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Dedicated to Professor Alina Skirgiełło on the occasion of her ninety fifth birthday

Studies on phytopathogenic and saprotrophic fungi in rush associations of Lake Glinno (NW Poland)

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During the vegetation seasons in years 2004 2005 the health state of rush plant species from *Phragmition* and *Magnocaricion* alliances around the Lake Glinno was investigated. From 13 plant species with disease symptoms 94 species of fungi and FLO were isolated. The highest mycological biodiversity was stated in *Phragmitetum australis* (24 species) and *Thelypteridi Phragmitetum* (27 species) plant associations. The host species in which the biggest number of fungi and FLO species was observed were: *Phragmites australis* (37 species) and *Carex acutiformis* (25 species). The highest mycological similarity based on the Jaccard Sörensen coefficient occurred between *Caricetum acutiformis* and *Glycerietum maximae* plant associations (50%) whereas the lowest value of the coefficient represented *Glycerietum maximae* and *Phalaridetum arundinaceae* associations (7%).

Key words: rush associations; saprotrophic and phytopathogenic fungi

INTRODUCTION

Rush vegetation represents a common object of both phytosociological (Tomaszewicz 1978; Kreft, Truchan 1996; Wołejko 2000; Bosiacka, Radziszewicz 2002) or ecological (Szczepański 1978; Marks, Randall 1994; Boszke et al. 2005) studies in Poland. Sporadic reports, on the other hand, focus on phytosanitary condition of these plants or deal with fungus-like organisms (FLO) or fungi that accompany rush associations and affect their health during their growth. The literature on this subject concern primarily *Phragmites australis* (Durska 1970; Mułenko 1989; Adamska, Błaszkowski 2000; Mazurkiewicz-Zapałowicz et al. 2005). Microscopic fungi phytopathogenic to other plants that are characteristic or distinctive for rush associations have been studied at the Łęczna-Włodawa Lake District (Mułenko 1989). To date, the fungal biodiversity

related to diversification of large-area *Phragmitetea*-class rush phytocenoses has not been described in Poland. Hence, these studies were undertaken in order to learn the distribution of both phytopathogenic and saprotrophic fungi and FLO accompanying the growth of plants in various rush communities located around Lake Glinno. These are the first studies aimed at characterization of the condition of rush associations in the region of Western Pomerania, Poland.

MATERIAL AND METHODS

The studies were carried out during the vegetation seasons of 2004 and 2005. The material was collected four times a year on five sites located along the bank of Lake Glinno, where typical patches of rush vegetation had formed, represented by *Phragmitetea* r.tx. et prsg 1942 class and *Phragmitetalia* Koch 1926 order with two alliances, *Phragmition* and *Magnocaricion*. The *Phragmition* alliance reed beds are characterised by poor floristic composition and a wide ecological amplitude of the species comprising such phytocenoses. These are found mainly on the banks of eutrophic bodies of still or sluggish water within the transition zone between the communities of *Potametea* class floating hydrophytes and the large sedges of the *Magnocaricion* association. On the other hand, either natural or anthropogenic communities of bog vegetation and large sedges classified within the *Magnocaricion* alliance inhabit slightly more elevated riparian zones that, compared to reed beds, are flooded less frequently and, if so, remain submerged for shorter periods of time (Matuszkiewicz 2001).

In *Phragmition* alliance were distinguished 3 plant associations: *Eleocharitetum palustris* Sennikov 1919, *Phragmitetum australis* Gams 1927 Schmale 1939 and *Glycerietum maximae* Hueck 1931 as well as four ones from *Magnocaricion* alliance: *Caricetum acutiformis* Sauer 1937, *Phalaridetum arundinaceae* (Koch 1926) Lib.1931, *Thelypteridi–Phragmitetum* Kuiper 1957 and *Caricetum ripariae* Soo 1928. The associations were distinguished by means of 9 phytosociological relevés applying the Braun-Blanquet method (Szafer, Zarzycki 1977), whereas the taxonomy of the identified plant communities is followed by Matuszkiewicz (2001).

In each association, we looked for plants exhibiting pathological changes. Such symptoms were found in 13 species: *Carex acutifomis* Ehrh., *C. pseudocyperus* L., *C. riparia* Curtis, *Eleocharis palustris* (L.) Roem. & Schult., *Eupatorium cannabinum* L., *Glyceria maxima* (Hartm.) Holmb., *Iris pseudoacorus* L., *Phalaris arundinacea* L., *Phragmites australis* (Cav.) Trin. ex Steud., *Polygonum amphibium* L. f. *natans* Moench, *Scirpus* (*Schoenoplectus*) *lacustris* L., *Sparganium erectum* L.em. Rchb., and *Typha latifolia* L. Additionally, in the patches of the analysed plant associations, submerged dead plant fragments (see Tab. 1 - SDPF) were collected, which were treated jointly, without species distinction, due to identification difficulties. The material in the form of the plants and their dead fragments were subjected to further analysis in the laboratory. Isolation and identification of the phytopathogenic and saprotrophic fungi from tissues of the collected plants was carried out twice. First, immediately after their collection, the plant fragments were incubated in sterile and humid chambers; thereafter, the microorganisms were inoculated onto PDA and CDA media, according to the methods by Kiràly et al. (1977). Supplementary observations and isolations were also carried out within two to four months using

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List of fungus like organisms (FLO) and fungi observed on 13 plant species within rush plant associations around the Lake Glinno

	Fungi species	Occurrence within plant associations							Number of hosts
		C A	*C R*	*E P*	*G M*	*P A*	*PH AR*	*T P*	
1.	*Acremoniella atra* (Corda) Sacc.					*PA*			1
2.	*Acremonium alternatum* Link	*PA;TL*							2
3.	*Acremonium* sp.		*GM*					*IP*	2
4.	*Acrospermum graminum* Lib.	*CA*						*PA*	2
5.	*Alternaria alternata* (Fr.) Keissler	*CA; CP;PA PAR TL*	*CR; GM*	*EP*	*CA;EC*	*PA*	*PAR EC; IP; SE*	*PA;IP CP*	11
6.	*Aplanes androgynus* (Archer) Humphrey	*CA*							1
7.	*Arthrinium phaeospermum* (Corda)M.B.Ellis					*PA*			1
8.	*Arthrinium sporophleum* Kunze	*CA*							1
9.	*Arthrobotrys conoides* Drechsler						*IP*		1
10.	*Botryotrichum piluliferum* Sacc. Marchal							*PA*	1
11.	*Cephalosporium* sp.	*PA*	*IP*	*EP*		*PA*		*PA*	3
12.	*Chaetomium globosum* Kunze	*CA*							1
13.	*Chaetomium* sp.							*IP*	1
14.	*Cladochytrium tenue* Nowakowski		*GM*						1
15.	*Cladosporium cladosporioides* (Fresen.) de Vries	*PA;TL CA*	*IP*		*EC*			*PA;IP*	5
16.	*Cladosporium herbarum* Pers.Link	*PA*	*GM*		*EC*	*PA*		*IP;PA*	4
17.	*Clavariopsis aquatica* de Wild. Thornton							*IP*	1
18.	*Claviceps microcephala* (Wallr.) Tul.							*PA*	1
19.	*Colletotrichum dematium* (Per.) Grove							*IP*	1
20.	*Colletotrichum typhae* HC Greene	*TL*							1
21.	*Cordella clarkii* HB Ellis						*CA*		1
22.	*Dactylella arnardii* Yadar						*IP*		1
23.	*Dactylella iridis* (T.Wotanabe)Ke Q. Zhang							*IP*	1
24.	*Dasyscyphus controversus* (Cooke) Rehm	*TL*						*PA*	2
25.	*Deightoniella arundinacea* (Corda) Hughes	*PA*							1
26.	*Doratomyces stemonitis* (Pers.) Morton&Smith	*PA*				*PA*	*PAR*	*IP;PA*	3
27.	*Epicoccum nigrum* Link	*CA*			*SL*				2

T a b l e 1 cont.

28.	*Fusarium avenaceum* (Fr.) Sacc.		*CR*						1
29.	*Fusarium aquaeductuum* (Radlk.et Rabenh.)Lagerd.			*EP*					1
30.	*Fusarium coeruleum* Lib. ex Sacc.	*TL*							1
31.	*Fusarium culmorum* (W.G. Smith) Sacc.			*EP*					1
32.	*Fusarium equiseti* (Corda) Sacc.							*PA*	1
33.	*Fusarium ? merismoides* Corda	*CA*							1
34.	*Fusarium oxysporum* Schlecht.	*CA*	*GM; CA*	*EP*				*IP*	4
35.	*Fusarium poae* (Peck) Bilaj					*PA*			1
36.	*Fusarium sambucinum* Fuckel			*EP*		*PA*	*CA*		3
37.	*Fusarium sulphureum* Schlecht.					*PA*			1
38.	*Geotrichum candidum* Link.					*PA*			1
39.	*Gliocladium roseum* Bainer						*CA*		1
40.	*Graphium putredinis* (Corda) Hughes	*CP*	*IP*				*SE*		3
41.	*Harposporium* sp.							*CA*	1
42.	*Hendersonia culmiseda* Sacc.					*PA*			1
43.	*Hymenoscyphus herbarum* (Pers. ex Fr.) Dennis							*SDPF*	1
44.	*Lentinus tigrinus* (Bull.Fr.)							*SDPF*	
45.	*Leptosphaeria caricis* Schrot.						*CA*		1
46.	*Leptosphaeria culmifraga* (Fr.) Ces & de Not					*PA*			1
47.	*Leptosphaeria eustoma* (Fuckel) Sacc.					*PA*			1
48.	*Leptosphaeria fuckelii* Niessel ex Voss					*PA*			1
49.	*Marasmius rotula* (Scop.) Fr.							*SDPF*	1
50.	*Mollisia caricina* Fautr.	*CP*							1
51.	*Monodictys levis* (Wiltshire) S.Hughes	*TL*							1
52.	*Monoblepharis ? macrandra* (Lagerheim) Woronin	*CA*			*CA*				1
53.	*Morenoina phragmitis* J.P.Ellis					*PA*		*PA*	1
54.	*Mucor plumbeus* Bonorden							*PA*	1
55.	*Nectriella dacrymycella* (Nyl.) Rehm						*IP*		1
56.	*Neottiospora caricina* Desm.Höhn.		*CR*						1
57.	*Oedocephalum* sp.					*PA*			1
58.	*Papulospora byssina* Hudson					*PA*			1
59.	*Papulospora sepedonioides* Preuss.							*CP*	1
60.	*Papulospora* sp.	*CA*							1
61.	*Periconia atra* Corda	*CA*			*CA*				1
62.	*Periconia byssoides* Pers.							*IP*	1

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63.	*Periconia cookie* Mason & M.B.Ellis					*PA*			1
64.	*Periconia hispidula* (Pers.) E.W.Mason.&E.B.Ellis	*CA*			*CA*				1
65.	*Periconia minutissima* (Corda)	*CA; PA*			*CA*			*IP*	3
66.	*Phoma arundinacea* Berk. Sacc.							*PA*	1
67.	*Phoma caricicola* Bruner		*CR*						1
68.	*Phoma herbarum* Westend							*PA*	1
69.	*Phoma pseudoacori* Brun.		*IP*					*IP*	1
70.	*Phomatospora berkeleyi* Sacc.					*PA*			1
71.	*Phyllosticta caricis* (Fckl.) Sacc.	*CA*			*CA*				1
72.	*Physoderma gerhardti* Schröter		*GM*						1
73.	*Psathyrella typhae* (Kalchbr.) Pears & Dennis	*TL*							1
74.	*Pseudocecosporella herpotrichoides* (Fron) Deighton	*CA*			*CA*				1
75.	*Puccinia caricina* DC.		*CR*						1
76.	*Puccinia coronata* Corda		*GM*						
77.	*Puccinia dioicae* Magn.						*CA*		1
78.	*Puccinia magnusiana* Korn.	*PA*				*PA*		*PA*	1
79.	*Puccinia phragmitis* (Schum.) Korn.	*PA*				*PA*		*PA*	1
80.	*Puccinia polygonii amphibii* Pers.						*PAM*		1
81.	*Pyrenochaeta* sp. de Nortis		*GM*						1
82.	*Pythium debaryanum* Hesje							*PA*	1
83.	*Rotula graminis* (Desm.) Crane& Schoknecht.	*CA; PA*	*CR*	*CA*		*PA*		*PA*	3
84.	*Scirrhia rimosa* (Alb. & Schw.) Nitschke ex Fuckel	*PA*						*PA*	1
85.	*Sclerotinia sulcata* Whetzel		*CR*						1
86.	*Septoria caricis* Pass.							*CP*	1
87.	*Staganospora sacchari* Lo et Ling.	*TL*							1
88.	*Torula herbarum* (Pers.) Link							*IP*	1
89.	*Trichaegum* (Corda) *nodulosum*							*CP*	1
90.	*Ulocladium botrytis* Preuss	*CA*			*CA*				1
91.	*Ulocladium chartarum* (Preuss) Simmons	*CP*						*TL*	2
92.	*Ustilago Davissi* Liro		*GM*						1
93.	*Ustilago grandis* Fr.							*PA*	1
94.	*Verticillium albo atrum* Reinke&Berth.	*CA*			*CA*				1

Explanations: *CA Carex acutiformis*; *CP Carex pseudocyperus*; *CR Carex riparia*; *EP Eleocharis palustris*; *EC Eupatorium cannabinum*; *GM Glyceria maxima*; *IP Iris pseudocyperus*; *PAR Phalaris arundinacea*; *PA Phragmites australis*; *PAM Polygonum amphibium*; *SL Scirpus (=Schoenoplectus) lacustris*; *SE Sparganium erectum*; *TL Typha latifolia*; *SDPF* submerged dead plant fragments

C A Caricetum acutiformis; *C R Caricetum ripariae*; *E P Elocharietum palustris*; *G M Glyceri etum maximae; P A Phragmitetum australis*; *PH AR Phalaridetum arundinaceae*; *T P Thelypteridi Phragmitetum*.

dry material. On both dates, an antibiotic-supplemented medium was used for the first isolation. In the next passages, in order to obtain pure, single-spore cultures, the antibiotic was not used. For taxonomic identification of the fungal isolates, the traits described in the following keys were applied: Barron (1972), Booth (1971), Borowska (1986), Ellis and Ellis (1985), Kochman and Majewski (1973), Kwaśna et al. (1991), and Majewski (1979). Nomenclature of macromycetes was given according to Wojewoda (2003).

In order to determine the similarity of species composition of the fungi found in the analysed rush phytocenoses, the Jaccard similarity coefficient modified by Sörensen (Trojan 1978) was applied:

$$S_o \quad 100 \frac{2c}{a+b}$$

where:
c – number of species common to two associations,
a – number of species in the first association,
b – number of species in the second association.

RESULTS AND DISCUSSION

The results obtained in this study are an introductory, first in Poland attempt to evaluate the diversity of rush associations in relation to saprotrophic and phytopathogenic fungi that inhabit the plants. On 13 plant species and plant dead fragments, in all the rush associations, 94 taxa of fungi and fungus-like organisms (FLO) were found (Tab. 1). Among the so far identified isolates, the Fungi kingdom species were dominant (97.87% of species), while FLO were sporadic, with 2.12% of those belonging to Oomycota (Fig. 1). The highest fungal diversity was found in the *Thelypteridi-Phragmitetum* and *Caricetum acutiformis* rush associations, where respectively

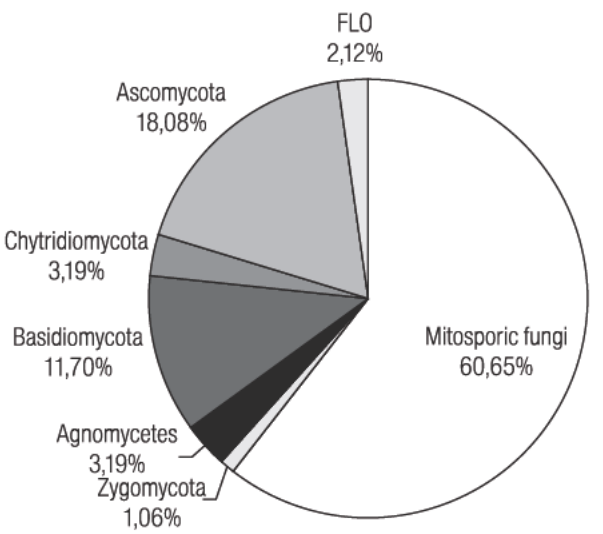

Fig.1. Precentage participation of fungus like organisms and fungi within rush plant associations around the Lake Glinno.

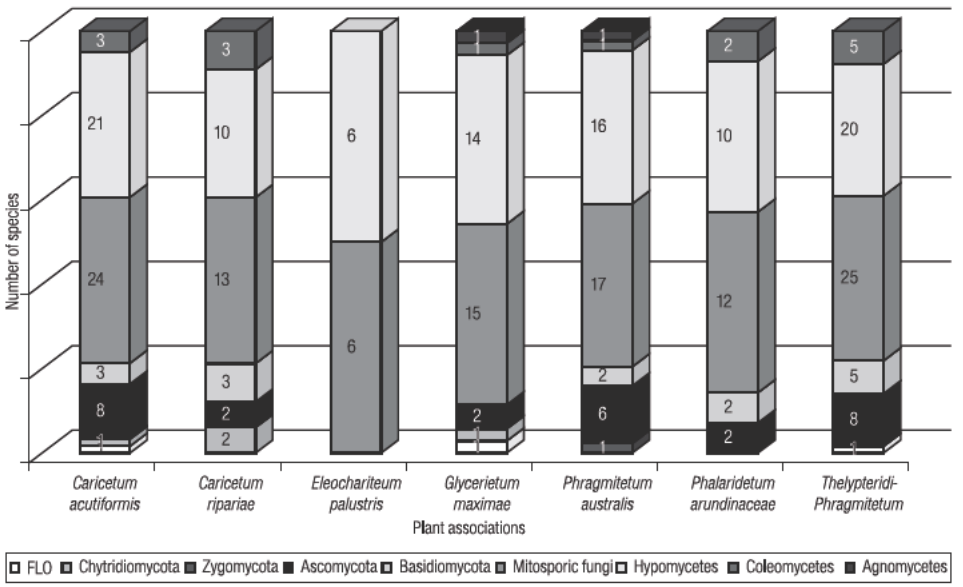

Fig.2. Biodiversity of fungus like organisms and fungi within 7 rush plant associations around the Lake Glinno.

39 and 37 species of FLO and fungi were encountered (Fig. 2). It should be stressed that although a poorer species diversity of fungi (27 taxa) was found in another community, *Phragmitetum australis*, all the observed species were bound with only one host plant (*P. australis*). On the whole, in three rush associations that included the common reed, 37 taxa of fungi and FLO were identified on the plant. *Pythium debaryanum*, an Oomycota organism found on reeds, deserves particular consideration. Biology of this species is tightly connected with aquatic environments. In our studies, the organism was isolated from inside of the stalk, therefore it presumably represented a major cause of weakening and death of reeds. Our research planned for the nearest future will focus on an in-depth enquiry into the frequency of occurrence of *Pythium* and the threats that the organism poses not only for the common reed. Such a need results from a real danger related to a rising incidence of *Pythium* found on most of littoral vegetation, which has been recently discovered in Germany (Nechwatal, Mendgen 2005; Nechwatal et al. 2005). The fungal biodiversity observed on *P. australis* within the associations of *Phragmitetum australis* (27 species) and *Thelypteridi-Phragmitetum* (24 species) is higher compared to that in the *Caricetum acutiformis* association (14 species, Tab. 1). This suggests that the floristic diversity of vegetation within an association may not be positively correlated with the diversity of Mycobiota species occurring on a particular host plant species. Our earlier studies on the phyllosphere and caulosphere of reeds in the discussed area revealed 31 species of fungi (Mazurkiewicz-Zapałowicz et al. 2005). According to other studies, taxonomic diversity of microscopic fungi associated with the common reed ranges between 18 (Brandenburger 1985) and 71 species (Ellis, Ellis 1985). There are also works focusing on the occurrence of phytopathogenic species which demonstrate that their diversity on reeds may be limited to 2-4 taxa

(Durska 1970; Adamska, Błaszkowski 2001). Due to progressive warming of climate in Europe, the common reed will probably become a host for thermophilic pathogens, which are being observed to spread beyond their original range. This has been already observed by Hyde et al. (1996), who reported *Nawawia dendroidea* as a new species affecting *Phragmites* reeds in South Africa.

The host plant association-dependent fungal biodiversity varies also for *Carex acutiformis*. The sedge hosts from 7 fungal species if found in the *Phalaridetum arundinaceae* association to 18 fungi if growing in the *Caricetum acutiformis* association. The specificity of a host plant habitat-dependent fungal biodiversity is determined by dissimilar, local climate and habitat (Andrzejewski, Weigle 2003). The *Caricetum acutiformis* association plants inhabit open, windy sites, which facilitate migration of fungal spores; on the other hand, *Thelypteridi-Phragmitetum* and *Phalaridetum arundinaceae* associations are situated in hollows or inlets, which provides some spatial isolation and restricts spore propagation.

Besides ecological factors, preferences of microorganisms (primarily saprotrophic ones) in relation to host plants may reflect differences in morphology and anatomy of the latter group. Namely, it has been observed that two plant species related to each other, which might be similar as hosts for a number of saprotrophic fungi, do not provide equally attractive substrates. To support this, as few as one fourth of the number of fungi hosted by *C. acutiformis* were found on *C. pseudocyperus*, all within the associations that these plants create together (Tab. 1). These differences probably result from dissimilar ways in which that associations are formed by the compared sedge species. *C. pseudocyperus* does not send runners, thus it occurs in small tufts scattered across the patches of the association. Moreover, its plants are nearly half the size of those of *C. acutiformis* or *P. australis*, which to a large extent protects against spores, especially those of less common fungi. Hence, phytopathogenic fungi observed sporadically in the littoral zone: *Pseudocercosporella herpotrichioides* and *Phyllosticta caricis* were actually found on *C. acutiformis*. Likewise, epiphytic foliage infection by *Puccinia dioicae* was found only on *C. acutiformis*. Conversely, another rust species, *Puccinia caricina*, was identified on *C. riparia*, the largest sedge species found in Poland. None of the *Uredinales* order species has been so far observed on *C. pseudocyperus*, whereas *Septoria caricis*, which causes chlorotic or necrotic leaf blotching, is a common phytopathogen to *C. pseudocyperus*. This implies that this sedge has by itself extended the range of *S. caricis* host plants known so far, as this pathogen has been so far isolated only from other sedge species (Ellis, Ellis 1985).

An interesting diversity was found among the fungal species that are characteristic of *Iris psudoacorus*. Out of 19 fungal taxa associated with this host plant, only 5 were found in the *Caricetum ripariae* association, whilst as many as 14 species – in *Thelypteridi-Phragmitetum*. This shows that the health condition of *I. psudoacorus* in the analysed patches of *Thelypteridi-Phragmitetum* associations was much poorer, especially as the fungi isolated from these plants were dominated by leaf blotching-causing species: *Clavariopsis aquatica*, *Colletotrichum dematium* and *Dactylella iridis* (Tab. 1). However, *Phoma pseudoacori* was the most significant phytopathogen of *I. pseudoacorus*, most frequently isolated from large and fuzzy leaf lesions. We have also isolated this species from sporadic plants of the *Caricetum ripariae* associa-

tion. Other authors also report *Phoma pseudoacori* as a frequent cause of necroses (Brandenburger 1985).

Scarce are the data on the incidence of *Fusarium oxysporum* infecting rush vegetation. This species is most often reported to cause plant fusarioses (Łacicowa 1975; 1977; Łacicowa, Kiecana 1980; Mańka, Frużyńska-Jóźwiak 1989; Kwaśna et al. 1991; Saniewska, Wach 2003). It is therefore worth mentioning that *F. oxysporum* in our studies was isolated from the stalks and leaves of so far unknown host plants: *I. pseudoacorus, C. acutiformis, Eleocharis palustris*, and *Glyceria maxima*. On the other hand, studies are continued that focus on physiological diversification and virulence of various strains of this species coming from various rush plants. In relation to zoosporic fungi, *Physoderma gerhardii* and *Cladochytrium tenue*, it is recognised that these species are non-specialised endoparasites of leaves. Various species of aquatic and wetland vegetation can become host organisms of these phytopathogens (Skirgiełło 1954; Brandenburger 1985); in the studied area, however, these fungi have been so far found only on *Glyceria maxima*, especially on the plants growing in the centres of the communities. On the littoral skirts, on the other hand, the dominant *G. maxima* leaf pathogens were *Puccinia coronata* and *Ustilago davisii*. In the *Glycerietum maximae* association, *Typha latifolia* was the accompanying species to *G. maxima*. This plant species was commonly infested by *Colletotrichum typhae*, which resulted in large blotches on the leaves, orange-brown in the centre surrounded by a dark-brown edge.

Based on the Jaccard-Sörensen coefficient the highest mycological similarity among rush plant associations was observed between *Caricetum acutiformis* with *Glycerietum maximae* (50%) whereas the lowest values of that coefficient represented *Glycerietum maximae* and *Phalaridetum arundinaceae* rush associations (7%) (Tab. 2). Evidently lower but comparable values of mycological similarity were observed between *Thelypteridi-Phragmitetum* and *Caricetum ripariae* (26%), *Caricetum ripariae* and *Eleocharitetum palustris* (25%), *Eleocharitetum palustris* and *Glycerietum maximae* (24%), *Thelypteridi-Phragmitetum* and *Caricetum acutiformis* (23%),

Table 2

Diagram of mycological similarity of distinguished rush plant associations around Lake Glinno

Plant association	T P	C A	C R	G M	P A	E P	PH AR
T P	X	23%	26%	13%	22%	14%	11%
C A		X	16%	50%	15%	10%	12%
C R			X	14%	11%	25%	18%
G M				X	13%	24%	7%
P A					X	16%	17%
E P						X	18%
PH AR							X

Explanations see Tab. 1

Thelypteridi-Phragmitetum and *Phalaridetum arundinaceae* (22%) rush plant associations.

Lack of comparable studies in Western Pomerania, as well as scarce literature published in Poland dealing with fungi of rush associations (Durska 1970; Mułenko 1989; Adamska, Błaszkowski 2000) result in the fact that a range of fungal species found on the plants that constitute these communities are their first observations in Poland. This is not due to the rarity of these species, but is rather a result of low interest in the subject and a fragmentary, local recognition of biodiversity. Therefore, similar studies are intended to be carried out over the next years, also in the rush associations of other lakes located within Western Pomeranian province.

A comparison of fungal diversity between all rush communities yields an interesting diversification in taxonomic groups of fungi. It has been demonstrated that among Mycobiota the most numerous taxa belong to mitosporic fungi, or Coleomycetes class (11 taxa) and Hyphomycetes (46 taxa). These species (57 taxa) represent 60.64% of the total taxonomic diversity. Ascomycota fungi (17 species) and Basidiomycota fungi (11 species) represent, respectively, 18.08% and 11.70% of the total fungal biodiversity. Chytridiomycota (3 species, 3.19%), Zygomycota (1 species, 1.06%), and – included into FLO – Oomycota (2 species, 2.12%), were found sporadically. These values are also reflected in the proportions of the fungal diversity in the plant associations: all the associations are dominated by mitosporic fungi (Fig. 2). Thus, the fungal diversity of the phyllo- and caulosphere are primarily formed by Hyphomycetes and Coleomycetes fungi. Similar trends in relation to other host plants have been confirmed by Cwalina-Ambroziak et al. (2000). *Fusarium* species are the most frequently found Hyphomycetes fungi in the studies area. These microorganisms belong to the so-called facultative parasites, which in adverse growth conditions and with weak plants can become the primary causes of pathological changes (Langerfeld 1971; Łacicowa 1979; Seppänen 1981; Chełkowski, Mańka 1983; Mańka et al. 1985; Chełkowski et al. 1989; Kwaśna et al. 1991). According to our study, this probably concerns *Eleocharis palustris*. Besides *F. oxysporum*, also three other *Fusarium* species were isolated from brown lesions located under the ear of the plant, namely *F. aquaeductuum*, *F. culmorum*, and *F. sambucinum*. Further studies are needed to establish which of these species form the main cause of the rot lesions found on the plants and which are only an accompanying factor. Complex and common occurrence of *Fusarium* species was also observed for *P. australis*. If we discuss this particular host plant, *Fusarium poae* is a species specially worth mentioning; according to Booth (1971), the fungus is responsible for plantlet fusarioses, malformations and withering of inflorescence in various plants of the family *Graminae*. Not only do *Fusarium* spp. affect the health of rush vegetation they live on, especially *P. australis* and *G. maxima*, they are also significant due to their intense toxin-producing activity. Namely, a real danger of poisoning arises due to an increasingly common use of *P. australis* as a housing construction material (roof cladding) or *G. maxima* as a livestock feed; this way either humans or livestock animals may become exposed to *Fusarium* toxins, especially those of the trichothecin-forming group (Chełkowski 1985). Saprotrophic *Alternaria, Cladosporium*, and *Doratomyces* fungi, commonly found on all rush vegetation species, represent another health hazard for people. Their strains isolated from various indoor bioaerosols

has been demonstrated to have an allergenic health effect (Zawisza 2001). Since reed is harvested in spring, the growth of saprotrophic fungi is particularly intensive. Other fungal species, *Deigtoniella arundinacea*, *Puccinia magnusiana*, *P. phragmitis*, and (sporadically) *Ustilago grandis*, lead to significant starvation and weakening of plants. This in turn has an economic aspect, since the pathogens cause biomass losses (Durska 1970; Tanaka 1991).

The continuation of these studies planned for the following years will presumably allow us to extend the list of the species associated with rush vegetation, and will also enable evaluation of the local significance of particular pathogens. Constant monitoring of fungal biodiversity and, thus, permanent health inspection of rush associations in Western Pomerania seems to be of particular importance, since large areas of waste land covered with reed beds are being assigned for reed cultivation (Friedrich, Jasnowska 2003; Rogalski et al. 2004). Besides, large-area rush phytocenoses represent a characteristic landscape element of riverine valleys and banks of lakes and streams (Ostendorp 1993; Boszke et al. 2005).

REFERENCES

Adamska I., Błaszkowski J. 2000. Microscopic fungus like organisms and fungi of the Słowiński National Park. I. Acta Mycol. 35(2): 243 259.

Andrzejewski R., Weigle A. 2003. Różnorodność biologiczna Polski. Drugi polski raport 10 lat po Rio. Narodowa Fundacja Ochrony Środowiska, Warszawa.

Barron G.L. 1972. Of *Hyphomycetes* from soil. R.E. Krieger Publishing Company.

Booth C. 1971. The genus *Fusarium*. Commonw.Mycol.Inst., Kew. Surrey.

Borowska A. 1986. Flora Polska. Grzyby (*Mycota*) 16: *Deuteromycetes, Hyphomycetes, Dematiaceae Phialoconidiae*. PWN, Warszawa Kraków.

Bosiacka B., Radziszewicz M. 2002. Roślinność oczek wodnych i wilgotnych zagłębień śródpolnych w okolicach Karlina (Pomorze Zachodnie). Bad. Fizjogr. Pol. Zach. Seria B, 51: 83 101.

Boszke P., Bociąg K., Szmeja J. 2005. Population structure and regeneration of *Phragmites australis* (Cav.) Trin. ex Steud. in flood control ditches in the depression wetland (Żuławy Wiślane, northern Poland). Pol. J. Ecol. 53(1): 3 12.

Brandenburger W. 1985. Parasitische Pilze an Gefäβpflanzen in Europa. Gustav Fischer Verlag, Stuttgart New York.

Chełkowski J. 1985. Mikotoksyny, wytwarzające je grzyby i mikotoksykozy. Wyd. SGGW AR, War szawa.

Chełkowski J., Mańka M. 1983. The ability of Fusaria pathogenic to wheat, barley and corn to pro duce zearalenone. Phytopath. Z. 106: 354 359.

Chełkowski J., Mańka M., Kwaśna H., Visconti A., Goliński P. 1989. *Fusarium sporotrichio ides* Sherb., *Fusarium tricinctum* (Corda) Sacc. and *Fusarium poae* (Peck) Wollenw. Cultural charac teristics, toxinogenicity and pathogenicity towards cereals. J. Phytopathol. 124:155 161.

Cwalina Ambroziak B., Kowalska E., Gronowicz Z. 2000. Zbiorowiska grzybów fyllosfery ziemniaka w zależności od wybranych warunków agrotechnicznych. Zesz.Probl. Post.Nauk.Rol. 478:123 128.

Durska B. 1970. Changes in te reed (*Phragmites communis* Trin.) condition caused by diseases of fungal and animal origin. Pol. Arch. Hydrobiol. 17 (30): 373 396.

Ellis M., Ellis J.P. 1985. Microfungi on land plants. An identification handbook. Macmillan Publishing Company, New York.

Friedrich S., Jasnowska J. 2003. Próba rozwiązania problemu ochrony gatunkowej roślin na prywat nych użytkach rolniczych na przykładzie Bagien Rozwarowskich (Pomorze Zachodnie). Chrońmy Przyr. Ojcz. 59 (2): 99 104.

Hyde K.D., Goh T.H., Steinke T. 1996. *Nawawia dendroidea*, a new synnematous hyphomycete from submerged *Phragmites* in South Africa. Mycol. Res. 100 (7):810 814.

Király Z., Klement Z., Solymosy F., Vörös J. 1977. Fitopatologia. Wybór metod badawczych. PWRiL, Warszawa.

Kochman J., Majewski T. 1973. Flora Polska. Grzyby (*Mycota*) 5: *Basidiomycestes, Ustilaginales*. PWN, Warszawa Kraków.

Kreft A., Truchan M. 1996. Zespoły roślinne strefy brzegowej Jeziora Łętowskiego w województwie słupskim. Bad. Fizjogr. Pol. Zach. Seria B, 45: 167 180.

Kwaśna H., Chełkowski J., Zajkowski P. 1991. Flora Polska. Grzyby (*Mycota*) 22: *Deuteromycetes, Hyphomycetes, Tuberculariaceae, Fusarium*. PWN, Warszawa Kraków.

Langerfeld E. 1971. Unterschiedliche Eigenschaften in der Pathogenität von zwei Kartoffelfäuler regern aus der Gattung *Fusarium* Lk. Nachrichtenbl. Dtsch. Pflanzenschutzdienstes (Braunschw.). 23 (11): 168 169.

Łacicowa B. 1975. Fuzarioza lnu (*F. oxysporum* f. *lini*) na Lubelszczyźnie. Ochr. Rośl. 3: 9 12.

Łacicowa B. 1977. Badania nad podatnością różnych odmian lnu na fuzariozę (*F. oxysporum* f. *lini*). Tezy do referatów na XVIII Sesję Naukową IOR, Poznań: 21 22.

Łacicowa B. 1979. Ocena laboratoryjna wirulencji szczepów *Fusarium oxysporum* f. *lini* i *Fusarium oxysporum* f. *phaseoli* oraz podatności odmian na porażenie przez te patogeny. Rocz. Nauk Rol. ser. E, 9, 1: 113 124.

Łacicowa B., Kiecana I. 1980. Zgorzel naczyń koniczyny czerwonej (*Trifolium pratense* L.) powodo wana przez *F. oxysporum* f. sp. *trifolii* (Jancz.) Biłaj. Rocz. Nauk Rol. ser. E, 10, 1 2: 145 161.

Majewski T. 1979. Flora Polska. Grzyby (*Mycota*) 11: *Basidiomycetes, Uredinales* II. PWN, Warszawa Kraków.

Mańka M., Frużyńska Jóźwiak D. 1989. An attempt of biological control of glasshouse carnation *Fusarium* wilt. Acta Hort. 225: 281 285.

Mańka M., Visconti A., Chełkowski J., Bottalico A. 1985. Pathogenicity of *Fusarium* isolates from wheat, rye, and triticale towards seedlings and their ability to produce trichothecenes and zearalenone. Phytopath. Z. 113: 24 29.

Marks M., Randall J. 1994. *Phragmites australis* (*P.communis*): threats, management and monitoring. Natl. Areas J. 14: 285 294.

Matuszkiewicz W. 2001. Przewodnik do oznaczania zbiorowisk roślinnych Polski. Ser. Vademecum Geobotanicum 3. PWN, Warszawa.

Mazurkiewicz Zapałowicz K., Janowicz K., Wolska M., Słodownik A. 2005. Bioróżno rodność gatunkowa grzybów mikroskopowych trzciny pospolitej *(Phragmites australis* (Cav.)Trin.ex Steud.) w zbiorowiskach szuwarowych Jeziora Glinno. Acta Agrobot. 58(2): 359 368.

Mułenko W. 1989. Mikroskopowe grzyby fitopatogeniczne Pojezierza Łęczyńsko Włodawskiego II. Acta Mycol. 24(2): 125 171.

Nechwatal J., Mendgen K. 2005. *Pythium litorale* sp.nov., a new species from the litoral of Lake Konstance, Germany. FEMS Microbiology Letters. 255: 96

Nechwatal J., Wielgoss A., Mendgen K. 2005. *Pythium phragmitis* sp. nov. , a new species clone to *P. arrhenomanes* as a pathogen of common reed (*Phragmites australis*). Mycol. Res. 109: 1337 1346.

Ostendorp W. 1993. Reed bed characteristics and significance of reeds in landscape ecology. Act. Limnol. 5: 149 161.

Rogalski M., Kwarta Cz., Trzaskoś M. 2004. Naturalistic qualities and economic values of rush communities inhabitating periodically flooded peat soils in the river Rurzyca valley. (In:) L. Wołej ko and J. Jasnowska (eds). The future of Polish mires. Monogr. AR in Szczecin: 251 256.

Saniewska A., Wach I. 2003. Rozwój fuzariozy powodowanej przez *Fusarium oxysporum* f.sp. *tulipae* na odmianach tulipanów potencjalnie wrażliwych i odpornych na tworzenie się gum na cebulach. Post. Ochr. Rośl./ Prog. Plant Prot. 43 (2): 898 900.

Seppänen E. 1981. Fusariums of the potato in Finland. I. On the *Fusarium* species causing dry rot in potatoes. Ann. Agric. Fenn. Ser. Phytopathol. 20 (2): 156 160.

Skirgiełło A. 1954. Grzyby niższe. Pragrzyby i Glonowce. PWN, Warszawa.

Szafer W., Zarzycki K. 1977. Szata roślinna Polski. II. PWN, Warszawa.

Szczepański A. J. 1978. Ecology of macrophytes in wetlands. Pol. Ecol.Stud. 4: 45 94.

Tanaka Y. 1991. Microbial decomposition of reed (*Phragmites communis*) leaves in a saline lake. Hydrobiologia 220: 119 129.

Trojan P. 1978. Ekologia ogólna. PWN, Warszawa.

Tomaszewicz H. 1978. Roślinność wodna i szuwarowa Polski (Klasy: *Lemnetea, Charetea, Potamogeto netea, Phragmitetea*) wg stanu zbadania na rok 1975. Rozpr. Uniw. Warsz.

Wojewoda W. 2003. Checklist of Polish larger *Basidiomycetes*. (In:) Z. Mirek (ed.). Biodiversity of Poland 7. W. Szafer Insitute of Botany, Polish Academy of Sciences, Kraków.
Wołejko L. 2000. Roślinność szuwarowa i turzycowiskowa z klasy *Phragmitetea* kompleksów źródlisko wych Polski północno zachodniej. Folia Univ. Agric. Stetin. 213 Agricultura (85): 221 246.
Zawisza E. 2001. Grzyby a choroby alergiczne. Nowa Medycyna 109 (1): 11 15.

Z badań grzybów fitopatogenicznych i saprotroficznych w zbiorowiskach szuwarowych Jeziora Glinno

Streszczenie

W badaniach prowadzonych w latach 2004 2005 stwierdzono występowanie 94 gatunków grzybów i organizmów grzybopodobnych (OGP) na 13 gatunkach roślin, występujących w siedmiu zespołach szuwarowych wokół Jeziora Glinno. Z fragmentów roślin wykazujących objawy chorobowe izolowano zarówno gatunki fitopatogeniczne z rodzajów: *Puccinia, Usti lago, Leptosphaeria, Septoria, Fusarium, Pythium* i in. jak i powszechnie obecne saprotrofy rodzajów: *Alternaria, Cladosporium, Doratomyces, Periconia, Rotula* i in. Największe zróżnico wanie gatunkowe stwierdzono wśród grzybów mitosporowych i Ascomycota, które stanowiły odpowiednio 61,63% i 18,08% wszystkich gatunków. Sporadycznie stwierdzano gatunki Chy tidiomycota, Oomycota i Zygomycota. Największa bioróżnorodność mikologiczna charakte ryzowała *Phragmites australis* (37 gatunków grzybów), *Carex acutiformis* (25 gatunków) i *Iris pseudoacorus* (19 gatunków).