drought lasted from April to September with short break in May. In the following years the periods of dry weather were shorter and broken with relatively long periods of increased precipitation. In 1995 the drought could be observed in IV, VII, VIII and X/XI; in 1996 – IV/V, VI/VII, VIII/IX and X/XI. The periods of physiological drought have disadvantageous effect on plant and fungi development.

C e l i ń s k i and F i l i p e k (1995) distinguished two types of forest community in the "Dębina" reserve: *Querco-Carpinetum medioeuropaeum* Tx. 1937, occurring in two subassociations – *Querco-Carpinetum stachyetosum* and *Querco-Carpinetum corydaletosum*, and a riverside forest community *Alneto-Ulmion*.

Detailed phytosociological investigations in this area were carried out in the years 1968 – 1969 by K r o t o s k a (1976). The main community of the reserve, which occupies the largest area, is an oak-hornbeam forest. Narrow depressions are covered by the riverside communities: *Fraxino-Ulmetum* in the northern part of the reserve and *Circaeo-Alnetum* in the middle part. There is also a small patch of the xerothermic oak community *Potentillo albae-Quercetum* in the south-eastern part of the reserve. At the place of heron nesting a nitrophilous community with therophytes appears. Non-forest communities occur only fragmentarily (Fig. 1).

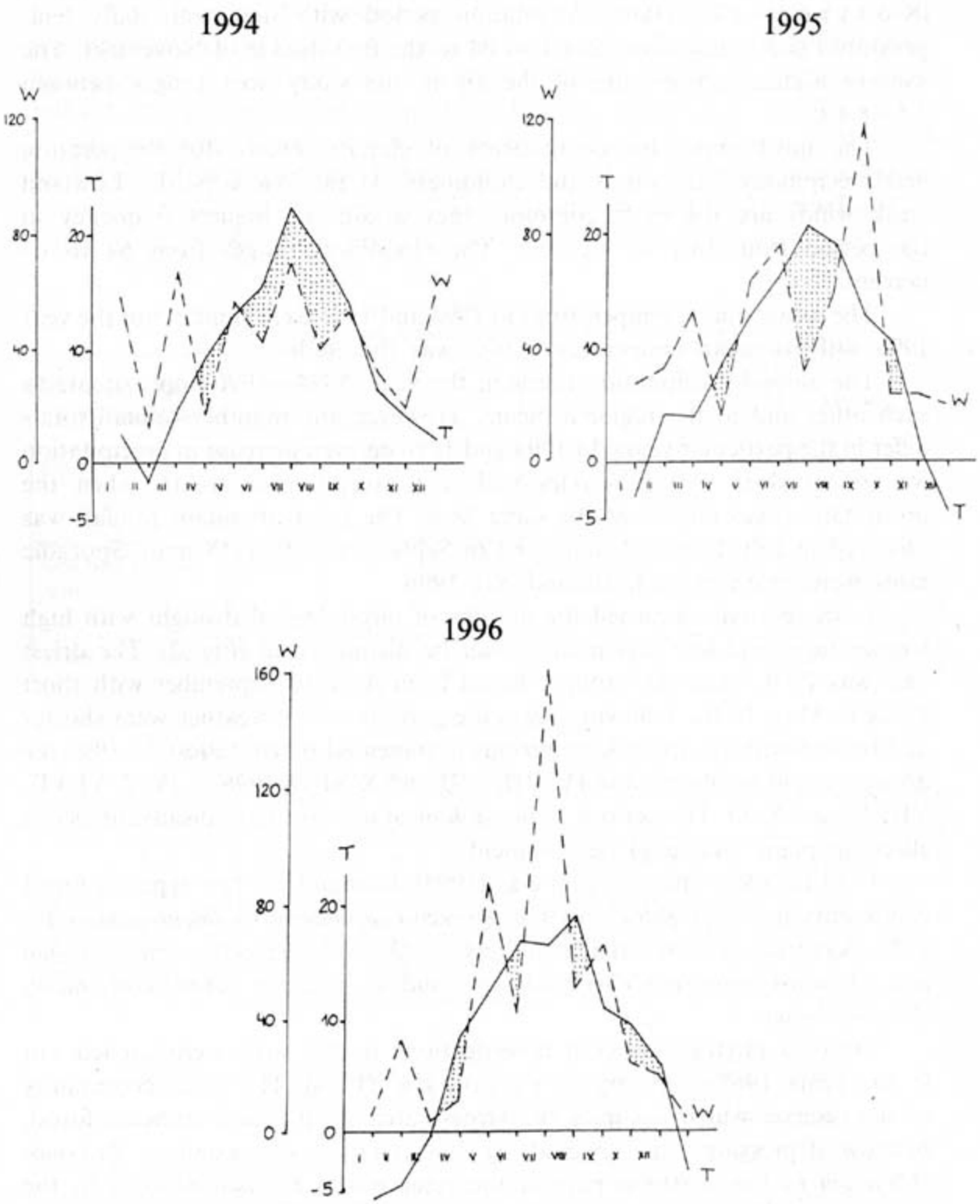

Fig. 2. Climatograms for the Poznań vicinity for the years 1994–1996. Dotted areas denote the periods of physiological drought
T – temperatures curve, W – precipitation curve

As the oak-hornbeam communities predominate in the reserve and they have been searched mycologically, they will be described in details. Species composition of the tree-stand has not changed in comparison with the phytosociological relevés by Celiński and Filipek (1955), but density of the higher tree layer decreased. The shrub layer is well developed only in the southern part of the reserve and it consists mainly of hazel. The herb layer is well developed and shows clear seasonal variability.

In the study area the association of mid-european oak-hornbeam forest *Galio silvatici-Carpinetum* Oberd. 1957 is distinctly diversified. Krotoska (1976) distinguished the following subassociations:

– *Galio-Carpinetum stachyetosum silvaticae* (= *Galio-Carpinetum typicum*),
– *Galio-Carpinetum corydaletosum*,
– *Galio-Carpinetum lathyretosum verni*.

The most widespread in the reserve are the first two mentioned subassociations.

Typical of the *Galio-Carpinetum stachyetosum silvaticae* subassociacion are the species of humid habitats: *Impatiens noli-tangere*, *Aegopodium podagraria*, *Ficaria verna*. The density of trees is relatively high, the undergrowth is almost not present. The facies with *Convallaria maialis* can be also distinguished. The light has a better access to the forest floor here, humidity is lower, so *Aegopodium podagraria* is lacking or very scarce.

Galio-Carpinetum corydaletosum, the second subassociation of the reserve, is characterized by the group of spring geophytes: *Corydalis cava*, *Gagea lutea* and *Corydalis fabacea*. *Anemone ranunculoides* and *Ficaria verna* are also abundant.

Small patches of the subassociation of *Galio-Carpinetum lathyretosum verni* occur in the driest places in the reserve. This community differs from the other syntaxa with the presence of *Melampyrum nemorosum* and *Calamintha vulgaris*, and from the other described subassociations of the oak-hornbeam forest with the presence of *Luzula pilosa*, *Galium silvaticum* and *Hieracium sabaudum*.

As a result of domination of the oak-hornbeam forests in the study area, a penetration of species of the *Carpinion alliance* into the riverside forest communities can be observed. The *Circaeo-Alnetum* association is characterized by considerable proportion of *Impatiens noli-tangere* in the herb layer and some species associated with humid and wet habitats, e.g. *Ranunculus repens*, *Scutellaria galericulata*, *Lycopus europaeus*, *Malachium aquaticum*.

One of the compounds of the *Fraxino-Ulmetum* tree-stand is *Ulmus laevis*, but the most frequent tree is *Alnus glutinosa*. The association is locally differentiated by the presence of *Stellaria holostea* and partly *Corydalis cava*.

The situation of the patch of *Potentillo albae-Quercetum* at the edge of the reserve results in occurrence of xerothermic species from the order *Quercetalia pubescentis* and species typical of non-forest communities in the herb layer. *Quercus robur* and a cross *Quercus robur* × *Quercus sessilis* prevail in the tree-stand of this association.

In the area of heron nesting a nitrophilous community with therophytes developed. Oaks, unlike hornbeams, are declining here. The most common shrub is *Sambucus nigra*. The herb layer is rich, dense and heterogeneous with considerable proportion of *Urtica dioica*.

Rich flora of the "Dębina" reserve comprises nearly 350 species of vascular plants (W o j t e r s k i 1976a). The presence of numerous plants protected by law, e.g. *Daphne mezereum* L., *Hedera helix* L., *Lilium martagon* L., and orchids: *Epipactis latifolia* (L.) All., *Neotia nidus-avis* (L.) Rich., *Platanthera bifolia* (L.) Rich. rises its value (S z a f r a ń s k i 1976).

METHODS

The investigations on macromycetes in the oak-hornbeam forest of the "Dębina" reserve near Wągrowiec were carried out in the years 1994–1996 in the frame of the research project "Mycological monitoring in European oak forests".

Two permanent observation plots of 1000 m^2 (20 m × 50 m) each were chosen and marked in two patches of the subassociations *Galio-Carpinetum typicum* and *Galio-Carpinetum corydaletosum*. Both of the plots consisted of 10 subplots (squares) – 10 m × 10 m for detailed monitoring of spatial distribution of macrofungi. The plots were set up in the phytocoenoses where mycosociological investigations were carried out in the years 1960–1962 (L i s i e w s k a 1965).

Present floristic composition of the plots was compiled by J. Jakubowska-Gabara on the basis of phytosociological relevés (Tab. 4).

Mycological observations were carried out in most cases twice a month, from March to the first frosts (XI/XII) with the exception of 1994, when the observations started from July. On each plot 36 observations were performed altogether. The number of sporocarps of each species in each subplot (square) was recorded as well as the type of habitat. Sporadically the species occurring outside the plots, but in the same patch of vegetation were also taken into consideration.

For species determination monographs, atlases and keys mentioned in the references were used.

The results of observations have been compiled in Table 5 and 6. They contain total numbers of sporocarps of particular species of fungi

found in the squares. Uncountable fruit-bodies have been marked with ×. The numbers in brackets denote the number of branches occupied by the fungus. The species have been listed from the highest spatial frequency (FR – percentage of squares with the presence of species).

The present results have been compared with the results of mycological research carried out in 1960–1962. Table 7 and 8 present an alphabetical list of macromycetes found on the plots in both periods of research. In the sixties the observations were carried out on permanent plots of 400 m^2, therefore only four squares (4×100 m^2) from each of the recent plots were taken for comparison: plot I – squares no. 2, 3, 7, 8 (Fig. 3), Plot II – squares no. 3, 4, 8, 9 (Fig. 3). In the Table 7 and 8 the numbers of visits with the presence of species are indicated; the index denotes a class of sporocarp abundancy (L i s i e w s k a 1965 acc. to M o s e r 1949).

To show changes of the mycoflora after 30 years, the Steinhaus index (W) has been used:

$$W = \frac{2c}{a + b}$$

where: a – number of species on plot I
b – number of species on plot II
c – number of species common for both of the plots.

The index value ranges from 0 to 1. High value of the index (close to 1), means high similarity of the plots. This method has been so far applied e.g. in mycosociological research (N e s p i a k 1959) as well as for determination of similarity of phytosociological relevés, among others, of root-plant fields in Wielkopolska (L a t o w s k i et al. 1979). In the presented work the Steinhaus index has been tried to express 1) mycological similarity of the two plots situated in different subassociations of the oak-hornbeam forest and 2) similarity of the mycoflora of the same plots in the years 1960–1962 and 1994–1996. The index is expressed in percentage.

General meteorological data for the neighbourhood of the study area have been obtained from the Institute of Meteorology and Water Economy in Poznań.

The data concerning the soils and tree-stands composition in the "Dębina" reserve have been obtained from the materials of the Durowo Forest Inspectorate, the data concerning trees cultivation – from the work by S i k o r s k i (1995) comprising the plans for the years 1996–1997.

The herbarium collection of fungi has been deposited in the POZM herbarium in the Department of Plant Ecology and Environment Protection, Adam Mickiewicz University in Poznań.

Table 4
Floristic composition on investigated plots in the "Dębina" reserve (Jakubowska-Gabara 1996, Tab. 5)

Association			*Galio silvatici-Carpinetum* Oberd. 1957																			CONSTANCY		
Subassociation			*typicum*										*corydaletosum*											
Subsequent number of relevé			1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20			
Number of plot			I										II											
Number of subplot			1	2	3	4	5	6	7	8	9	10	1	2	3	4	5	6	7	8	9	10			
Surface of the relevé		[m²]	100																					
Date			May and September 1995																					
Density of tree layer	a_1	%	80	20	20	20	30	60	40	60	60	70	70	80	80	70	70	80	80	70	80	70			
Density of tree layer	a_2	%	–	–	–	50	70	60	60	60	–	–	–	20	–	–	50	–	–	–	–	–			
Density of shrub layer	b	%	–	–	20	30	–	–	–	–	–	–	5	–	30	20	40	10	–	10	–	–			
Cover of herb layer	c	%	90	90	60	50	75	90	90	90	90	90	100	100	100	100	100	100	100	90	90	100	Relevés		
Cover of moss layer	d	%	–	–	–	–	–	–	–	–	–	–	<5	–	–	–	–	–	–	–	–	<5	1–10	11–20	1–20
Trees and shrubs:																									
Carpinus betulus	a_1		4	2	2	·	·	2	2	3	3	3	·	3	3	4	3	5	5	4	4	4	V	V	V
	a_2		·	·	·	3	4	4	4	4	·	·	·	·	·	·	·	·	·	·	·	·	V	V	V
	b		·	·	2	3	·	·	·	·	·	·	·	·	1	·	·	·	·	·	·	·	I	I	I
	c		·	+	·	·	·	·	+	·	+	+	·	+	+	·	·	·	·	+	+	+	II	III	III
Quercus robur	a_1		·	·	·	1	3	3	2	3	2	3	·	·	·	2	2	·	·	·	3	2	IV	II	III
	c		1	1	+	+	1	1	2	2	1	1	+	+	+	+	+	1	+	+	1	+	V	V	V
Acer pseudoplatanus	a_1		2	·	·	·	·	·	·	·	·	·	2	3	·	·	·	1	1	·	·	·	I	III	II
	a_2		·	·	·	·	·	·	·	·	·	·	·	1	·	·	2	·	·	·	·	·	I	III	II
	b		·	·	·	+	·	·	·	·	·	·	·	·	·	·	1	·	·	·	·	·	I	I	I
	c		1	1	·	1	1	1	1	1	1	+	+	+	1	1	1	1	1	2	1	2	V	V	V
Tilia cordata	a_1		·	·	·	2	·	·	·	·	·	·	3	2	2	·	·	·	·	·	·	·	I	II	II
	a_2		·	·	·	1	·	·	·	·	·	·	·	1	·	·	3	·	·	·	·	·	I	II	II
	b		·	·	·	+	·	·	·	·	·	·	1	·	3	2	2	1	·	1	·	·	I	III	II
	c		·	·	·	·	·	·	·	·	·	·	+	+	+	+	+	+	+	+	·	·	–	IV	II
Euonymus europaeus	c		+	·	·	·	·	·	·	·	+	+	+	+	·	·	·	1	+	+	·	·	II	III	II
Sambucus niger	a_1		·	·	·	+	·	+	·	·	·	·	·	·	·	·	·	+	+	·	+	·	I	II	II
Ulmus laevis	a_1		·	·	·	·	·	·	·	·	·	·	·	·	2	·	·	·	·	·	·	·	–	I	I
	c		·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	+	·	·	–	I	I
Fraxinus excelsior	c		·	·	·	·	·	·	·	·	·	·	·	·	·	+	+	·	·	·	·	·	–	I	I
Padus avium	c		·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	+	·	·	·	·	–	I	I
Herbs and mosses																									
D. ass.																									
Acer campestre	c		·	+	+	+	+	+	·	+	+	1	·	+	·	·	+	·	+	+	·	+	IV	III	IV

Chaerophyllum temulentum	·	·	·	·	·	·	·	·	·	·	2	2	3	2	3	2	1	1	1	1	–	V	III
D. subass.																							
Ranunculus ficaria	·	+	+	·	+	2	2	+	+	2	4	4	4	3	4	4	3	3	3	3	V	V	V
Ancmone ranunculoides	·	·	·	·	·	·	+	+	·	1	2	3	2	2	2	2	2	2	2	1	II	V	IV
Corydalis cava	·	·	·	·	·	·	·	·	·	·	3	3	4	4	3	4	3	2	3	4	–	V	III
Gagea lutea	·	·	·	·	·	·	·	·	·	·	·	+	1	+	·	·	·	·	·	·			
Ch. *Fagetalia sylvaticae*																							
Lamiastrum galeobdolon	1	+	2	+	+	1	1	1	+	1	2	2	2	1	3	2	1	2	2	2	V	V	V
Milium effusum	1	2	1	1	2	1	2	1	1	2	1	1	1	·	1	1	2	2	1	1	V	V	V
Stellaria holostea	1	1	1	2	+	1	1	2	3	3	1	1	+	·	1	1	1	+	1	+	V	V	V
Polygonatum multiflorum	1	1	·	+	+	1	1	1	+	·	1	2	2	2	1	2	·	2	1	+	IV	V	V
Viola reichenbachiana	+	+	·	+	·	+	+	1	1	1	+	1	+	+	·	·	2	+	+	2	IV	IV	IV
Lathyrus vernus	+	+	·	·	·	+	1	·	·	+	·	·	·	·	+	·	·	·	·	+	III	I	II
Galium odoratum	+	·	·	·	·	·	·	1	·	+	·	+	+	1	+	·	·	·	·	·	II	II	II
Pulmonaria obscura	·	·	+	·	·	·	·	·	+	·	·	·	·	+	+	·	·	·	·	·	I	I	I
Scrophularia nodosa	·	·	·	+	·	·	+	·	·	·	·	·	·	·	·	·	+	·	·	·	I	I	I
Ranunculus lanuginosus	·	·	·	·	·	·	·	·	·	·	+	1	+	1	·	+	·	+	·	1	–	IV	II
Asarum europaeum	·	·	·	·	·	·	·	·	·	·	1	1	1	1	1	1	+	+	·	·	–	IV	II
Stachys sylvatica	·	·	·	·	·	·	·	·	·	·	+	+	·	1	1	1	·	·	+	+	–	IV	II
Adoxa moschatelina	·	·	·	·	·	·	·	·	·	·	·	·	+	1	·	1	·	·	·	·	I	II	I
Paris quadrifolia	·	·	·	·	·	·	·	·	·	·	+	+	·	·	·	·	·	·	·	·	–	I	I
Ch. *Querco-Fagetea*																							
Anemone nemorosa	5	4	4	3	4	5	4	5	4	4	3	3	3	2	2	3	3	4	2	3	V	V	V
Hepatica nobilis	+	+	+	+	+	·	1	+	1	1	·	·	·	·	·	+	+	·	+	+	V	II	IV
Aegopodium podagraria	+	·	·	·	+	·	+	1	·	·	1	2	2	2	1	2	·	1	2	2	II	V	IV
Other species																							
Galeopsis pubescens	+	+	+	+	+	+	+	+	+	+	·	·	·	·	+	·	+	+	+	+	V	III	IV
Geranium robertianum	·	+	·	+	+	·	1	+	+	·	+	·	·	·	·	1	+	+	+	+	III	III	III
Oxalis acetosella	+	1	+	·	·	1	+	·	·	·	+	·	·	·	+	+	+	·	+	1	III	III	III
Moehringia trinervia	·	·	+	+	1	·	+	·	·	+	·	+	·	·	+	·	1	+	·	+	III	III	III
Majanthemum bifolium	·	·	1	2	1	+	·	+	1	+	·	·	·	·	·	·	+	+	1	·	IV	II	III
Urtica dioica	·	·	·	·	·	·	·	·	·	·	1	1	2	·	·	1	+	1	2	2	–	IV	II
Geum urbanum	·	·	·	·	·	·	·	·	·	·	+	+	+	·	·	+	+	+	+	+	–	IV	II
Convallaria maialis	·	·	·	·	·	·	+	3	+	·	·	·	·	·	·	·	·	·	·	·	II	–	I
Galeopsis bifida	+	+	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	·	I	–	I

Additionally in relevés: 8 – *Ranunculus auricomus* +; 11 – *Galium aparine* +, *Rubus sp.* +, *Eurhynchium hians* +, 16 – *Lapsana communis* +, *Chelidonium maius* +; 18 – *Polygonatum odoratum* +; 20 – *Agropyron caninum* +, *Eurhynchium hians* +.

CHARACTERISTICS OF VEGETATION AND MYCOTA ON THE OBSERVATION PLOTS

Plot I

Galio silvatici-Carpinetum typicum

The plot is situated in the flat area, on formerly boggy, muck-brown soil with loose, well decomposed leaf litter (up to 4 cm thick) and muck humus horizon (about 30 cm thick), pH 3.5–4.5. The tree-stand consists of two layers. The upper one (a_1) comprises *Quercus robur*, *Carpinus betulus* and solitary specimens of *Acer pseudoplatanus* and *Tilia cordata*. The lower one (a_2) is dominated by *Carpinus betulus*, which forms also scarce, but relatively numerous in comparison with the other species, undergrowth.

Generally the undergrowth is hardly developed. The herb layer consists of numerous species typical of mixed deciduous forest and it undergoes distinct seasonal changes. In the early spring *Anemone nemorosa*, *Hepatica nobilis* and *Ranunculus ficaria* are prevailing, in the latter period – *Stellaria holostea*, *Millium effusum*, *Lamiastrum galeobdolon* and *Galeopsis pubescens*. In the subplot no. 8, where the forest floor is better insolated, *Convallaria maialis* predominates (Tab. 4).

The plot is characterized by the presence of logs of oak and hornbeam overgrown by mosses, numerous lying branches (subplots no. 5, 6, 7) and standing dead trunks of oak, hornbeam and sycamore (Fig. 3).

In the years 1994–1996, 136 species and forms of macromycetes were found, among them 34 terrestrial, 54 lignicolous and 48 litter inhabiting fungi.

In the group of terrestrial fungi the most abundant and frequent were the species: *Macrolepiota rhacodes*, *Laccaria laccata*, *Lactarius quietus* and *Paxillus involutus*. About 1/3 of species from this group were recorded only once. 14 mycorrhizal fungi were found, they belong to the genera: *Lactarius*, *Xerocomus*, *Hebeloma*, *Russula*, *Laccaria*, *Paxillus* and *Amanita* (Tab. 5).

The most numerous leaf litter decomposers were *Collybia butyracea* var. *asema*, *C. peronata* and *Lepista flaccida*, as well as *Mycena polyadelpha*, occurring in the late autumn on decomposing leaves under the upper layer of litter. Some species, e.g. *Clitocybe gibba*, *C. langei*, *Collybia dryophila*, *Mycena filopes*, *Psathyrella obtusata* were found almost in all the squares, but in small number of fruit-bodies.

The species fruiting on fallen branches, e.g. *Crepidotus variabilis*, *Marasmius rotula* and *Mycena vitilis* were abundant. The plenty of logs favoured the occurrence of *Mycena inclinata*, *M. galericulata*, *M. erubescens*. There are species recorded almost all over the year in this group: *Ganoderma lipsiense*, *Hymenochaete rubiginosa*, *Schizopora paradoxa*, *Stereum hirsutum* and *Xylaria longipes*.

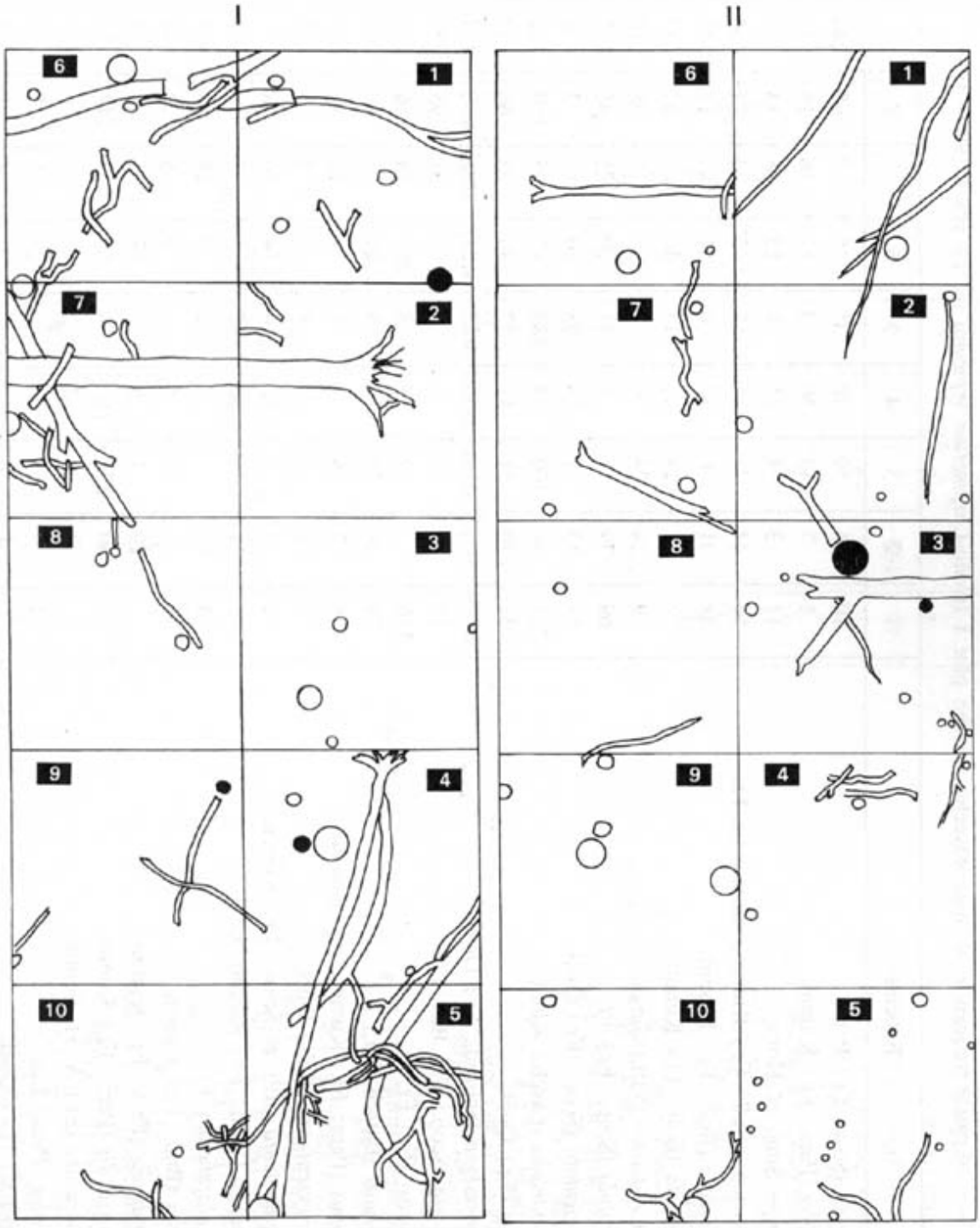

Fig. 3. Plot I in *Galio-Carpinetum typicum*
Plot II in *Galio-Carpinetum corydaletosum*
○ living trees ● dead trees

Table 5

Spatial frequency of macromycetes on the plot I (*Galio-Carpinetum typicum*) in the years 1994–1996

Species	1	2	3	4	5	6	7	8	9	10	FR (%)
Lepista flaccida (Sow.: Fr.) Pat.	10	26	59	70	35	35	2	66	244	35	100
Clitocybe gibba (Pers.: Fr.) Kumm.	1	7	13	50	3	12	16	15	22	20	100
Clitocybe langei Sing. ex Hora	11	3	4	15	8	13	88	14	25	31	100
Collybia butyracea (Bull.: Fr.) Kumm. var. *asema* Fr.	56	44	77	56	52	65	44	74	54	24	100
Collybia dryophila (Bull.: Fr.) Kumm.	38	31	6	13	20	21	41	11	21	28	100
Collybia peronata (Bolt.: Fr.) Kumm.	72	72	24	21	11	46	127	31	67	11	100
Macrolepiota rhacodes (Vitt.) Sing.	9	24	24	6	7	5	18	38	16	6	100
Marasmius rotula (Scop.: Fr.) Fr.	69	79	15	8	11	20	25	85	155	72	100
Mycena galericulata (Scop.: Fr.) Quél.	88	33	1	18	78	10	63	3	8	61	100
Mycena polyadelpha (Lasch.) Kühn.	211	96	100	33	285	17	75	150	142	105	100
Mycena vitilis (Fr.) Quél.	31	20	21	15	22	36	33	60	37	61	100
Schizopora paradoxa (Schrad.: Fr.) Donk	x(21)	x(5)	x(15)	x(36)	x(32)	x(23)	x(8)	x(7)	x(14)	x(36)	100
Laccaria laccata (Scop.: Fr.) Bk. et Br.	18	1	22		1	22	34	95	90	206	90
Lactarius quietus (Fr.) Fr.	156		19	37	8	267	14	16	93	124	90
Paxillus involutus (Batsch.: Fr.) Fr.	59	48	27		9	49	26	30	47	17	90
Mycena galopus (Pers.: Fr.) Kumm. var. *galopus*	1	22	6		8	5	23	13	17	40	90
Xerocomus chrysenteron (Bull.) Quél.	3	1	2		8	6	3	3	3	18	90
Mycena sanguinolenta (Alb. et Schw.: Fr.) Kumm.	1	9	2	12	4	14	10	6		14	90
Armillaria mellea (Vahl.: Fr.) Kumm. s.l.	1	11	4	90	42	3	7		51		80
Marasmius splachnoides Fr.	3	15			1	6	18	3	4	13	80
Mycena filopes (Bull.: Fr.) Kumm.	4		3	5		9	5	8	14	19	80
Clitocybe candicans (Pers.: Fr.) Kumm.		20	4	5		17	1	5	7	9	80
Crepidotus variabilis (Pers.: Fr.) Kumm.		40	271	163	4	50	7	147	11		80
Psathyrella obtusata (Fr.) A. H. Smith		2	28	2	2		2	6	27	9	80
Clitocybe dicolor (Pers.) Lge.	2	1	3				1	5	3	5	70
Psathyrella gracilis (Fr.) Quél.		1	8			6	2	1	13	6	70

Clitocybe metachroa (Fr.) Kumm.	32	14	24			3	75	29	13		70
Lepista nuda (Bull.: Fr.) Cke.	1	1			11	10	3		28	14	70
Pluteus atricapillus (Batsch.) Fayod	5	16			8	5	4	3		2	70
Clitocybe phyllophila (Fr.) Quél.	4					1	5	2	1	2	60
Conocybe tenera (Schff.: Fr.) Fayod	23	3			1			7	24	21	60
Mycena alcalina (Fr.: Fr.) Kumm.		1			1		20	2	2	104	60
Mycena stylobates (Pers.: Fr.) Kumm.				2		2	1	1	1	5	60
Mycena inclinata (Fr.) Quél.		58		257	152	138	1069			83	60
Stereum hirsutum (Willd.: Fr.) Pers.		x(1)	x(1)	x(1)	x(1)	x(1)	x(1)				60
Psathyrella hydrophila (Bull. ex Mérat) Mre.			116	79	50	32			7		50
Lactarius subdulcis (Bull.: Fr.) S. F. Gray	8		1					3	7	9	50
Agrocybe praecox (Pers.: Fr.) Fay.		2	7			1	4	3			50
Mycena polygramma (Bull.: Fr.) S. F. Gray var. *polygramma*	1						4	1	2	1	50
Clitocybe vibecina (Fr.) Quél.		1			12		4	2		6	50
Entoloma asperellum (Fr.) Mos.	9	1			2		2			3	50
Mycena chlorinella (Lge.) Sing.					2	7	1	2		3	50
Mycena pura (Pers.: Fr.) Kumm.	1	9				1	2			1	50
Xylaria longipes Nitschke	5			127	326	8					40
Xylaria hypoxylon (L. ex Hook.) Grev.					30	82			14	103	40
Collybia marasmioides (Britz.) Brsky. et Stangl.		101				18	56		20		40
Clitocybe hydrogramma (Bull.: Fr.) Kumm.						4	2	1		1	40
Clitocybe inornata (Sow.: Fr.) Gill.	1			2		2	5				40
Mycena pelianthina (Fr.) Quél.	2				6			2		1	40
Psathyrella murcida (Fr.) Kits. van Wav.							1	2	2	11	40
Psathyrella spadiceo-grisea (Schaeff.) Mre.	3		3						2	1	40
Marasmius bulliardii (Quél.)	3					3			11	2	40
Psathyrella fusca (Schum.: Fr.) Pearson	1		19							4	30
Collybia confluens (Pers.: Fr.) Kumm.	64	190				59					30
Fistulina hepatica (Schaeff.) Fr.	1	4	2								30
Ganoderma lipsiense (Batsch.) Atk.				8	7	2					30
Lepista nebularis (Batsch.: Fr.) Harmaja				14	7		8				30

Tab. 5 cont.

Species	1	2	3	4	5	6	7	8	9	10	FR (%)
Agaricus silvicola (Vitt.) Sacc.				6	3				5		30
Clitocybe cerussata (Fr.) Kumm.		2					9		4		30
Mycena erubescens v. Höhn.		64					674		2		30
Xerula radicata (Relh.: Fr.) Dörfelt					2	2			5		30
Collybia cookei (Bres.) J. D. Arnold								8	8	3	30
Macrolepiota procera (Scop.: Fr.) Sing.								1	1	2	30
Psathyrella gyroflexa (Fr.) Konr. et Maubl.								6	1	14	30
Psathyrella nolitangere (Fr.) Pears. et Dennis			4					1		4	30
Xylaria polymorpha (Pers. ex Mér.) Grev.				56				506		395	30
Lycoperdon perlatum Pers.: Pers.	9					4				2	30
Marasmius cohaerens (Pers.: Fr.) Cke. et Quél.						3	5			3	30
Amanita rubescens Pers.: Fr.						3				1	20
Ascocoryne sarcoides (Jacq.: Fr.) Groves et Wilson				1		10					20
Bisporella citrina (Batsch: Fr.) Korf et Carpenter					18			56			20
Galerina unicolor (Fr.) Sing.							4	1			20
Collybia succinea (Fr.) Quél.		2				7					20
Conocybe rickeniana P. D. Orton	1	6									20
Coprinus domesticus (Bolt.: Fr.) S. F. Gray	1		7								20
Coprinus micaceus (Bull.: Fr.) Fr.			3	235							20
Cystoderma carcharias (Pers.) Konr. et Maubl.			18	14							20
Clitocybe odora (Bull.: Fr.) Kumm.			6	34							20
Entoloma junicinum (Kühn. et Romagn.) Noord.									3	3	20
Megacollybia platyphylla (Pers.: Fr.) Kotl. et Pouz.	2									4	20
Lactarius decipiens Quél.		1								1	20
Hymenoscyphus fructigenus (Bull.: Fr.) S. F. Gray		4								3	20
Hypholoma fasciculare (Huds.: Fr.) Kumm.		175			7						20
Hypholoma sublateritium (Fr.) Quél.		27			125						20

Kuehneromyces mutabilis (Schaeff.: Fr.) Sing. et Smith					20					7	20
Lycoperdon pyriforme Schaeff.: Pers.					2	72					20
Pluteus salicinus (Pers.: Fr.) Kumm.					3	1					20
Marasmiellus ramealis (Bull.: Fr.) Sing.					5		8				20
Marasmius torquescens Quél.						3	6				20
Mycena tintinnabulum (Fr.) Quél.					7		30				20
Psathyrella subnuda (Karst.) A. H. Smith						5			20		20
Pseudoclitocybe cyathiformis (Bull.: Fr.) Sing.				6	1						20
Coprinus xanthothrix Romagn.	5										10
Cyathus stratus (Huds.) Willd.: Pers.		18									10
Pluteus phlebophorus (Dittm.: Fr.) Kumm.		8									10
Chondrostereum purpureum (Pers.: Fr.) Pouz.		x(1)									10
Collybia fusipes (Bull.: Fr.) Quél.		2									10
Marasmius wynnei Bk. et Br.		1									10
Pluteus nanus (Pers.: Fr.) Kumm.		1									10
Schizophyllum commune Fr.: Fr.			5								10
Clitocybe fragrans (With.: Fr.) Kumm.				8							10
Exidia glandulosa Fr.				x(2)							10
Lepiota clypeolaria (Bull.: Fr.) Kumm.					1						10
Mycena parabolica Fr.					21						10
Mycena rosea (Bull.) Sacc. et Dalla Costa					4						10
Calocera cornea (Batsch: Fr.) Fr.						200					10
Conocybe semiglobata Kühn. et Watl.						3					10
Xerocomus rubellus (Krbh.) Moser						2					10
Russula pectinata Fr.						2					10
Russula vesca Fr.						1					10
Phlebia radiata Fr.						1					10
Laetiporus sulphureus (Bull.: Fr.) Murrill						1					10
Hymenochaete rubiginosa (Dicks.: Fr.) Lév.							340				10
Mycena galopus (Pers.: Fr.) Kumm. var. *nigra* (Fl. Dan.) Kühn.							249				10
Galerina hypnorum (Schrank: Fr.) Kühn.							6				10

Tab. 5 cont.

Species	1	2	3	4	5	6	7	8	9	10	FR (%)
Entoloma rhodocylix (Lasch.) Mos.							4				10
Collybia cirrhata (Schum.: Fr.) Kumm.								7			10
Lepista gilva (Pers.: Fr.) Pat.								4			10
Panaeolina foenisecii (Pers.: Fr.) Mre.								3			10
Flammulaster granulosus (Lge.) Watl.								2			10
Hebeloma longicaudum (Fr.) ss. Lge.								2			10
Stropharia aeruginosa (Curt.: Fr.) Quél.								1			10
Psathyrella pseudogracilis (Romagn.) Mos.									10		10
Lactarius piperatus (L.: Fr.) Pers.									5		10
Psilocybe crobula (Fr.) M. Lge. ex Sing.									3		10
Entoloma nidorosum (Fr.) Quél.									1		10
Pleurotus pubescens (Sow.) Schroet. ss. Lge.										8	10
Stereum subtomentosum Pouz.										8	10
Mycena polygramma (Bull.: Fr.) S. F. Gray var. *pumila* Lge.										3	10
Psathyrella frustulenta (Fr.) A. H. Smith										3	10
Hebeloma mesophaeum (Pers.: Fr.) Quél.										1	10
Lepiota cristata (Bolt.: Fr.) Kumm.										1	10
Mycena capillaris (Schum.: Fr.) Kumm.										1	10
Mycena epipterygia (Scop.: Fr.) S. F. Gray										1	10
Ripartites tricholoma (A. et S.: Fr.) Karst.										1	10
Xerocomus badius (Fr.) Kühn. ex Gilb.										1	10

At the bases of living oaks fruit-bodies of *Fistulina hepatica*, *Armillaria mellea* and *Collybia fusipes* were found. This last species is considered a "weakness" parasite – its harmful effect depends on earlier impairment of a tree (P r z y b y ł 1995).

Plot II

Galio silvatici–Carpinetum corydaletosum

The plot is situated in a shallow depression, in the neighbourhood of *Fraxino-Ulmetum* patches. This subassociation occurs on muck soil with black humus horizon (about 20 cm thick) and high level of ground water. The soil pH ranges between 4.5–7.

Carpinus betulus distinctly predominates in the tree-stand. As an admixture *Quercus robur*, *Acer pseudoplatanus*, *Tilia cordata* and solitary *Ulmus laevis* occur.

The shrub layer consists of scarcely occurring lime tree and sycamore.

The group of spring geophytes can be distinguished in the herb layer: *Ranunculus ficaria*, *Anemone ranunculoides*, *A. nemorosa*, *Corydalis cava*, *Gagea lutea*. Subsequently the following plants predominate in this layer: *Chaerophyllum temulentum*, *Lamiastrum galeobdolon*, *Millium effusum*, *Stellaria holostea*, *Polygonatum multiflorum*, *Urtica dioica* and *Aegopodium podagraria* (Tab. 4).

The proportion of mosses is minute and the litter layer is not very thick. There is a broken oak trunk on the plot (subplot no. 3) as well as logs of oak, hornbeam, and sycamore overgrown by mosses, and numerous branches inhabited by sporotrophic fungi (Fig. 3).

Favourable habitat conditions are reflected in the fungal flora of the presented subassociation. In the years 1994–1996, 152 taxa of macrofungi were found on the plot II (67 terrestrial, 36 litter inhabiting and 49 lignicolous fungi).

Among the terrestrial fungi 48 species were found exclusively in this subassociation. They belong mainly to the following genera: *Coprinus*, *Cortinarius*, *Inocybe*, *Lactarius*, *Lepiota*, *Naucoria*, *Russula*. The most abundantly fruiting species was *Laccaria laccata*, the most frequently recorded – *Lactarius quietus*, *Paxillus involutus* and *Lycoperdon perlatum* (Tab. 6).

In the vicinity of the investigated plot, within the subassociation with *Corydalis cava*, 2 old fruit-bodies of *Langermannia gigantea* were found.

Proportion of species inhabiting fallen leaves and fruits was the smallest. *Collybia butyracea* var. *asema* and *Collybia confluens* (1044 fruit-bodies on one subplot) were relativiely more numerous in some squares; *Hymenoscyphus fructigenus*, *Mycena polyadelpha* and *Collybia dryophila* occurred on the whole plot (Tab. 6).

Table 6

Spatial frequency of macromycetes on the plot II (*Galio-Carpinetum corydaletosum*) in the years 1994–1996

Species	1	2	3	4	5	6	7	8	9	10	FR (%)
Mycena galericulata (Scop.: Fr.) Quél.	22	34	142	41	11	4	478	17	44	6	100
Mycena polyadelpha (Lasch.) Kühn.	2	23	52	43	38	17	45	65	45	85	100
Hymenoscyphus fructigenus (Bull.: Fr.) S. F. Gray	9	4	33	126	6	10	24	33	96	106	100
Mycena vitilis (Fr.) Quél.	12	7	14	33	63	18	3	9	34	78	100
Collybia dryophila (Bull.: Fr.) Kumm.	2	4	2	9	7	6	4	12	19	11	100
Schizopora paradoxa (Schrad.: Fr.) Donk	x(12)	x(8)	x(14)	x(13)	x(25)	x(6)	x(15)	x(39)	x(4)	x(25)	100
Marasmius rotula (Scop.: Fr.) Fr.	16	9	3	9	21	31	29	38	35		90
Mycena galopus (Pers.: Fr.) Kumm. var. *galopus*	8		18	13	33	14	1	2	26	23	90
Mycena filopes (Bull.: Fr.) Kumm.	2	2	6	10	12	3		6	17	16	90
Xerula radicata (Relh.: Fr.) Dörfelt			13	4	1	1	1	1	1		70
Laccaria laccata (Scop.: Fr.) Bk. et Br.			13	1		74	33	43	35	80	70
Tubaria furfuracea (Pers.: Fr.) Gill.	11	4	7	1		8	56		2		70
Psathyrella obtusata (Fr.) A. H. Smith	4	3	2			1	2	6	5		70
Crepidotus variabilis (Pers.: Fr.) Kumm.			3	9		75	60	81	35		60
Humaria hemisphaerica (Wiggers: Fr.) Fuckel		4			2	4	2	3		14	60
Lepiota cristata (Bolt.: Fr.) Kumm.	2		6	8	14				1	2	60
Xylaria longipes Nitschke	569	5	25	12		45	10				60
Lycoperdon perlatum Pers.: Pers.		13			2	3	5		39	6	60
Paxillus involutus (Batsch: Fr.) Fr.		2	1			4	27	18	40		60
Collybia butyracea (Bull.: Fr.) Kumm. var. *asema* Fr.	1						1	117	23	2	50
Collybia peronata (Bolt.: Fr.) Kumm.						3	18	10	4	3	50
Lactarius quietus (Fr.) Fr.						8	2	15	90	11	50
Inocybe geophylla (Sow.: Fr.) Kumm. var. *geophylla*					2		4	3	1	1	50
Conocybe tenera (Schff.: Fr.) Fayod	1		1					1	1	1	50
Coprinus domesticus (Bolt.: Fr.) S. F. Gray				4		3		2	1	4	50
Dacryomyces stillatus Nees.: Fr.	x(2)	x(2)		x(1)	x(2)		x(2)				50
Flammulaster ferrugineus (Mre. ex Kühn.) Watl.		2	2		6		1			3	50
Mycena inclinata (Fr.) Quél.		100	112		100		4			2	50

Psathyrella gracilis (Fr.) Quél.		5		12	1	1			4		50
Conocybe rickeniana P. D. Orton		2		5	6		4				40
Lactarius pyrogalus (Bull.: Fr.) Fr.	4	6			2		2				40
Pluteus atricapillus (Batsch) Fayod			21			7	5	1			40
Xerula longipes (Bull. ex St. Am.) Mos.		1	20	1				5			40
Postia stiptica (Pers.: Fr.) Jülich	7	5			18		45				40
Russula pectinata Fr.		5						3	5	2	40
Coprinus xanthothrix Romagn.	2						1	4			30
Entoloma junicinum (Kühn. et Romagn.) Noord.	4	3							1		30
Inocybe geophylla (Sow.: Fr.) Kumm. var. *lilacina* Fr.					5				3	2	30
Tricholoma lascivum (Fr.) Gill. ss. Lge.					7				3	6	30
Tubaria pellucida (Bull.: Fr.) Gill.					5				2	4	30
Marasmius splachnoides Fr.								17	19	14	30
Alnicola langei (Kühn.) Sing.						17	1			1	30
Mycena alcalina (Fr.: Fr.) Kumm.			1	1		6					30
Mycena polygramma (Bull.: Fr.) S. F. Gray	1	1								1	30
Russula farinipes Rom. in Britz.		1				1				4	30
Lepista nebularis (Batsch: Fr.) Kumm.	12				10						20
Mycena chlorinella (Lge.) Sing.	2									3	20
Alnicola subconspersa (Kühn. ex Orton) Mos.	84	8									20
Hypholoma fasciculare (Huds.: Fr.) Kumm.		20	176								20
Collybia cookei (Bres.) J. D. Arnold			80							2	20
Macrolepiota rhacodes (Vitt.) Sing.			9					8			20
Marasmiellus ramealis (Bull.: Fr.) Sing.			2				1				20
Coprinus lagopus Fr.				2				2			20
Coprinus plicatilis (Curt.: Fr.) Fr.				1		1					20
Inocybe brunneoatra (Heim) P. D. Orton				3						5	20
Conocybe subovalis Kühn. et Watl.					1	1					20
Cystolepiota sistrata (Fr.) Sing.					1					2	20
Lepiota setulosa Lge.		1			4						20
Pholiotina filaris (Fr.) Sing.		1			14						20
Pholiotina arrhenii (Fr.) Sing.		1				1					20
Laccaria proxima (Boud.) Pat.						4	3				20

Tab. 6 cont.

Species	1	2	3	4	5	6	7	8	9	10	FR (%)
Russula xerampelina (Schaeff.) Fr.						4				1	20
Xylaria hypoxylon (L. ex Hook.) Grev.						24			15		20
Psathyrella hydrophila (Bull. ex Mérat) R. Mre.								68	94		20
Clitocybe langei Sing. ex Hora								4	2		20
Pluteus salicinus (Pers.: Fr.) Kumm.								2	2		20
Clitocybe candicans (Pers.: Fr.) Kumm.								1		1	20
Bjerkandera adusta (Willd.: Fr.) Karst.									14	4	20
Mycena galopus (Pers.: Fr.) Kumm. var. *nigra* (Fl. Dan.) Kühn.					1				11		20
Mycena sanguinolenta (Alb. et Schw.: Fr.) Kumm.									7	1	20
Stereum hirsutum (Willd.: Fr.) Pers.			x(1)							37	20
Xerocomus chrysenteron (Bull.) Quél.		1								20	20
Coprinus disseminatus (Pers.: Fr.) S. F. Gray	118										10
Inocybe maculata Boud.	4										10
Lactarius obscuratus (Lasch) Fr.	4										10
Rhodophyllus griseorubellus (Lasch) Quél.	3										10
Clitocybe dicolor (Pers.) Lge.	1										10
Alnicola melinoides (Bull.: Fr.) Kühn.	1										10
Lactarius tabidus Fr. ss. Neuh.	1										10
Calocera cornea (Batsch: Fr.) Fr.		50									10
Peziza praetervisa Bres.		1									10
Lactarius blennius Fr.		1									10
Hypholoma sublateritium (Fr.) Quél.			424								10
Coprinus micaceus (Bull.: Fr.) Fr.			32								10
Ganoderma lipsiense (Batsch) Atk.			27								10
Fistulina hepatica (Schaeff.) Fr.			10								10
Ganoderma lucidum (Curt.: Fr.) Karst.			7								10
Psathyrella vernalis (Lge.) Mos.			6								10
Galerina hypnorum (Schrank: Fr.) Kühn.			5								10
Flammulaster granulosus (Lge) Watl.			2								10

Inocybe praetervisa Quél.			2									10
Psathyrella fusca (Schumm.: Fr.) Pearson			2									10
Meripilus giganteus (Pers.: Fr.) Karst.			2									10
Mycena cinerella (Karst.) Karst.			2									10
Inocybe hirtella Bres.			1									10
Agaricus haemorrhoidarius Schulz. in Kalchbr.			1									10
Laetiporus sulphureus (Bull.: Fr.) Murr.			1									10
Tubaria hiemalis Rom. ex Bon.			1									10
Melanophyllum echinatum (Roth: Fr.) Sing.				2								10
Panaeolus ater (Lge.) Kühn. et Romagn.				2								10
Psathyrella prona (Fr.) Gill.				2								10
Psathyrella pseudogracilis (Romagn.) Mos.				1								10
Pluteus hispidulus (Fr.: Fr.) Gill.				1								10
Psilocybe inquilina (Fr.: Fr.) Bres.				1								10
Coprinus picaceus (Bull.: Fr.) S. F. Gray				1								10
Mycena acicula (Schff.: Fr.) Kumm.				1								10
Flammulina velutipes (Curt.: Fr.) Karst.					9							10
Entoloma subradiatum (Kühn. et Romagn.) Mos.					6							10
Inocybe microspora Lge.					1							10
Pluteus nanus (Pers.: Fr.) Kumm.					1							10
Cortinarius bibulus Quél.					1							10
Laccaria amethystina (Huds. ex Hook.) Cke.						11						10
Russula heterophylla (Fr.) Fr.						8						10
Hebeloma mesophaeum (Pers.: Fr.) Quél.						3						10
Hebeloma sacchariolens Quél.						2						10
Russula chamaeleontina Fr.						2						10
Lepiota tomentella Lge.						1						10
Collybia confluens (Pers.: Fr.) Kumm.							1044					10
Ramaria stricta (Pers.: Fr.) Quél.							34					10
Mycena pelianthina (Fr.) Quél.							9					10
Galerina triscopa (Fr.) Kühn.							3					10
Mycena flavoalba (Fr.) Quél.							3					10
Mycena niveipes Murr.							2					10

Tab. 6 cont.

Species	1	2	3	4	5	6	7	8	9	10	FR (%)
Alnicola bohemica Vel.							1				10
Simocybe rubi (Berk.) Sing.							1				10
Pleurotus pubescens (Sow.) Schroet. ss. Lge.								7			10
Inocybe napipes Lge.								7			10
Clitocybe gibba (Pers.: Fr.) Kumm.								7			10
Psathyrella gyroflexa (Fr.) Konr. et Maubl.								4			10
Coprinus leiocephalus Orton								3			10
Clitocybe odora (Bull.: Fr.) Kumm.								2			10
Clitocybe vibecina (Fr.) Quél.								1			10
Agrocybe praecox (Pers.: Fr.) Fay.								1			10
Ciboria batschiana (Zopf et Sydow) Buchw.									4		10
Stropharia aeruginosa (Curt.: Fr.) Quél.									2		10
Mycena supina (Fr.) Kumm.									1		10
Marasmius bulliardii Quél.									1		10
Mycena pura (Pers.: Fr.) Kumm.									1		10
Delicatula cuspidata (Quél.) Cejp									1		10
Inocybe asterospora Quél.										12	10
Peniophora quercina (Pers.: Fr.) Cooke										8	10
Xerocomus badius (Fr.) Kühn. ex Gilb.										4	10
Macrolepiota procera (Scop.: Fr.) Sing.										2	10
Mycena stylobates (Pers.: Fr.) Kumm.										2	10
Stropharia caerulea Kreisel										1	10
Tephrocybe rancida (Fr.) Donk										1	10
Clitocybe hydrogramma (Bull.: Fr.) Kumm.										1	10
Cortinarius decipiens Fr.										1	10
Cortinarius glandicolor Fr. var. *curtus* Fr. ss. Lge.										1	10
Lepiota castanea Quél.										1	10
Amanita rubescens Pers.: Fr.										1	10
Armillaria mellea (Vahl.: Fr.) Kumm. s.l.										1	10

The presence of logs and numerous fallen branches resulted in occurrence of species forming hardy and long-lasting carpophores as well as fungi with delicate and ephemeral fruit-bodies. The most frequent were: *Mycena galericulata*, *M. vitilis*, *M. filopes*, *M. galopus*, *Marasmius rotula* and *Schizopora paradoxa*. The occurrence of a species protected by law in Poland – *Meripilus giganteus* at the base of an oak windfall should be stressed (it had not been recorded in the Wielkopolska region before; Skirgiełło 1976/1977). The presence of *Ganoderma lucidum* is also worthy of notice.

RELATIONSHIP BETWEEN MACROMYCETES OCCURRENCE AND SOME ECOLOGICAL FACTORS

Analysis of the occurrence of macrofungi against the background of two different subassociations of the oak-hornbeam forest reveals the influence of habitat conditions on mycoflora. Quantitative and qualitative differences between the macromycetes of each subassociation result, among other things, from the habitat humidity. Humid and fertile subassociation of *G.-C. corydaletosum* is characterized by the higher number of recorded species in comparison with the drier subassociation of *G.-C. typicum*. Differences can be seen both in mycorrhizal and terrestrial saprotrophic fungi. Rich soil of *G.-C. corydaletosum* favours the occurrence of delicate and ephemeral fungi, e.g. from the genera *Inocybe*, *Naucoria* and *Tubaria*. In the subassociation of *G.-C. typicum* more species of litter decomposers were found because of the thicker litter layer. Lignicolous fungi, both saprotrophs and parasites, closely related to their substrate, did not revealed any significant quantitative or qualitative differences in both investigated subassociations (Fig. 4).

A factor limiting development of mycoflora is the cover of herb layer. In the spring, in the period of lush green vegetation, macrofungi are very scarce with the exception of lignicolous species fruiting almost all over the year. Higher cover of the herb layer in *G.-C. corydaletosum* during the whole vegetation season results in less abundant fruiting of particular species in comparison with the typical subassociation.

The situation of the *G.-C. corydaletosum* plot near the riverside communities favours the occurrence of fungi typical of *Fraxino-Ulmetum*, e.g. *Alnicola subconspersa*, *Lactarius obscuratus*, *Coprinus disseminatus*, *Cortinarius bibulus* and *Psathyrella vernalis* (compare Lisiewska and Bujakiewicz 1976).

A very important factor affecting development of fungi is precipitation in correlation with air temperature. In 1994 the annual precipitation total amounted to 524 mm. July was the month of the highest rainfall and high mean temperature (Tab. 2 and 3). The combination of these two factors resulted in low

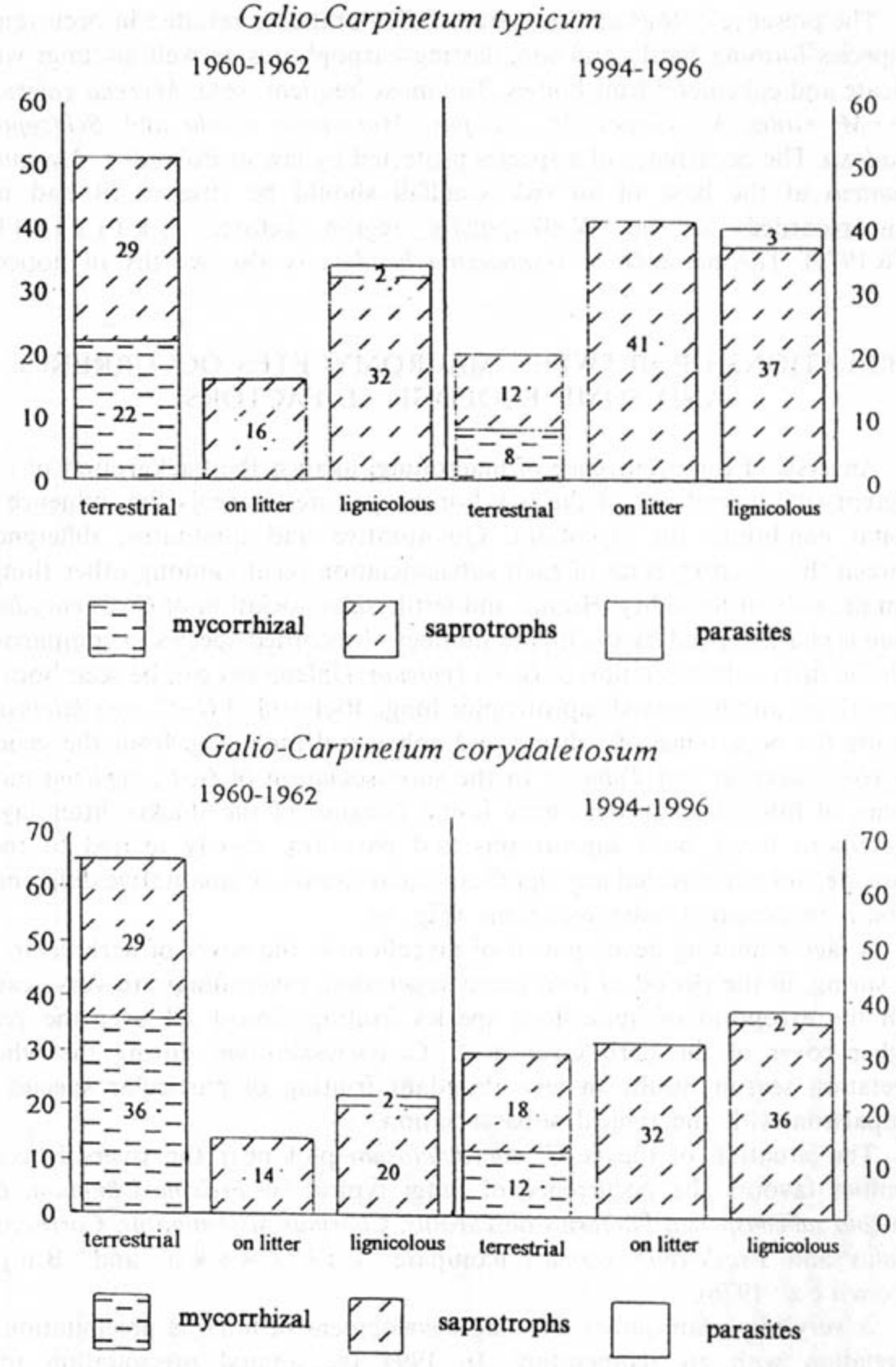

Fig. 4. Proportion of ecological groups of macromycetes (in %) on the plots in the compared investigation periods

fructification, even the lack of fungi in *G.-C. typicum*. The highest number of fruit-bodies in that year, mostly of saprotrophic species, was found at the end of September, when the physiological drought period lasting from April finally finished (Fig. 2). In December, which was characterized by relatively high rainfall total (59 mm) and exceptionally high in that season of the year temperature (2.4°C), 22 species of fungi were found. They were exclusively saprotrophs, e.g. *Clitocybe dicolor*, *C. inornata*, *Flammulina velutipes*, *Mycena tintinnabulum*, *M. polygramma* var. *pumila* and *Phlebia radiata*.

Precipitation in 1995 was quite high and evenly distributed all over the year. The annual rainfall total (542 mm) was the highest in the investigated years. Slight increase in species number was observed in that year from the first decade of May to the end of June; the peak of fructification was observed in October. In the summer 1995, not too humid but warm, many species of *Mycena* and *Psathyrella* forming tiny and delicate carpophores were found. Similarly to the previous year, fructification of fungi in 1995 reflected the drought periods (Fig. 2). In spite of not too advantageous climatic conditions, about 60% of the total number of species found in both subassociations were recorded in that year.

The year 1996 was characterized by the lowest annual precipitation total (515 mm) and relatively low mean temperatures (Tab. 2 and 3). The precipitation in the first half-year was rather inconsiderable, but it was plentiful in the period from July to November. In that year the highest number of fungal species was recorded; 108 species were found in *G.-C. typicum* and 107 in *G.-C. corydaletosum*. Fructification of fungi was gradually increasing to the maximum in September (*G.-C. typicum*) and October (*G.-C. corydaletosum*), and then quickly decreased. Mass occurrence of saprotrophic species, e.g. *Marasmius rotula*, *Collybia butyracea* var. *asema*, *C. peronata*, *Mycena erubescens* as well as mycorrhizal species: *Lactarius quietus*, *Laccaria laccata* and *Paxillus involutus* was observed then. After the peak the number of species decreased simultaneously with the decrease in fruiting abundance. July 1996 was the record month in terms of the amount of precipitation (160 mm) in the whole investigation period. The number of fungal species recorded in that month was three times higher than in respective months in the preceding years. Majority of these fungi had not been previously found before September.

A part of species found in each year did not occur in the following years. Also, every year some new species appeared on the plots. In 1995 on the plot of *G.-C. typicum* 33 new species occurred and on the plot of *G.-C. corydaletosum* 50 new species were recorded. In 1996, 36 and 47 more species appeared respectively. The macrofungi on the *G.-C. corydaletosum* plot were more sensitive to the soil humidity changes in comparison with the plot in *G.-C. typicum*.

HUMAN IMPACT ON FUNGI

Before 1992 the "Dębina" reserve had been under the full law protection. By that time no cultivation operations had been undertaken at all. Abandoned logs and branches had become a substrate for many species of fungi. The reserve had not abounded in edible fungi so it had not been the object of collective mushroom hunting. In spite of prohibition of any fruit collection, the reserve had been trampled and scoured for acorns by people, the litter layer had been disturbed heavily.

For many years unfavourable conditions for oak self-restoration have been observed in the reserve. Seedlings and undergrowth of oak are lacking. Low precipitation and lowering ground water level enhance a decline of old, branchy oak trees with shallow root systems (P r z y b y ł 1995). The number of oak falls and broken trees increases. Since 1992 the reserve has been under the partial protection. The change of protection status has enabled a planned cultivation treatment. In January 1995 dead oaks were partially removed from the tree-stand. A year later some other trees were also cut in that places and 5 gaps of different size and shape were prepared for new trees planting. The clearings were to be planted in 1997 with seedlings of *Quercus robur* coming from the seeds collected in the reserve in 1995. The method of combining a natural and artificial way of trees introduction was thought to be the best way of tree-stand rejuvenation (S i k o r s k i 1995).

The clearance realized in the winter 1996 carried consequences for the observation plots. The plot in *G.-C. typicum* was run over by heavy machines so that a road cut the squares no. 1, 2, 3, 8, 9, 10. The clearing in *G.-C. corydaletosum* was made just by the plot and overlap it (Fig. 5).

The vegetation started regenerating on the road in *G.-C. typicum* not before the end of June 1996. Gradually some plants appeared on it, e.g. *Stellaria holostea*, *Galeopsis pubescens*, *Anemone nemorosa*, *Geranium robertianum*, *Moehringia trinervia*, *Urtica dioica*, *Polygonatum multiflorum* and *Majanthemum bifolium*. Some of these species were flowering a month later then in the undisturbed part of the plot. In August the road was completely overgrown. *Stellaria holostea* and *Millium effusum* occurred in great amount, clusters of *Galeopsis pubescens* started to flower. In the clearing near the plot II *Aegopodium podagraria* flowered in plenty instead of *Corydalis cava*.

The numbers of species of fungi recorded in 1996 on disturbed and undisturbed squares of the plot in *G.-C. typicum* did not differ significantly. At the beginning of vegetation season, when the road differed considerably from the other parts of the plot, sporocarps were scarce anyway. In the months of peak fructification the vegetation managed to regenerate; presumably fungal mycelium had not been destroyed as well.

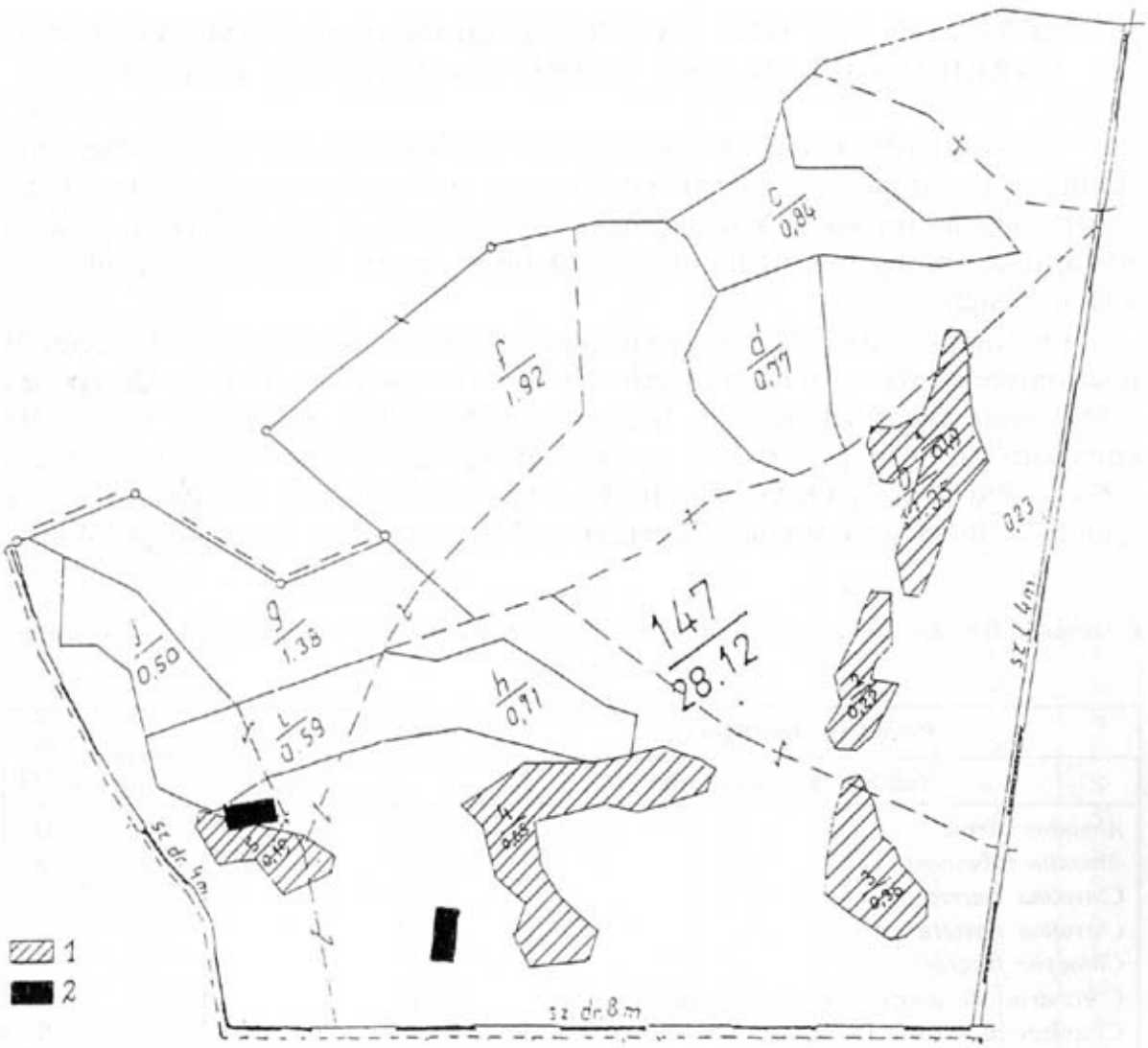

Fig. 5. A sketch of tree-stand clearings in the "Dębina" reserve (winter 1996): 1 — clearing, 2 — observation plot

Among 24 species of macrofungi found on the road *Psathyrella fusca*, *Collybia succinea*, *Lactarius piperatus* and *Entoloma asprellum* were recorded only in 1996. *Agrocybe praecox* and *Conocybe tenera*, fungi typical of fertile and frequently nitrophilous habitats, occurred sporadically in 1995, but in 1996 the number of their fruit-bodies increased considerably and almost exclusively on the newly created road. Two species of edible mushrooms not recorded in the reserve earlier were found in 1996 on the destroyed squares: *Xerocomus rubellus* and *X. badius*.

The effect of trees clearance on the occurrence of fungi on the plot in *G.-C. corydaletosum* as well as the influence of the gap in the nearest tree-stand will probably be noticeable only after longer period of time.

COMPARISON OF THE MYCOCOENOLOGICAL OBSERVATIONS CARRIED OUT IN THE YEARS 1960-1962 AND 1994–1996

The comparison refers to the work by L i s i e w s k a (1965) where the results of investigations carried out 30 years ago on the macromycetes of the oak-hornbeam forests of Wielkopolska were published. The observations were performed, among the others, in the "Dębina" reserve on permanent plots of 400 m^2 each.

On the plot in *G.-C. typicum* (formerly *G.-C. stachyetosum*) 122 species of macromycetes were found altogether in the two periods of study. 29 species (24%) were recorded only in the years 1960–1962, 34 species (28%) are common for both periods, 59 species (48%) were found only in the years 1994–1996 (Tab. 7). On the plot in the subassociation *G.-C. corydaletosum* 131 species of fungi were found altogether and the respective data are as follows:

T a b l e 7

Changes in the macromycetes after 30 years on the permanent plot (400 m^2) in *Galio-Carpinetum typicum*

Period of investigations	1960–1962	1994–1996	Substrate	Ecol. group
Number of observations	26	36		
Amanita citrina	1^{+}		z	M
Amanita rubescens	1^{+}		z	M
Clavulina cinerea	4^{+-2}		z	S
Clavulina cristata	1^{1}		z	S
Clitocybe fragrans	1^{1}		z	S
Cortinarius decipiens (= *Hydrocybe decipiens*)	1^{2}		z	M
Cystolepiota sistrata (= *Lepiota seminuda* f. *minima*)	1^{1}		z	S
Entoloma juncinum (= *Rhodophyllus junceus*)	3^{+-1}		z	S
Entoloma lampropus (= *Rhodophyllus lampropus*)	2^{+}		d	S
Entoloma rhodopolium (= *Rhodophyllus rhodopolius*)	1^{1}		z	S
Ganoderma lipsiense (= *G. applanatum*)	x		d	S
Hohenbuehelia serotina	2^{2}		d	S
Humaria hemisphaerica (= *Lachnea hemisphaerica*)	2^{1}		z	S
Inocybe asterospora	4^{+}		z	M
Laccaria amethystina	3^{1}		z	M
Lactarius camphoratus	1^{+}		z	M
Lycoperdon perlatum	5^{+-1}		z	S
Macrocystidia cucumis	1^{1}		z	S
Mycena polygramma f. *pumila*	1^{+}		d	S
Panellus stypticus	8^{2-3}		d	S
Polyporus arcularius	2^{+-1}		d	S
Psathyrella conoceps	1^{1}		z	S
Pseudoclitocybe cyathiformis (= *Cantharellula cyathiformis*)	2^{1-2}		d	S
Scleroderma verrucosum	1^{1}		z	S
Sclerotinia tuberosa	1^{2}		z	P
Tricholoma album	3^{+-1}		z	M
Xerocomus subtomentosus	3^{+-2}		z	M

Xylaria hypoxylon (=*Xylosphaera hypoxylon*)	x		d	S
Xylaria polymorpha (=*Xylosphaera polymorpha*)	x		d	S
Agrocybe praecox	3^{+-1}	4^{+-2}	z	S
Clitocybe gibba (=*Clitocybe infundibuliformis*)	2^{1}	9^{+-2}	z,s	S
Collybia confluens	3^{1-2}	5^{2-3}	s	S
Collybia dryophila	11^{+-2}	12^{+-2}	z,s	S
Collybia peronata	2^{+-1}	14^{1-3}	s	S
Collybia succinea	1^{1}	1^{1}	z,d	S
Cyathus striatus	3^{2}	2^{1-2}	s	S
Galerina unicolor (=*Pholiota unicolor*)	1^{1}	2^{+-1}	d	S
Hebeloma longicaudum	1^{1}	1^{1}	z	M
Hymenoscyphus fructigenus (=*Helotium fructigenum*)	1^{1}	1^{1}	s	S
Hypholoma fasciculare (=*Naematoloma fasciculare*)	2^{2}	9^{+-3}	d	S
Laccaria laccata	7^{+-2}	5^{1-3}	d	M
Lactarius quietus	9^{+-2}	4^{1-2}	z	M
Lactarius subdulcis	2^{1}	4^{+-1}	z	M
Lepista nebularis (=*Clitocybe nebularis*)	5^{1-2}	2^{+-2}	z	S
Macrolepiota procera	2^{+-1}	1^{+}	z	S
Marasmius rotula	8^{1-3}	8^{+-3}	d	S
Mycena alcalina	3^{+-2}	5^{+-2}	d	S
Mycena filopes	18^{+-1}	6^{+-2}	s	S
Mycena galericulata	2^{1-2}	10^{+-2}	d	S
Mycena galopus var. *galopus*	$+^{+}$	8^{+-2}	s,d	S
Mycena polyadelpha	1^{2}	3^{1-4}	s	S
Mycena polygramma	2^{1-2}	2^{+-1}	d	S
Mycena pura	1^{1}	4^{+-2}	s	S
Mycena stylobates	$^{+}$	2^{+}	s	S
Mycena vitilis	1^{+}	18^{+-2}	d	S
Paxillus involutus	2^{+-1}	9^{1-3}	z	M
Pluteus atricapillus (=*Pluteus cervinus*)	4^{+-1}	10^{+-2}	d	S
Psathyrella hydrophila (=*Psathyrella appendiculata*)	1^{1}	4^{1-2}	d	S
Psathyrella gracilis	3^{+-1}	5^{+-2}	z,s	S
Schizopora paradoxa (=*Xylodon versiporus*)	x	x	d	S
Stereum hirsutum	x	x	d	S
Stropharia aeruginosa	1^{+}	1^{+}	z	S
Xerocomus chrysenteron	6^{+-1}	4^{+-2}	z	M
Armillaria mellea s.l.		6^{1-2}	d	P
Bisporella citrina		1^{3}	d	S
Chondrostereum purpureum		x	d	S
Clitocybe candicans		3^{+-2}	s	S
Clitocybe cerussata		2^{1-2}	s	S
Clitocybe dicolor		1^{2}	s	S
Clitocybe hydrogramma		2^{+-1}	s	S
Clitocybe inornata		1^{+-1}	s	S
Clitocybe langei		7^{1-2}	s	S
Clitocybe metachroa		4^{1-4}	s	S
Clitocybe odora		3^{+-1}	s	S
Clitocybe phyllophila		1^{2}	s	S
Clitocybe vibecina		2^{1}	s	S
Collybia butyracea var. *asema*		11^{+-3}	s	S

Tab. 7 cont.

Period of investigations	1960–1962	1994–1996	Substrate	Ecol. group
Number of observations	26	36		
Collybia cirrhata		1^{2}	s	S
Collybia cookei		1^{2}	s	S
Collybia fusipes		1^{1}	d	P
Collybia marasmioides		6^{1-3}	d	S
Conocybe rickeniana		1^{2}	z	S
Conocybe tenera		4^{+-2}	z	S
Coprinus domesticus		1^{2}	z	S
Coprinus micaceus		1^{1}	d	S
Crepidotus variabilis		14^{1-3}	z	S
Cystoderma carcharias		3^{1-3}	d	S
Entoloma asprellum		2^{+-1}	d	S
Entoloma rhodocylix		1^{1}	z	S
Fistulina hepatica		9^{+-1}	d	P
Flammulaster granulosus		1^{1}	d	S
Galerina hypnorum		1^{2}	d	S
Hymenochaete rubiginosa		26^{4}	d	S
Hypholoma sublateritium		1^{2}	d	S
Lactarius decipiens		1^{+}	z	M
Lepista flaccida		9^{+-2}	s	S
Lepista gilva		1^{1}	s	S
Lepista nuda		3^{+-1}	z	S
Macrolepiota rhacodes		12^{+-2}	z	S
Marasmiellus ramealis		1^{2}	d	S
Marasmius cohaerens		1^{1}	s	S
Marasmius splachnoides		4^{1-2}	s	S
Marasmius torquescens		2^{1}	s	S
Marasmius wynnei		1^{+}	s	S
Mycena chlorinella		2^{+-1}	d	S
Mycena erubescens		10^{+-4}	d	S
Mycena galopus var. *nigra*		3^{1-4}	d	S
Mycena inclinata		13^{1-4}	d	S
Mycena pelianthina		1^{1}	s	S
Mycena sanguinolenta		6^{+-2}	d	S
Mycena tintinnabulum		1^{2}	d	S
Panaeolia foenisecii		1^{1}	s	S
Pluteus nanus		1^{+}	d	S
Pluteus phlebophorus		2^{1}	d	S
Psathyrella fusca		3^{+-2}	s	S
Psathyrella gyroflexa		1^{2}	s	S
Psathyrella murcida		2^{+-1}	s	S
Psathyrella nolitangere		1^{1}	s	S
Psathyrella obtusata		6^{+-2}	s	S
Psathyrella spadiceo-grisea		1^{1}	s	S
Schizophyllum commune		1^{1}	d	S
Xylaria longipes		29^{2-4}	d	S

Explanations:
Substrate: z – soil, s – litter, d – wood
Ecological group: M – mycorrhizal, S – saprotrophic, P – parasites

Table 8

Changes in the macromycetes after 30 years on the permanent plot (400 m^2) in *Galio-Carpinetum corydaletosum*

Period of investigations	1960–1962	1994–1996	Substrate	Ecol. group
Number of observations	26	36		
Agaricus minimus	1^1		z	S
Agaricus silvicola	4^+		z	S
Amanita phalloides	2^{+-1}		z	M
Calocybe gambosa (=*Calocybe georgii*)	3^{1-2}		z	S
Collybia confluens	1^2		s	S
Clitocybe cerussata	1^2		z	S
Conocybe subovalis (=*Galera tenera* f. *tenera*)	2^+		z	S
Cortinarius decipiens (=*Hydrocybe decipiens*)	1^2		z	M
Exidia glandulosa	2^1		d	S
Flammulina velutipes	2^2		d	S
Galera tenera f. *minor*	1^+		z	S
Geopyxis carbonaria	1^1		z	S
Hebeloma longicaudum	1^+		z	M
Hygrophorus cassus	1^1		z	M
Inocybe asterospora	1^+		z	M
Inocybe fastigiata	1^+		z	M
Laccaria amethystina	1^1		z	M
Lactarius subdulcis	1^+		z	M
Lactarius vellereus	1^1		z	M
Leccinum duriusculum	1^+		z	M
Lentinus adhaerens	1^+		d	S
Limacella guttata (=*Limacella lenticularis*)	3^{1-2}		z	S
Macrolepiota procera	1^1		z	S
Mycena chlorinella	1^1		z	S
Mycena polygramma f. *ambiqua*	1^1		s	S
Mycena polygramma f. *polygramma*	2^1		d	S
Oudemansiella badia	1^+		d	S
Peziza vesiculosa (=*Pustularia vesiculosa*)	1^+		z	S
Russula adusta	1^+		z	M
Russula densiflora	1^+		z	M
Russula fellea	1^+		z	M
Russula lutea	1^+		z	M
Rusula nigricans	3^{1-2}		z	M
Sclerotina tuberosa	1^1		z	P
Tricholoma album	7^{+-2}		z	M
Tricholoma sulphureum	1^1		z	M
Xerocomus subtomentosus	1^1		z	M
Clitocybe langei	1^1	3^{+-1}	z,s	S
Collybia butyracea var. *asema*	1^1	7^{+-3}	s	S
Collybia dryophila	3^{+-1}	10^{+-2}	s	S
Entoloma junicinum (=*Rhodophyllus junceus*)	1^1	1^1	z	S
Humaria hemisphaerica (=*Lachnea hemisphaerica*)	1^2	1^1	z	S

Tab. 8 cont.

Period of investigations	1960–1962	1994–1996	Substrate	Ecol. group
Number of observations	26	36		
Laccaria laccata	2^{1}	6^{+-2}	z	M
Lactarius quietus	2^{+-2}	8^{+-2}	z	M
Marasmius rotula	1^{2}	5^{1-2}	d	S
Mycena alcalina	2^{+-2}	2^{+}	d	S
Mycena filopes	9^{+-2}	13^{+-2}	s	S
Mycena galericulata	1^{1}	13^{+-4}	d	S
Mycena galopus var. *galopus*	1^{1}	8^{+-2}	z,d	S
Mycena polyadelpha	1^{3}	3^{2-4}	s	S
Mycena pura	1^{+}	1^{+}	z,s	S
Mycena sanguinolenta	1^{+}	2^{+-2}	s,d	S
Mycena vitilis	1^{+}	17^{+-2}	d	S
Psathyrella gracilis	1^{+}	4^{+-2}	z,s	S
Xerula radicata	2^{+-1}	9^{+-2}	d	S
Xylaria hypoxylon (= *Xylosphaera hypoxylon*)	x	x	d	S
Agaricus haemorrhoidarius		1^{+}	z	S
Agrocybe praecox		1^{+}	z	S
Bjerkandera adusta		3^{1-2}	d	S
Ciboria batschiana		1^{1}	s	S
Clitocybe candicans		1^{+}	s	S
Clitocybe gibba		2^{1}	s	S
Clitocybe odora		1^{1}	s	S
Clitocybe vibecina		1^{+}	s	S
Collybia cookei		2^{2}	s	S
Collybia peronata		6^{+-2}	s	S
Conocybe rickeniana		3^{+-2}	z	S
Conocybe tenera		3^{+}	z	S
Coprinus domesticus		4^{+-1}	d	S
Coprinus lagopus		3^{+-1}	z	S
Coprinus leiocephalus		1^{1}	z	S
Coprinus micaceus		1^{2}	d	S
Coprinus picaceus		1^{+}	z	S
Coprinus plicatilis		1^{+}	z	S
Coprinus xanthothrix		1^{1}	z	S
Crepidotus variabilis		9^{1-2}	d	S
Dacryomyces stillatus		1^{+}	d	S
Delicatula cuspidata		1^{+}	s	S
Fistulina hepatica		5^{+-1}	d	P
Flammulaster ferrugineus		1^{1}	z	S
Flammulaster granulosus		1^{1}	d	S
Galerina hypnorum		1^{1}	d	S
Ganoderma lipsiense		32^{+-2}	d	S
Ganoderma lucidum		9^{1}	d	S
Hymenoscyphus fructigenus		8^{2-3}	s	S
Hypholoma fasciculare		9^{1-3}	d	S

Hypholoma sublateritium		12^{1-4}	d	S
Inocybe brunneoatra		2^{+-1}	z	M
Inocybe geophylla var. *geophylla*		3^{+-1}	z	M
Inocybe geophylla var. *lilacina*		2^{+-1}	z	M
Inocybe hirtella		1^{+}	z	M
Inocybe napipes		1^{2}	z	M
Inocybe praetervisa		1^{1}	z	M
Laetiporus sulphureus		1^{+}	d	P
Lepiota cristata		7^{+-1}	z	S
Lycoperdon perlatum		8^{+-2}	z	S
Macrolepiota rhacodes		7^{+-1}	z	S
Marasmiellus ramealis		1^{1}	d	S
Marasmius bulliardii		1^{+}	s	S
Marasmius splachnoides		3^{1-2}	s	S
Melanophyllum echinatum		1^{1}	z	S
Meripilus giganteus		6^{+}	d	S
Mycena acicula		1^{+}	d	S
Mycena cinerella		1^{1}	d	S
Mycena galopus var. *nigra*		2^{1-2}	d	S
Mycena inclinata		2^{2-3}	d	S
Mycena supina		1^{+}	s	S
Panaeolus ater		1^{1}	s	S
Paxillus involutus		6^{+-3}	z	M
Pleurotus pubescens		1^{2}	s	S
Pluteus atricapillus		8^{+-2}	d	S
Pluteus hispidulus		1^{+}	d	S
Pluteus salicinus		2^{1}	d	S
Psathyrella fusca		1^{1}	s	S
Psathyrella gyroflexa		1^{1}	s	S
Psathyrella hydrophila		4^{2-3}	d	S
Psathyrella obtusata		3^{+-2}	s	S
Psathyrella prona		1^{2}	s	S
Psathyrella pseudogracilis		1^{+}	s	S
Psathyrella vernalis		1^{2}	s	S
Psilocybe inquilina		1^{+}	d	S
Russula pectinata		2^{1-2}	z	M
Schizopora paradoxa		29^{+-2}	d	S
Stereum hirsutum		1^{2}	d	S
Stropharia aeruginosa		1^{1}	z	S
Tricholoma lascivum		3^{1}	z	M
Tubaria furfuracea		5^{+-2}	s	S
Tubaria hiemalis		1^{+}	s	S
Tubaria pellucida		1^{1}	s	S
Xerula longipes		6^{+-2}	d	S
Xylaria longipes		11^{1-2}	d	S

Explanations:
Substrate: z – soil, s – litter, d – wood
Ecological group: M – mycorrhizal, S – saprotrophic, P – parasites

37 (28%), 19 (15%) and 75 (57%) (Tab. 8). Proportion of species recorded exclusively 30 years ago is similar in both subassociations, but the group of species common for both periods of study is twice as numerous on the plot in *G.-C. typicum* in comparison with the plot in *G.-C. corydaletosum* (Fig. 6).

In the group of species found exclusively in the years 1960–1962 terrestrial fungi are prevailing (65.5% in *G.-C. typicum*, 66.1% in *G.-C. corydaletosum*), among them many mycorrhizal fungi.

Majority of species found exclusively in the years 1994–1996 are saprotrophic fungi, proportion of mycorrhizal and parasitic species is minute (Tab. 7 and 8).

Changes in the species composition of fungi after 30 years concern both the numbers of species in ecological groups and the numbers of species inhabiting particular substrate (Fig. 4). Analysis of the proportion of fungi living on different substrates in the investigated subassociations of oak-hornbeam forest reveals ca 50% decrease in terrestrial species in favour of litter decomposers and lignicolous fungi. In this regard the number of saprotrophic species has increased and the proportion of mycorrhizal fungi has decreased, especially in *G.-C. corydaletosum* (24% reduction) (Fig. 4). The probable reason of this phenomenon is a change of habitat conditions which are no longer favourable for terrestrial fungi.

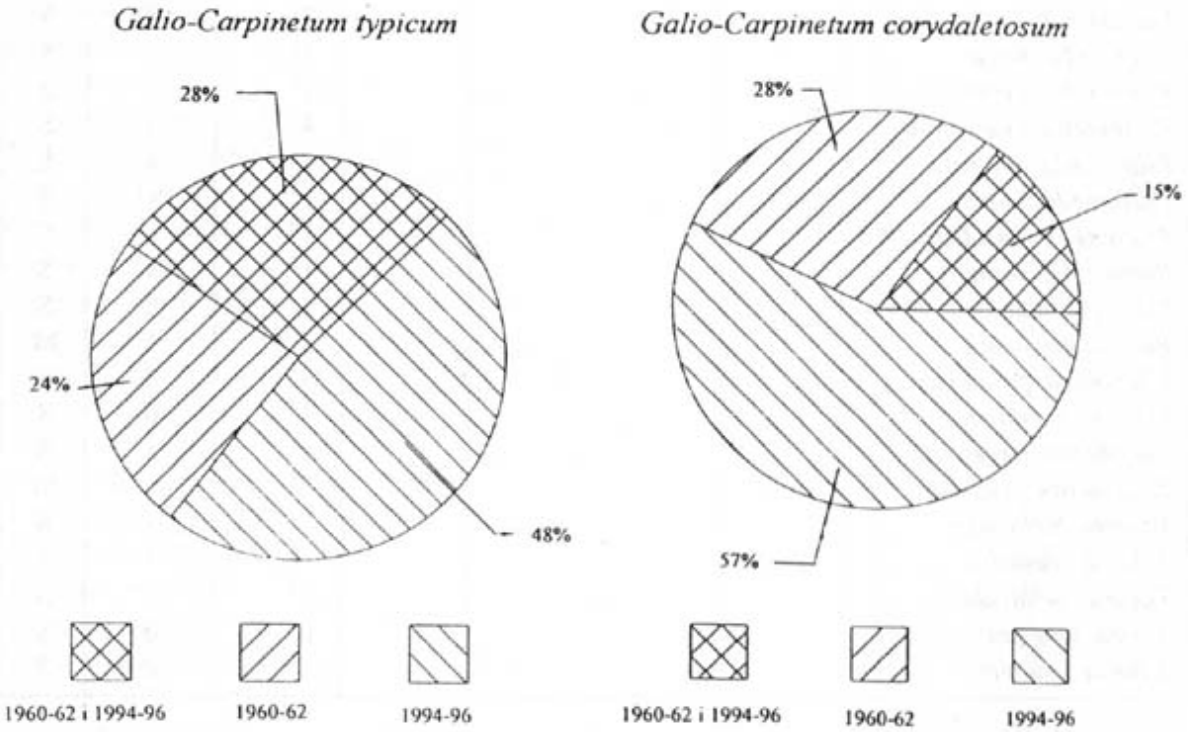

Fig. 6. Proportion of macromycetes (in %) on the plots in two investigation periods

Some of the species found on investigated plots have changed the plant community, e.g. *Clitocybe cerussata*, *Mycena chlorinella*, *Lycoperdon perlatum*, *Ganoderma lipsiense*. 13 species have spread to the second subassociation and only 8 have withdrawn from one of the formerly occupied subassociation.

The analysis of the Steinhaus index reveals that the investigated plots are more similar nowadays in terms of their mycoflora than 30 years ago. The index has increased from 42% to 50%. However, the analysis of species similarity of each separate subassociation in different time periods reveals intermediary similarity of *G.-C. typicum* (44%) but small similarity of *G.-C. corydaletosum* (25%).

SUMMING-UP OF THE RESULTS

1. Monitoring of macromycetes in the phytocoenoses of *Galio-Carpinetum typicum* and *Galio-Carpinetum corydaletosum* in the "Dębina" reserve (the Wielkopolska region) was carried out in the years 1994–1996. A permanent observation plot of 1000 m^2 was set up in both subassociations of the oak-hornbeam forest. The plots were divided into 10 subplots (squares) 10 m × 10 m. 36 observations were performed on each plot.
2. In total 213 taxa were found, mainly *Agaricales* (*Basidiomycetes*). In *G.-C. typicum* 139 taxa and in *G.-C. corydaletosum* – 154 taxa were recorded.
3. Fruiting of two species of fungi protected by law in Poland was ascertained: *Meripilus giganteus* and *Langermannia gigantea*. 18 species from the Red List (W o j e w o d a and Ł a w r y n o w i c z 1992) were also found, among them vulnerable species: *Fistulina hepatica* and *Coprinus picaceus*, rare species: *Ganoderma lucidum* and *Mycena supina*, and endangered species, e.g. *Mycena pelianthina*, *Clitocybe candicans*, *Entoloma asprellum*, *E. juncinum*, *E. rhodocylix* and *Lepiota setulosa*.
4. Classification of species according to the inhabited substrate has been applied. 84 species of terrestrial, 56 of litter decomposing and 73 of lignicolous fungi have been distinguished.
5. Ecological groups of fungi have been also distinguished: 43 species of mycorrhizal, 165 species of saprotrophic and 5 species of parasitic fungi.
6. Mycological observations on the two plots have revealed both quantitative and qualitative differences between the two subassociations of oak-hornbeam forest. In the drier subassociation *G.-C. typicum* fewer species were found than in the fertile and more humid subassociation with *Corydalis cava*, particularly of terrestrial fungi (Fig. 4). The subassociation

of *G.-C. typicum* was characterized by the higher number of litter decomposing species because of the thicker litter layer. The number of lignicolous species on both of the plots was similar. The group of exclusive species could be distinguished on each plot. In *G.-C. corydaletosum* it consisted of 48 species, mainly from the genera *Coprinus*, *Lepiota*, *Cortinarius*, *Inocybe*, *Naucoria*, *Lactarius* and *Russula*. In *G.-C. typicum* exclusive species were less numerous.

7. Monitoring of big, rectangular plots of 1000 m^2, divided into 10 subplots (squares) enabled to determine changes in spatial distribution of mycoflora. Some of the species occurred almost on the all squares of the plot, but most of them displayed low spatial frequency (Tab. 5 and 6). Therefore mycocoenological researches should be carried out on adequately big permanent plots or on several smaller ones in the same plant community.
8. An influence of some ecological factors (e.g. habitat conditions, distributions of temperatures and precipitation) on macrofungi has been investigated. They affect mycoflora as intercorrelated factors.
9. After 30 years changes in species composition of fungi has been observed in the plots of 400 m^2. They include differences in the species numbers in particular ecological groups (mycorrhizal, saprotrophic and parasitic fungi) and in the numbers of species inhabiting particular substrate.

   The number of terrestrial species has diminished in favour of litter decomposing and lignicolous species. Simultaneously, the number of saprotrophic fungi has increased and proportion of mycorrhizal fungi has decreased (Tab. 7 and 8).

   A part of the species have changed the forest subassociation after 30 years. Most of the fungi have spread to the second subassociation, a few have withdrawn from one of the formerly occupied phytocoenon.

   As the Steinhaus index is concerned, an increase in mycological similarity between investigated subassociations can be observed from 0.42 (42%) in the years 1960–1962 to 0.50 (50%) in the years 1994–1996. Similarity of mycoflora of *G.-C. typicum* in both investigated periods is higher (0.51–51%) than that of *G.-C. corydaletosum* (0.29–29%).

   Probable reason of changes in the mycoflora is a process of oak decline in the reserve resulting to a high degree from worsening habitat conditions, mainly decreasing humidity.
10. Creation of clearings nearby the plot II and destroying a part of the plot I in the winter 1996 did not affected the mycoflora of the plots significantly in that year. Changes will be probably noticeable in the next years.

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

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Zmiany w mikoflorze macromycetes grądów rezerwatu „Dębina" (północna Wielkopolska)

Streszczenie

Badania nad zmianami w mikoflorze macromycetes w grądach rezerwatu „Dębina" pod Wągrowcem prowadzono w latach 1994–1996.

W dwóch fitocenozach *Galio-Carpinetum typicum* i *Galio-Carpinetum corydaletosum* wytyczono po jednej stałej powierzchni 1000 m^2, podzielonej na 10 podpowierzchni, celem uchwycenia zmian mikoflory w przestrzeni. Powierzchnie założono w miejscach, w których były prowadzone badania mikosocjologiczne w latach 1960–1962 (Lisiewska 1965). Zanotowano łącznie 213 taksonów grzybów, głównie *Agaricales*, w tym 139 w *G.-C. typicum* i 154 w *G.-C. corydaletosum*.

Dokonano podziału grzybów według podłoża na owocujące na ziemi (84 gatunki), na ściółce (56 gatunków) i na drewnie (73 gatunki), a także sklasyfikowano zanotowane macromycetes do grup ekologicznych: grzybów mikoryzowych (43 gatunki), saprotrofów (165 gatunków) i pasożytów (5 gatunków).

Porównanie uzyskanych wyników badań z obserwacjami mikosocjologicznymi sprzed 30-tu lat wykazało znaczne zmiany jakościowe i ilościowe zarówno wśród grzybów zasiedlających różne podłoża, jak i w ekologicznych grupach macromycetes. Zmiejszyła się liczba gatunków grzybów naziemnych o około 50% na korzyść gatunków naściółkowych i nadrzewnych. Równocześnie zwiększyła się liczba gatunków saprotroficznych (o 24% w *G.-C. corydaletosum*) przy spadku udziału grzybów mikoryzowych, co wiąże się prawdopodobnie z zamieraniem dębów i pogarszaniem się warunków wilgotnościowych na terenie rezerwatu.