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Macrofungi of the *Querco-Ulmetum minoris* association in the Ostrów Panieński reserve on the Vistula river (N Poland)

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Results of a three-year mycocoenological study performed on two permanent plots in floodplain forests near Chełmno on the Vistula river are presented. The 101 species of macrofungi collected in the area are discussed in relation to various substrates and habitats in which they occur.

Key words: mycocoenology, macrofungi, *Querco-Ulmetum*, nature reserve.

INTRODUCTION

Phytocoenoses of elm floodplain forests in large river valleys in Poland have so far been classified as *Fraxino-Ulmetum* or, more recently, as the *Ficario-Ulmetum campestris* association (Oberdorfer 1957; Matuszkiewicz 1976; Matuszkiewicz 1981). According to the phytosociological nomenclature (Weber et al. 2000) and recent works by Matuszkiewicz (2001), the correct name of these forests is *Querco-Ulmetum minoris* Issler 1924.

The study in the Ostrów Panieński reserve was conducted as part of a larger project on the role and contribution of macrofungi on floodplains in Poland and in the world (Bujakiewicz 1973, 1977, 1985/87, 1989, 1991 (1992), 1997).

I wish to thank everyone involved in the field and laboratory studies for their kind help. My special thanks go to the late Professor Teofil Wojterski for drawing my attention to an interesting area of study. Thanks are due to Dr Halina Ratyńska-Nowak and Dr Andrzej Brzeg for phytosociological releves, Prof. Stanisław Bałazy (Poznań), Dr Andrzej Chlebicki (Kraków) and Dr Åke Strid (Stockholm) for the identification or revision of some genera. I am also obliged to Ms Urszula Matuszewska and mgr Dorota Obiegała for their technical assistance during the preparation of the manuscript.

GENERAL PHYSIOGRAPHY

The Ostrów Panieński reserve is located in the Fordon Valley on the right bank of the Vistula river on the floodplain in the Kępa Panieńska (240 ha), ca. 1.5 km south-west of Chełmno (Fig. 1). The plain is bordered by Trynka, a tributary of the Vistula river, on the southern side. It is separated from the main bed of the Vistula river by a dam erected in 1935. The reserve comprises a small part of the Kępa Panieńska island.

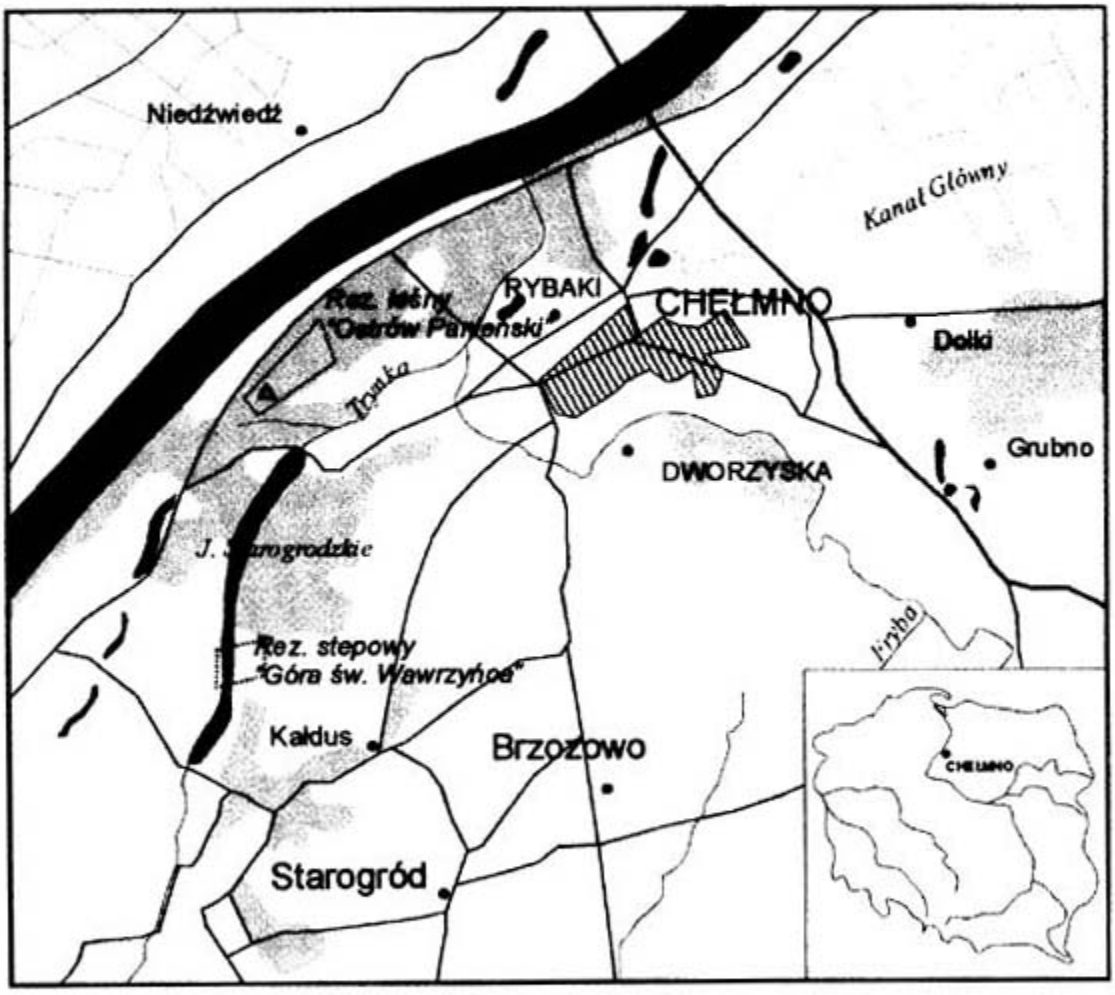

Fig. 1. Location of the study area in the Vistula river basin (scanned by Dorota Obiegała from Tourist Map 1: 100000 Vicinity of Bydgoszcz, PPWK Wrocław 1995). Explanations: 1 – rivers and lakes; 2 – forests; 3 – cities; 4 – roads; 5 – reserves; 6 – permanent observation plots.

The geographical position of the reserve is determined by north 53°21′ latitude and east 18°24′ longitude. The elevation of the land is small, 26.3 m at the most (K ę p c z y ń s k i and W i l k o ń - M i c h a l s k a 1967).

Soils on the island are formed by sandy loams and loamy sands; the dam prevents flooding. According to the classification of Polish climates (W o ś 1999), the area belongs to the Chełmińsko-Toruński region, including the Toruńska Valley and part of the Chełmińskie Lake District. Days with overcast sky, high temperature and without precipitation, and days with overcast sky, high temperature and precipitation are characteristic features of this climate. The vegetation period near Toruń lasts for 214 days and the mean annual precipitation total is 529 mm. The mean annual temperature measured at the nearest meteorological station (Toruń) between 1981 and 1990 is 8.2°C (Ochrona Środ. 1995).

According to the geobotanical division proposed by S z a f e r (1972), the area belongs to the Baltic Division within the Region of Pomorski Południowy Pas Przejściowy, characterised by a great variety of geomorphological formations and vegetation landscapes. In the classification proposed by M a t u s z k i e w i c z (1993), the reserve lies in the Mazowiecko-Poleski Division in the Chełmińsko-Dobrzyńska Section and the Lower Vistula Valley Region. It comprises eastern parts of the Region of Pomorski Południowy Pas Przejściowy in Szafer's classification.

METHODS

Two permanent plots, close to each other, were delimited in May 1981 in the phytocoenoses of the *Querco-Ulmetum minoris* Issler 1924 elm floodplain forest (Fig. 1). Observations were conducted for three years (1981—1984), excluding 1982, usually from May to November. Altogether 20 observations were performed in each plot. The floristic composition of the plots is given in Table 1, while Table 2 presents the species of fungi occurring in the plots according to habitat groups, i.e. the type of substrates they occupy.

The nomenclature was accepted mostly after M o s e r (1983), D e n n i s (1978), J ü l i c h (1984), W a t l i n g (1982), H a n s e n and K n u d s e n (1992, 1997), L i z o ň (1992).

The collection was deposited in the mycological herbarium (POZM) in the Department of Plant Ecology and Environment Protection at the Adam Mickiewicz University, Poznań, Poland.

PHYTOCENOSES OF ELM FLOODPLAIN FORESTS

The Ostrów Panieński reserve is one of the few areas in Poland in which floodplain forests developing on the bottom of large valleys are protected (S o j e c k a - K o z ł o w s k a 1961; C z u b i ń s k i et al. 1977; R a d z i e j o w s k i 1996). Thanks to the efforts of Professor Adam Wodziczko, the first reserve in the area, covering 168 ha, had been established already in 1922, and felling of old stands had been forbidden since 1926. Following World War II, as late as in 1956, only the area of 14.43 ha was partly protected.

Table 1
Querco-Ulmetum minoris in the Ostrów Panieński reserve

Successive number		1		2	
Number of plot		I		II	
Date		1.06.1983*	2.08.2000**	1.06.1983*	2.08.2000**
Density	a1	40	70	40	80
	a2	70	15	60	10
	b	50	60	40	70
Cover	c	90	90	90	75
	d	20	30	20	15
Height of trees in m		–	30	–	30
Average diameter in cm		–	40	–	40
Age of trees (class)		–	VI/VII	–	VII
Area of record		400	400	400	400
Number of species		21	36	20	32
Ch.*D. *Querco-Ulmetum**:					
Quercus robur	a1	3.1	3.1	3.1	2.1
	c	+	+	·	+
**Ulmus laevis*	a1	·	2.1	·	3.4
	a2	2.1	1.1	3.2	1.1
	b	+	+	+	+
**Ulmus minor*	a2	·	·	·	1.2
	b	·	+.2	·	+.2
	c	·	·	·	+
Sambucus nigra	b	+	2.2	3.2	2.2
	c	1.1	+	+	+
Cornus sanguinea	b	·	1.2	·	1.2
	c	·	·	·	+
Aegopodium podagraria		2.3	4.4	1.2	3.3
**Gagea lutea*		·	(+)	·	(+)
Viola odorata		·	+.2	·	·
**Anemone ranunculoides*		(+)	(+)	(+)	(+)
Ch. *Alnion incanae*:					
Padus avium	a2	·	·	·	1.2
	b	+	2.2	·	3.2
	c	·	+	+	1.2
Circaea lutetiana	c	1.1	2.1	1.1	2.2
Festuca gigantea		·	+	·	+.2
Eurhynchium angustirete		·	+.2	·	+.2
Ch. *Fagetalia** and *Querco-Fagetea*:					
**Fraxinus excelsior*	a1	·	1.2	·	2.1
	a2	3.2	2.2	1.1	1.1
	b	2.1	2.1	·	1.2
	c	1.1	1.1	+	1.1
**Acer pseudoplatanus*	a2	·	+	·	·
	b	·	2.1	·	

Acer campestre	a2	·	+	·	1.2
	b	·	+	·	+
	c	+	1.1	+	1.1
Tilia cordata	b	·	1.1	·	·
Ficaria verna	c	(2.2)	(4.4)	(1.2)	(3.4)
Gagea minima		·	(+)	·	(+)
Scrophularia nodosa		·	+	·	+
Adoxa moschatellina		·	+	·	+.2
Paris quadrifolia		·	+	+	+.2
Ch. *Artemisietea** and *Convolvuletalia*:					
Glechoma hederacea		2.2	2.4	2.2	3.3
Rubus caesius		1.2	2.1	+	1.1
**Urtica dioica*		1.1	2.2.	·	·
Galium aparine		3.4	2.1	3.4	2.1
Geum urbanum		+	+	+	+
Impatiens parviflora		1.1	+.2	+	2.2
Lamium maculatum		+	+.2	+	1.2
Chaerophyllum temulum		·	r	·	+
Humulus lupulus		·	·	·	+
Ch. *Rhamno-Prunetea*:					
Euonymus europaea	b	·	·	·	1.2
	c	·	+	·	1.2
Others:					
Phalaris arundinacea		·	+°	·	·
Poa trivialis		·	+°	·	·
Eurhynchium hians	d	2.3	3.4	2.3	2.3
Fissidens taxifolius	d	1.2	+.2	+.2	1.2
Brachythecium rutabulum	d	+.2	+.2	+.2	+.2

Explanations: * – releves made by dr Halina Ratyńska-Nowak; ** – releves made by dr Andrzej Brzeg

T a b l e 2

Macrofungi in phytocenoses of the Querco-Ulmetum minoris in the Ostrów Panieński reserve

Number of observation plot	1	2	THROPHIC GROUP
Years of observations	3	3	
Area of observation plot in sq. m.	400	400	
Number of observations	20	20	
Number of species	61	84	
Total number of species	101		
Ground:			
Conocybe moseri Watling	2r		S
Conocybe arrheni (Fries) Kits van Waveren	1r		S
Conocybe tenera (Schaef.: Fr.) Fayod	1r		S
Inocybe trechispora (Berk.) Karst.	1r		M
Lactarius quietus Fr.	1r		M
Xerocomus rubellus (Krombh.) Mos.	(1r)		M
Entoloma rhodopolium (Fr.: Fr.) Kumm.	1r	1r	M
Agaricus campester (L.) Fr.	1r	1r	S

Conocybe rickeniana P. D. Orton	1^r	1^r	S
Coprinus cortinatus Lange	1^r	1^r	S
Agaricus xanthoderma Gen.	1^r	1^n	S
Hebeloma saccharioleus Quil.	1^r	2^r	M
Laccaria laccata (Scop.: Fr.) Berk. et Br.		4^n	M
Conocybe mairei (Kühn.:) Watling		2^r	S
Lepista sordida (Fr.) Sing.		(1^n)	S
Agaricus arvensis Schaef.: Fr.		1^r	S
Cystolepiota bucknallii (Bk. et Br.) Sacc.		1^r	S
Cystolepiota hetieri (Boud.) Sing.		1^r	S
Melanophyllum echinatum (Roth: Fr.) Sing.		1^r	S
Litter:			
Mycena galopoda (Pers.: Fr.) Kumm.		3^r	S
Rutstroemia firma (Pers.: Fr.) Karst.		2^r	S
Crepidotus haustellaris (Fr.: Fr.) Kumm.		1^r	S
Rutstroemia sydowiana (Rehm) White		1^r	S
Mycena amygdalina (Pers.) Sing.	3^n	1^r	S
Hemimycena delectabilis (Peck) Sing.	1^n	1^r	S
Hymenoscyphus fructigenus (Bull.: Fr.) S.F. Gray	1^s	1^r	S
Crocicreas coronatum (Bull.: Fr.) Carpenter	4^s	1^r	S
Crocicreas cyathoideum (Bull.) Carpenter	6^s	3^n	S
Marasmius setosus (Sow.) Noordel.	5^{r-s}	3^n	S
Marasmius rotula (Scop.: Fr.) Fr.	7^r	6^{r-n}	S
Mycena vitilis (Fr.) Quil.	13^s	12^{r-n}	S
Mycena acicula (Schaef.: Fr.) Kumm.	7^{r-n}	7^{r-n}	S
$^+$*Nectria cinnabarina* (Tode) Fr.	5^{r-s}	5^{n-s}	P/S
Mycenella margaritispora (Lge.) Sing.	1^r	1^r	S
Simocybe rubi (Berk.) Sing.	1^r	1^r	S
Mycena speirea (Fr.: Fr.) Gill.	11^{r-n}	12^{r-n}	S
$^+$*Tubercularia vulgaris* Tode: Fr.	10^s	12^{n-s}	P/S
Mycena stylobates (Pers.: Fr.) Kumm.		4^r	S
Crepidotus subsphaerosporus (Lge.) Khn. et Romagn.		3^r	S
Crepidotus variabilis (Pers.: Fr.) Kumm.		2^r	S
Hymenoscyphus albidus (Roberge) Phill.		1^n	S
Mycena amicta (Fr.) Quil.		1^r	S
Entomogenous fungi:			
Paecilomyces farinosus (Holm. ex S.F. Gray) Brown et Smith		2^r	P
**Tilachlidiopsis nigra* Yakushiji et Kumazawa		2^r	P
**Cordyceps entomorrhiza* (Dicks.: Fr.) Link	1^r	4^{r-n}	P
**Polycephalomyces* sp. 186[1]		1^r	P
Logs, stumps, boughs, etc.:			
Mollisia cinerea (Batsch) P. Karst.		2^r	S
Ascocoryne sarcoides (Jacq.) Grov. et Wilson		1^r	S
Galerina unicolor (Fr.) Sing.		1^r	S
$^\circ$*Skeletocutis nivea* (Jungh.) Keller		1^r	S
Tyromyces stipticus (Pers.: Fr.) Kotl. et Pouzar		(1^r)	S
Xerula pudens (Pers.) Sing.	7^n	1^r	S
Dasyscyphus niveus (Hedw.) Sacc.	11^{n-s}	4^{n-s}	S
Mycena galericulata (Scop.: Fr.) S. F. Gray	4^n	3^n	S
Oudemansiella radicata (Relh.) Sing.	2^r	1^r	S
Coprinus micaceus (Bull.: Fr.) Fr	2^n	2^{r-n}	S
Pluteus cervinus (Schaeff.: Fr.) Kumm.	2^r	2^r	S
Hypholoma fasciculare (Huds.) Kumm.	(1^n)	1^n	P/S

Coprinus domesticus (Bolt.: Fr.) S. F. Gray	1^r	1^r	S
Hypholoma subviride Berk. et Curt.	1^r	(1^n)	S
Hyphoderma sambuci (Pers.: Pers.) J. Erikss.	1^r	1^n	S
Armillaria mellea (Vahl.: Fr.) Kumm. s.l.	(1^r)	(1^a)	S
Hirneola auricula — judae (Bull. ex St.- Am.) Berk.	1^r	2^r	P/S
Marasmiellus ramealis (Bull.: Fr.) Sing.	1^r	2^r	S
Exidia truncata Fr.	1^r	3^{r-n}	S
Pleurotus cornucopiae Paul.: Fr.	(1^n)	7^{n-a}	S
Auricularia mesenterica (Dicks. ex S.F. Gray) Pers.		9^n	S
Polyporus squamous (Pers.: Fr.) Fr.		4^n	S
Daldinia concentrica (Bolt: Grev.) Ces. et de Not.		4^{r-n}	P/S
Hypholoma sublateritium (Fr.) Quil.		3^n	P/S
Flammulina velutipes (Curt.) Sing.		3^r	S
Mycena olida Bres.		3^r	S
Bjerkandera adusta (Willd.: Fr.) P. Karst.		2^r	P/S
Coprinus xanthothrix Romagn.		2^r	S
Hohenbuehelia atrocoerulea (Fr.) Sing.		(2^r)	S
Hypocrea citrina (Pers.: Fr.) Fr.		2^r	S
Pluteus romellii (Britz) Sacc.		2^r	S
°*Steccherinum ochraceum* (Pers.: Fr.) S.F. Gray		2^r	S
Coprinus disseminatus (Pers.: Fr.) S.F. Gray		1^a	S
Dasyscyphus virgineus S.F. Gray		1^a	S
Kuehneromyces mutabilis (Schaef.: Fr.) Sing. et Smith		(1^a)	S
°*Phellinus ferruginosus* (Schrad.: Fr.) Pat.		1^a	S
Ascocoryne cylichnium (Tul.) Korf		1^r	S
Bulgaria inquinans Fr.		(1^r)	S
Flammulaster ferruginea (Mre. ex Khn.) Watl.		1^r	S
Grifola frondosa (Dickson: Fr.) S.F. Gray		(1^r)	P/S
Lyophyllum ulmarium (Bull.) Khn.		(1^r)	S
Pluteus griseopus Orton		1^r	S
°*Radulomyces confluens* (Fr.) Crist.		1^r	S
Schizopora paradoxa (Schrad.) Donk.		1^r	S
Simocybe centunculus (Fr.) Sing.		1^r	S
Daedalea quercina (L.) Fr.	x	x	P/S
+*Diatrypella pulvinata* Nke.	x	x	S
Ganoderma applanatum (Pers.) Pat.	x	x	P/S
Hymenochaete rubiginosa (Dicks.) Liv.	x	x	S
Stereum hirsutum (Willd.: Fr.) S.F. Gray	x	x	P/S
Ustulina deusta (Hoffm.: Fr.) S.F. Gray	x	x	S
Xylaria hypoxylon (L.) Grev.	x	x	S
Xylaria polymorpha (Pers.: Fr.) Grev.	x	x	S
Trametes versicolor (L.: Fr.) Pilat		(x)	P/S
Foot of living trees:			
Mycena erubescens v. Hohnel	1^r	3^r	S

Explanations: 1, 5, 10 — number of records; r (rare), n (numerous), a (abundant) — degree of abundance (Jahn et al. 1967); (1^a) — recorded outside the permanent plot. Trophic groups: M — mycorrhizal; P — parasitic; S — saprotrophic; * — det. Stanisław Bałazy; + — det. Andrzej Chlebicki; o — det. Åke Strid; x — species forming tough fruit-bodies or stromas; ^{1}/ — under elaboration (Bałazy personal comm.)

At present the reserve protects the multispecies elm forest with a considerable contribution of maple (*Acer campestre*) reaching there the eastern limit of its geographical range.

The elm floodplain forest in the Ostrów Panieński reserve grows on the soils of browning valley alluvium with humus of mull type. Owing to the presence of the dam, total floods are rare, while inundations are more frequent. The soil is always moist. The soil profile reveals mainly uniform present-day deposits reaching down to the depth of 2–3 m, and the soil stratification is marked at the depth of 1 m. The process of the valley alluvium formation was inhibited and gave way to the browning process. Silt loams, fine and coarse, prevail and constitute approximately 60% of the soil. The contribution of silt and clay is significant, while coarse-grain sands are deficient. The soil has a crumbly structure and is characterised by good porosity. Precipitation and the lessivage process are the main soil-forming factors at present. Litter decays in 75% in a year (D z i a d o w i e c 1990). The pH of the soil is neutral, the C/N ratio is 9 (–10) and does not undergo significant changes.

The community of *Querco-Ulmetum minoris* is a multispecies and multilayered mesohigrophilous deciduous forest growing in wide valleys on the valley alluvium. The tree stand in the Ostrów Panieński reserve is composed of as many as 16 tree species and 17 shrub species. *Quercus robur, Fraxinus* spp., *Ulmus laevis* and *Populus* spp. dominate in the layer a_1. *Ulmus minor* and *Acer campestre* prevail in the layer a_2. Ash and poplar trees come from afforestations established in the beginning of the 20th century.

The field layer is very rich and differentiated. The occurrence of 141 herbal species was confirmed in the reserve, with a significant contribution of the species characteristic of the *Querco-Ulmetum* elm floodplain forest and the *Alnion incanae* alliance, which is evidenced in the phytosociological releves of the permanent plots (Table 1). The occurrence of representatives of the order *Convolvuletalia* and the class *Artemisietea* is interesting. *Galium aparine, Lamium maculatum, Glechoma hederacea* and *Urtica dioica* are the dominant species in the compact field layer.

Characteristic gaps in the tree stand in the reserve are a result of the death of elm trees brought about by Dutch elm disease. The disease most often attacks *Ulmus minor*.

In autumn 1983, clear evidence of forest protection measures was observed in the tree stands in both permanent plots. These measures, undertaken in response to the gradation of the gypsy moth (*Lymantria dispar* L.), comprised mainly oak trees. As a result, the area occupied by *Galium aparine* was extended, proofs of heavy machinery works were visible on the soil surface and several sites were covered with sawdust. It should also be mentioned that local inhabitants traditionally collect acorns in autumn.

Despite many disturbing factors, such as lowering of the ground water table, Dutch elm disease, forest protection measures, and pollution from the cellulose production plant in Świecie, no significant changes in the vegetation

cover were observed. Furthermore, no signs of changes of the regular oak-hornbeam forest were noticed. A comparison of the phytosociological releves made on the same sites in the elm floodplain forest over a period of 17 years shows that the general condition of the elms has improved (Table 1).

There are many old and new stumps, mostly oak stumps, and a few elm logs. Litter on the forest floor is rather poor and includes mainly shoots of field layer plants and petioles of *Fraxinus* spp.

OCCURRENCE OF MACROFUNGI IN PHYTOCOENOSES OF *QUERCO-ULMETUM*

The elm floodplain forests in the Ostrów Panieński reserve are not exposed to flooding but are only periodically inundated. The soil is fertile, always moist and clammy. First reports on the occurrence of macrofungi in the reserve were published in a paper by B u j a k i e w i c z (1989).

Only fungi developing tough fruit-bodies or stromata on fallen logs or stumps are abundant throughout the year in the elm floodplain forest (Table 2). Terrestrial fungi occurred sporadically, as late as in June, and were represented mainly by saprotrophic species *Conocybe rickeniana* and *Melanophyllum echinatum*, and ectomycorrhizal *Xerocomus rubellus* and *Laccaria laccata*. The earliest mass occurrences of terrestrial fungi were observed in August (*Entoloma rhodopolium* and *Agaricus xanthoderma*). Even in autumn this group was poorly represented. It was interesting to find representatives of the genus *Conocybe*, and species typical of fertile soils rich in basic compounds in particular, e.g. *Conocybe arrheni* and *C. mairei* (W a t l i n g 1982). *Melanophyllum echinatum* is also directly connected to fertile soils. The occurrence of two species of the genus *Cystolepiota*, *C. bucknallii* and *C. hetieri* (B u j a k i e w i c z 1989), both rarely noted in Poland, also deserves special attention. *Cystolepiota bucknallii* is known from the Pieniny Mountains in Poland (G u m i ń s k a 1972) and is also rare in Europe (A r n o l d s et al. 1995; P i l á t 1969; L a n g e 1935–40), whereas *Cystolepiota hetieri* was reported in Poland from the park in Uniejów (L i s i e w s k a and R y b a k 1990). Both species prefer fertile soils (A r n o l d s et al. 1995). According to this author, *Cystolepiota hetieri* is related to the forests from the *Alno-Padion* alliance.

According to O b e r d o r f e r (1957), a characteristic feature of the *Querco-Ulmetum* elm floodplain forest is the occurrence of morels *Morchella* spp. In his opinion, species of the genus *Morchella* are typical of the *Ulmion* alliance. As reported by C a r b i e n e r et. al. (1975), the genus Morchella is represented in the elm floodplain forest growing close to the Rhine river bed and thus often flooded. In Poland, the occurrence of *Morchella esculenta* was recorded in the elm floodplain forest in the Wielka Kępa Ostromecka reserve on the Vistula river (B u j a k i e w i c z 1991/1992), which is flooded a few times a year. In the Ostrów Panieński reserve no species of the genus *Morchella*

were observed, which corroborates the hypothesis of Carbiener et al. (1975).

The fast decay of litter in the forests studied in the Ostrów Panieński reserve is most probably related to the presence of *Mycena, Marasmius, Crocicreas and Crepidotus*. The saprotrophic fungi of the genera *Collybia* and *Clitocybe*, known from mesotrophic deciduous forests, were not found in the reserve forest or occur there sporadically. These observations were confirmed by a study carried out in the elm floodplain forest in the Wielka Kępa Ostromecka reserve (Bujakiewicz 1991/1992).

Forest litter fungi are particularly abundant in autumn (September, October). Particularly interesting is the occurrence of *Mycenella margaritispora*, connected with elm floodplain forests, in Poland noted also in the Białowieża National Park in *Circaeo-Alnetum* phytocenoses (Nespiak 1959) and on Babia Góra in *Caltho-Alnetum* (Bujakiewicz 1979).

In the Ostrów Panieński reserve, the occurrence of 4 species of entomopathogenic fungi was noted, of which *Cordyceps entomorrhiza* was the most abundant one. The fungus develops on larvae, pupae and adult forms of *Coleoptera* of the genus *Carabus* L. The stromata and conidial fruiting of this species were observed mainly in June and August. According to Bałazy (1982/1986), the fungus occurs in Poland in dispersed localities and is connected with fertile habitats (Bujakiewicz 1989). It is a species characteristic of floodplain forests (Luschka 1997), which are not flooded (Bałazy, personal communication).

An important habitat group in the elm floodplain forest, comprising 54 species, is that of the fungi decaying fallen logs, stumps and branches. The majority of them are saprotrophic. A species characteristic of elm floodplain forests is *Pleurotus cornucopiae* growing on logs of elm trees attacked by Dutch elm disease, caused by an ascomycetous fungus, *Ceratostomella ulmi* (Schw.) Buism. *Plerotus cornucopiae* promotes the formation of specific mycocoenoses known as *Pleurotetum cornucopiae*, comprising a few species of fungi, described by German authors (Kreisel and Müller 1987). Insufficient data makes it impossible to draw definite conclusions on the presence of the *Pleurotetum cornucopiae* mycocoenosis in the Ostrów Panieński reserve. Other fungal species the occurrence of which is related to the timber of elm trees are *Hirneola auricula-judae*, also observed on *Sambucus nigra*, and *Lyophyllum ulmarium*, a constant element of elm floodplain forests (Carbiener 1981).

Oak (*Quercus robur*) is a natural component of the tree stand in the Ostrów Panieński reserve, unlike the forest in the Wielka Kępa Ostromecka reserve. Its presence entails the occurrence of a fairly abundant group of fungi related to this tree and its litter, such as, for instance *Xylaria polymorpha* (Fig. 2), *Xerula pudens* (Fig. 3), *Grifola frondosa, Dasyscyphus niveus, Diatrypella pulvinata* and *Marasmius setosus*.

An important component of the elm floodplain forest is *Auricularia mesenterica*, a species fairly rare in Poland, recorded mostly in natural

Fig. 2. *Xylaria polymorpha* occurs abundantly on stumps of *Quercus robur* in autumn (Phot. Anna Bujakiewicz, October 1984).

Fig. 3. *Xerula pudens* forms numerous fruit-bodies on oak stumps (Phot. Anna Bujakiewicz, October 1984).

floodplain forests and secondary communities, or parks and gardens (W o j e w o d a 1977; L u s c h k a 1997; K r i e g l s t e i n e r 2000). It is a weak parasite and saprobiont of deciduous trees, mainly *Fraxinus, Populus, Quercus* and *Tilia*. It had already been reported from the Ostrów Panieński reserve (B u j a k i e w i c z 1989).

Stromata of *Daldina concentrica* occurred fairly abundantly on fallen branches, mostly of ash trees (*Fraxinus* spp.). Darkened petioles of ash tree leaves on the forest floor were covered with fine fruit-bodies of *Hymenoscyphus albidus*.

A comparison of the species composition and habitat groups of the fungi found in the phytocoenoses of elm floodplain forests in the reserves of Wielka Kępa Ostromecka and Ostrów Panieński shows (Table 3) significant differences between the areas, set apart by 25 km (in a straight line) only and similar in terms of habitat conditions. The absence of floods, which bring in new organic matter, rich in nutrients, and form new substrates for fungi in the Ostrów Panieński reserve is the main reason for the differences. Therefore, environmental conditions in this reserve are more stable, the amount of rotting timber smaller, and the composition of fungal species poorer. In particular, the number of hygrophyte fungal species, e.g. those of the genus *Pluteus*, is lower and ecological ranges of fungi related to the type of substrate are more distinct. Differences in the composition of fungal species are also connected with the presence of oak trees (*Quercus robur*) in the Ostrów Panieński reserve and their absence in the Wielka Kępa Ostromecka reserve. The ratio of habitat groups in the two areas is very similar, but the low percent of the species that both areas have in common testifies to significant differences. There are only 4 common terrestrial species (2%), including only 2 ectomycorrhizal ones, *Laccaria laccata* and *Xerocomus rubellus*. According to L u s c h k a (1997), *Xerocomus rubellus* is the only ectomycorrhizal species directly related to floodplain forests. In the group of litter-inhabiting fungi, there are 8 (4%) common species, whereas in the group of lignicolous fungi the total number of common species is 23 (12%). Thus, the reserves have only 35 (19%) of the 178 species recorded in both on them in common. The occurrence of *Hemimycena delectabilis, Hohenbuehelia atrocoerulea, Lyophyllum ulmarium* and *Hirneola auricula – judae* should also be mentioned in this group.

According to literature (L u b e l s k a 1954, after C a s p a r y 1886), the presence of *Tuber aestivum* Vitt. has been reported from the area of the Kępa Panieńska island. The occurrence of truffles (called *Tuber mesentericum* Vitt.) was also mentioned by K ę p c z y ń s k i and W i l k o ń - M i c h a l s k a (1967). In view of the lack of the herbarial evidence, however, the site of the truffle has not been confirmed (Ł a w r y n o w i c z 1988), and seems highly unlikely in the light of new data (Ł a w r y n o w i c z, personal communication), although the data from central Germany confirm the possibility of the occurrence of hypogeous fungi in floodplain forests (L u s c h k a 1997).

RESULTS AND CONCLUSIONS

The total number of macromycetes species observed throughout the 3 years of mycocoenological study in the phytocoenoses of the *Querco-Ulmetum minoris* elm floodplain forests in the Ostrów Panieński reserve is 101. It includes species very rare in Poland, such as *Cystolepiota bucknallii, C. hetieri, Auricularia mesenterica, Mycenella margaritispora, Cordyceps entomorrhiza* and *Ascocoryne cylichnium.*

Possibly the absence of annual floods is the factor restricting the macromycetes species range as well as the abundance of fruit-bodies, even though the period possibly favourable for the development of fruit-bodies is extended (Table 3).

Table 3

Comparison of trophic and ecological groups of macrofungi occurring in the Wielka Kępa Ostromecka reserve (WKO) and the Ostrów Panieński reserve (OP) on Vistula river

Name of reserve	WKO		OP	
Phytosociological unit	*Querco-Ulmetum minoris*			
Habitat conditions	Yearly flooding		No flooding	
Type of soil	Alluvial soil		Alluvial soil with browning process	
Period of investigations in years	3		3	
Number of permanent plots	2		2	
Area of each plot	400		400	
Number of observations	16		20	
Number of species	141		101	
Number and percent of species on ground	29	(25%)	19	(18%)
Ectomycorrhizal	7		6	
Number and percent of species on litter	29	(25%)	23	(22%)
Number and percent of species on wood	70	(50%)	54	(53%)
Total number of species	178			
Number of species in common	35 (19%)			
Number of species in common on ground	4 (2%)			
Number of species in common on litter	8 (4%)			
Number of species in common on wood	23 (12%)			

The richest habitat group is that of saprotrophic fungi (over 70%), including mainly lignicolous species. The contribution of ectomycorrhizal species is small and the group of parasites comprises a few innoxious species. Dutch elm disease, responsible for mass deaths of elm trees, seems to be the most dangerous one.

As the reserve is freely accessible and the forests show significant marks of penetration, e.g. cattle grazing and meadow mowing, the contribution of non-forest fungi is quite small (*Conocybe moseri, C. rickeniana, C. tenera*). No coprophilous fungi were found, and meadow fungal species are represented only by *Agaricus campestris*.

The occurrence of some representatives of nitrophilous saprotrophic fungi, including those of the genera *Conocybe, Cystolepiota* and *Melanophyllum*, typical of the *Querco-Ulmetum* in the valley of the river Rhine (C a r b i e n e r et. al. 1975) was confirmed in the Ostrów Panieński reserve. Similarly to the floodplain forests in the river Rhine valley, the number of ectomycorrhizal species in the area studied is very small. *Quercus robur*, usually rich in symbiotic species, seems to change its ectotrophic character in the elm floodplain forest. Of the 6 ectomycorrhizal species, only *Lactarius quietus* is a definite symbiont of the oak tree. Other species, such as *Laccaria laccata, Hebeloma sacchariolens* and *Inocybe trechispora*, represent the group of fungi related to the early stage of afforestation, and their presence can even indicate some disturbances in the environment (L u s c h k a 1997).

Mainly lignicolous species, including *Hirneola auricula-judae, Auricularia mesenterica, Lyophyllum ulmarium* and *Pleurotus cornucopiae* (Table 2), represented the group of fungi characteristic and differential to the *Querco-Ulmetum* association (C a r b i e n e r 1981). *Lepista sordida* was the only representative of terrestrial fungi in this group.

Fungus species from the red list of threatened macrofungi in Poland (W o j e w o d a and Ł a w r y n o w i c z 1992) occurring in the area studied include *Mycenella margaritispora* (E), *Grifola frondosa* (V), *Pleurotus cornucopiae* (V), *Xerula pudens* (V), *Auricularia mesenterica* (R), *Lyophyllum ulmarium* (R), *Melanophyllum echinatum* (R), *Phellinus ferruginosus* (R), *Agaricus xanthoderma* (I) and *Mycena olida* (I).

The results of the study in the Ostrów Panieński reserve confirm a characteristic species composition of the fungi occurring in elm floodplain forests and provide evidence on their distribution and ecological requirements.

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Makromycetes zespołu *Querco-Ulmetum minoris* rezerwatu Ostrów Panieński nad Wisłą

Streszczenie

Praca zawiera wyniki trzyletnich badań mikocenologicznych przeprowadzonych w lasach zalewowych koło Chełmna nad Wisłą. Łącznie 101 gatunków grzybów zanotowano i przeanalizowano na tle różnych grup troficzno-siedliskowych.