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Influence of soil fungi community in selected mountain stands on the development of *Cylindrocarpon destructans* (Zins.) Scholt.

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Abstract

A trial based on the method of biotic series (M a ń k a, 1974) was undertaken in order to study the effect of the fungal communities isolated from the soil, rhizosphere, roots, and mycorhiza of silver fir self-seed on the development of a parasitic fungus *Cylindrocarpon destructans* (Zins.) Scholt., which causes dying of fir seedlings in some mountain forests (K o w a l s k i, 1980a). It was found that on the plots where the self-regeneration of the fir (*Abies alba* Mil.) was good the resistance index of the investigated soil fungal community was about four times as high as in the plots where no self-seed of silver fir was observed.

INTRODUCTION

A lack of self regeneration of silver fir stands, manifested by the chronic decay of its 2 to 6-year-old self-seed, is probably due to an excessive infestation of the roots of seedlings by a parasitic fungus *C. destructans*. This can be assumed at least for some fir stands in the Carpathians and Sudety (K o w a l s k i, 1980b). The abundant appearance of *C. destructans* in some field trials and its almost total lack in the other depends undoubtedly on a complex of various ecological factors. One of the difficulties we meet is: how to express those factors as a total and how to determine to what a degree they influence the occurrence and development of *C. destructans*. A method developed by M a ń k a (1965, 1974) seems to be sufficiently adequate to express the effect of the environment on the pathogenic organisms. The method has been verified several times by various authors in different ecological conditions (M a ń k a, 1974). Use of this method could help in explaining excessive appearance of *C. destructans* in some mountain forests. It can also provide a basis for the prognosis of its occurrence.

MATERIAL AND METHODS

Investigations within the State Research Project 09.01. were carried out on fixed plots in Carpathian and Sudetian forests. The forests have been previously characterized from the pedological (Adamczyk, Januszek, 1977), phytosociological and silvicultural points of view (Jaworski, 1979). The plots were established in order to solve the problem whether the lack of natural reforestiation could be connected with microbiological changes in the soil favoring an excessive development of fungi which caused root diseases in tree seedlings.

Fungi were isolated from the soil, rhizosphere, roots and mycorhiza of a 2 to 6-years-old self-seeds of silver fir with the method given in the paper of Kowalski (1980a: Table 4). The isolated fungi were identified and segregated into separate communities of soil, rhizospheric, root and mycorhiza fungi (Kowalski, 1980a: Tables 5 to 7). In order to determine the influence of a fungal community from the investigated soil environment on the development of the parasitic fungus *C. destructans* a method of biotic series was used (Mańka, 1965, 1974). Fifteen species of fungi (called "test fungi") were tested in a two-organism culture with the *C. destructans* Pk90 (the latter called "tested fungus"). The "test fungi" were those of the most abundant occurrence; in each part of the soil environment (i.e. in the soil, rhizosphere, roots and mycorhiza) no less than 70 percent of the total number of isolates of the investigated community (Kowalski, 1980a: Tables 5 to 7). Each culture had three replications. The distance between the inoculates in the two-organism culture was about 2.5 cm. The tested fungus, as well as the individual test fungi, were grown additionally in two replications. The result was read after 10 days of incubation on the glucose-potato agar by means of the estimate scale established for the method of biotic series (Mańka, 1974). In the case where the tested fungus was a different strain of *C. destructans,* the highest estimate provided for the competetive influence type was applied increased by one degree. The effect of the soil fungal communities which did not inhibit the development of *C. destructans* Pk90 was expressed by minus values. When the effects inhibited the development of the parasite, plus values were given. The total biotic effect presented in Table 2 is an algebraic sum of the single biotic effects multiplied by the number of occurrence of the particular fungal species in the environment (Table 1).

RESULTS

Results are given in Tables 1 and 2. It can be seen that the fungal communities on the fields Kopciowa (No. 6), Potok Jałowiecki (No. 25), and Wyszki (No. 37) under the laboratory conditions inhibited the development of *C. destructans* Pk90 to a considerably higher degree

Table 1

The effect of the fungal community isolated in the autumn from the soil (A), rhizosphere (B), roots (C) and mycorrhizae (D) of 2-6 year old fir seedlings on the growth of the culture *Cylindrocarpon destructans* Pk90

Species of fungi	Experimental areas in which fir regenerated:															
	poorly								well							
	Pewroźnik (No. 1)		Płaj (No. 23)		Długopole (No. 36)				Kopciowa (No. 6)		Potok Jałowiecki (No. 25)		Wyszki (No. 37)			
	year 1974				1973		1974		year 1974				1973		1974	
	No. of fungal isolates	Individual biotic effect	No. of fungal isolates	Individual biotic effect	No. of fugal isolates	Individual biotic effect	No. of fungal isolates	Individual biotic effect	No. of fungal isolates	Individual biotic effect	No. of fungal isolates	Inqividual biotic effect	No. of fungal isolates	Individual biotic effect	No. of fungal isolates	Individual biotic effect
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
Absidia spinosa Lend.							5:	−2:					4:	+6:		
Acremonium charticola (Lind.) W. Gams							: 6	:−4	: 9	:−2			11:	−1:		
									9:	−2:						
A. kiliense Grütz			5:12	−4:−4												
			:2	:−3												
A. luzulae (Fuck.) Gams					: 5	:−7										
A. petridii Gams et Frankl.															: 1	:+1
A. strictum Gams													: 7	:+1		
Aspergillus cfr. *candidus* Link					5:	−4:	:16	:−5			: 8	:−3	24: 9	−2:−2	11: 6	−2:−2
A. repens (Corda) de Bary	:13	:−5														
Aureobasidium pullulans (de Bary) Arnaud							: 7	:−6								
													5:	−3:		
Beauveria bassiana (Bals.) Vuill.							: 8	:−2								
B. brongiartii (Sacc.) Petch															:15	:−2
Chloridium chlamydosporis (van Beyma) Hugh.	: 5	:−5	: 4	:−6							: 3	:−2				
C. viride Link													: 4	:−5		
Chrysosporium pannorum (Link) Hugh.	4:	+3:	4: 4	−4:−4	3:	−3:			2: 8	+3:−2			3:	−3:	3:	−2:
			: 1	:−2							7: 3	−2:−2				
Cladosporium herbarum (Pers.) Link					:10	:−4							:12	:−1		
					7:	−4:										
Coniothyrium fuckelii Sacc.			2:	−1:			:10	:−2								
							: 1	:−3								

Chrysosporium pannorum (Link) Hugh.	4:	+3:	4: 4	−4:−4	3:	−3:			2: 8	+3:−2			3:	−3:	3:	−2:
Cladosporium herbarum (Pers.) Link			: 1	:−2	:10	:−4					7: 3	−2:−2	:12	:−1		
Coniothyrium fuckelii Sacc.			2:	−1:	7:	−4:	:10	:−2								
Cylindrocarpon destructans (Zins.) Scholt.	65:16	−5:−5	13: 1	−5:−5	:14 136:	:−5 −5:	: 1 94:21	:−3 −5:−5	13: 5	−5:−5	: 2	:−5			3: 2	−5:−5
Cytospora abietis Sacc.									: 5	:+3						
C. cfr. *kunzei* Sacc.													6:	−3:		
Dendrophoma sp. Bkm 207			4: 4	−4:−4												
Epicoccum purpurascens Ehrenb.					9:	+2:	: 1	:+2					18:	+2:		
Fusarium solani (Mart.) Appel et Wollen.	6:	−5:														
Fusidium viridae Grove					5:	−2:										
Humicola brevis (Gilm. et Abb.) Gilm.									7:	−4:						
H. fuscoatra Traaen	12: : 2	−5: :−5	15:14	−5:−4	2:	−5:	12:	−5:	16:	−5:	18:	−5:	4:	−2:		
H. grisea Traaen	4:	−5:														
Humicola sp. Kg 114							6:	−4:								
Memnoniella echinata (Rivol.) Gall.							: 2	:−4							2:	−5:
Monilia geophila Oud.	10: 9	−5:−6	21: 8	−5:−5	13:	−5:	24: 5	−5:−5			1:	−5:				
Monocillium humicola Barron			: 2	:−5									17:	−5:		
Monodyctis putredinis (Wallr.) Hugh.	6:	−3:														
Mortierella alpina Peyroud	: 6	:−1									1:	+6:				
M. dichotoma Linnem.																
M. gemmifera M. Ellis															2:	+2:
M. gracilis Linnem.	:11	:−1									2:	+4:			27:	+4:
M. horticola Linnem.			: 3	:−5					: 3	:+6						
M. humicola Oudem.									5:	−3:						
M. humilis Linnem.	10: 6	−1:−2	4:	+6:	: 7	:+1	6:	+3:	10:	0:	: 6	:+4	: 3	:+5		
M. hygrophila Linnem.	:10	:−2									10: 3	+4:+6			: 1	:+6

Mortierella alpina Peyroud	: 6	:−1														
M. dichotoma Linnem.											1:	+6:				
M. gemmifera M. Ellis																
M. gracilis Linnem.	:11	:−1									2:	+4:			2:	+2:
M. horticola Linnem.															27:	+4:
M. humicola Oudem.			: 3	:−5					: 3	:+6						
M. humilis Linnem.	10: 6	−1:−2	4:	+6:	: 7	:+1	6:	+3:	5: 10:	−3: 0:	: 6	:+4	: 3	:+5		
M. hygrophila Linnem.	:10	:−2									10: 3	+4:+6			: 1	:+6
M. isabellina (Oud.) Zycha							: 2	:+3							3:	+7:
M. marburgensis Linnem.	11: 7:	−2: +5:							: 7	:−2					: 1	:+1
M. microspora Wolf	: 2	:+2							: 5	: 0						
M. cfr. minutissima van. Tieg. *var. dubia* Linnem.											9:21	−1:−1				
M. nana Linnem.	6:	−4:			6:	−2:	8:	−2:					5:	−1:	3:	−1:
M. parvispora Linnem.	: 2 11:	:−3 +3:	20:27	+3:+2	4:	+2:	9: 16:21	−2: +2:−1	16:22	+5:+5	6:22	+6:+5	6: 6	+2:+1	8: 5 4:14	−1:−1 +2:+2
M. ramanniana (Moeller) Linnem.	11: 9	+3:+3	55:12	+2:+3	11:	−2:	39: 8 8:	−1:+1 +1:	15:13 6:	+6:+6 +2:	74:14	+6:+5			: 1	:+2
M. ramanniana var. angulispora (Naum.) Linnem.			7:15	−2:−2			: 2	:+1	: 4	:+2	: 6	:+1			3:	+3:
M. verticillata Linnem.			11: 4	−2:−2											: 5	:+1
M. vinacea Dixon—Stew.	5:12	−4:−4	9: 4 20:	+6:+4 −3:	10: 6	−4:−4	23: 9	−3:−4	13:16	+1:+1	2:	−3:	4:	−1:	2:	−2:
M. zonata Linnem.	35:29	−4:−4	17: : 6	−4: :−2	13:	−4:	48:19	−4:−4	34: 4:	+1: +7:	11: 2	−3:−3			9: : 5 2:	−2: :+3 +7:
Mycelium radicis atrovirens Mel.	74:17	−6:−6	: 5 74:24	:−4 −5:−5	46:	−6:	: 7 179:44	:−5 −5:−6	4:18 154:32	−4:−3 −3:−3	1:10 123:33	−4:−3 −3:−3	137:	−4:	2:20 206:65	−3:−3 −3:−3
Myxosporium abietinum Rostr.	26:	−1:					4:	−1:	11:	−1:	: 1	:+1			: 4	:+1
Oidiodendron citrinum Barron			: 5	:−4												

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
Oidiodendron cerealis (Thumen) Barron									: 9	:−4						
O. echinulatum Barron															: 4	:−3
O. flavum Szilv.							: 5	:−4			2:	−2:	: 4	:−2	12:23	−2:−2
O. griseum Robak			: 8	:−5					:13	:−3	:27	:−4	9:	−4:	57:	−4:
O. maius Barron					: 5	:−5	:10	:−5	:13	:−3					:24	:−2
O. tenuissimum (Peck) Hugh.					: 9	:−6	4: 4	−5:−5			: 3	:−2			: 4	:−2
O. truncatum Barron	: 6	:−4							8: 8	−4:−4	3: 3	−4:−4	4:	−4:	: 3	:−4
Paecilomyces carneus (Duché et Haim) Br. et Smith	7: 3	−5:−6					: 2	:−4							: 4	:−4
P. farinosus (Dicks ex Fr.) Br. et Smith	:20	:−3														
Penicillium citrinum Thom	:40	:−3			: 9	:−4	: 6	:−3								
P. decumbens Thom					: 9	:−6										
P. fellutanum Biourge					16:	−1:	29:	−1:					: 8	:+3	3: 3	−1:+3
P. funiculosum Thom	4:	−2:	52: 6	−3:−2	25: 7	−2:−2	5:	−2:			83: 3	−1:+1	:30	:+2	: 3	:−5
P. implicatum Biourge			6:	−3:			7:	−2:	6:	−1:	6:	−1:			: 5	:+2
P. nigricans Bain.					6:	+2:										
P. raciborskii Zal.			2:	+1:			8:	−1:	8:	+3:						
P. simplicissiumum (Oud.) Thom			6:	+1:					8: 5	+3:+3						
P. spinulosum Thom													14:	0:		
P. vinaceum Gilm. et Abb.					5:	+3:	6:	+1:			5:	+4:	10: 7	+2:+6	13:48	+2:+2
Penicillium sp. Kr. 108													35:	+4:	55:	+4:
Penicillium sp. Pk 104	6:	+1:							:10	:−2			:15	:+2		
Petromyces sp. D 54-107													8:	−1:		

Penicillium sp. Kr. 108										:10	:−2			8:	−1:			
Penicillium sp. Pk 104	6:	+1:																
Petracomyces sp. D 54-107														7:	+4:			
Phoma cfr. bohemica Bubák et Kabat.																		
Ph. glomerata (Cda) Wollen. et Hoch.	: 6	:+5												8:	+6:	3:	+6:	
Pseudogymnoascus roseus Raillo	25:	−5:					4:	−4:	4:	−4:								
	: 2	:−5																
P. vinaceus Raillo	11:	−5:							3:	−5:								
Rhinocladiella atrovirens Nannf.													7:	−4:				
Scopulariopsis brumptii Salvanet-Duval	: 7	:−4												11:	−4:	19:	−4:	
	7:	−4:																
Septonema chaetospira (Grove) Hugh.	:15	:−4																
S. secedens Cda	7:	−4:																
Thysanophora penicillioides (Roum.) Kendr.	6:52	−4:−4	9: 9	−5:−5	8:11	−6:−6			4:45	−2:−2	2:22	−2:−3						
	53:19	−5:−5	58: 9	−5:−5	32:	−5:	9:	−5:	62:11	−3:−2	61:12	−2:−2	10:	−3:	2:	−4:		
Tolypocladium sp. Jg 19											2:	−2:						
Torulomyces lagena Delit.													: 8	:−4	5:	−4:		
Trichocladium opacum (Cda) Hugh.																		
											: 1	:−3						
Trichoderma album Preuss			3:11	+7:+7	14: 8	+7:+4	7: 9	+7:+7	: 6	:+7	: 6	:+7						
			8:	+7:	23:	+3:	22:	+4:	7:	+7:	20:	+7:	5:	+7:				
T. glaucum Abbott	: 6	:+7	2:	+7:	7: 8	+7:+6			3:	+7:	2:	+7:						
					27:	+7:			8:	+7:	6:	+7:			20:	+7:		
T. koningi Oudem.					:18	:+7			2:	+7:			8:	+7:				
									16:	+7:			15:	+7:				
T. lignorum (Tode) Harz					4:	+7:	6:	+7:	: 6	:+7	: 3	:+8	58:	+8:	12:	+7:		
	7:	+7:	11:	+7:	31:	+7:	5:	+7:	7:	+7:	13:	+8:	73:	+7:	45:	+7:		
Trichoderma sp. Dr1							:10	:−3										
Varicosporium elodea Kegel	9:	−5:	13: 4	−5:−5	8:	−3:	5:	−4:										
Verticillium bulbillosum W. Gams et Malla									: 7	:−1								
													6:	+3:	: 3	:+3		
V. candelabrum Bonord.							7:	0:										
V. cfr. *capitatum* Ehrenb.							:10	:+2					9:	+1:				

T. koningi Oudem.					:18	:+7			2:	+7:			8:	+7:		
									16:	+7:			15:	+7:		
T. lignorum (Tode) Harz					4:	+7:	6:	+7:	: 6	:+7	: 3	:+8	58:	+8:	12:	+7:
	7:	+7:	11:	+7:	31:	+7:	5:	+7:	7:	+7:	13:	+8:	73:	+7:	45:	+7:
Trichoderma sp. Dr1							:10	:−3								
Varicosporium elodea Kegel	9:	−5:	13: 4	−5:−5	8:	−3:	5:	−4:								
Verticillium bulbillosum W. Gams et Malla									: 7	:−1			6:	+3:	: 3	:+3
V. candelabrum Bonord.							7:	0:								
V. cfr. *capitatum* Ehrenb.							:10	:+2					9:	+1:		
V. chlamydosporium Godd.											:4	:−4				
V. cfr. *lecanii* (Zimm.) Viég.											6: 2	−5:−5			: 3	:−3
Not sporulating											4:	−2:				
A 163-41; B 163-133; D 163-36; D 163-59					21: 7	0:−5										
B 54-22; B 54-87					8;8:	+2;0:							:16;16	:−2;−3		
Pk 1; Pm 1	8: 4	+2:−5														
Pkm 166; Pm 7	10: 8	−3:−4														
Pm 12; Pm 24	:3;6	:−4;−6														
Bg 46; Br 62; Bkm 120; Bm 23			3:11	−4:−5												
			16:30	−6:−6							:33	:−4				
Bkm 129, Bm 3			11:13	−4:−5												
Bm 40			: 2	:−4												
Dg 128; Dm 23; Dm 29							5:	−4:								
							:8;6	:−5;−4								
Kr 179; (Kr 179, Km 9, Km 24, Km 74); Dr 39							:7	:−6	:27	:−4					6: 3	−1:−3
Km 4, Km 56									:3;3	:0;+5						
Jg 22; Jr 77; JK 84; Wm 15											3: 6	−4:−4				
											10: 2	−4:−2			: 6	:−6
Jr 109; Wm 88											: 4	:−5				
											:10	:−4			: 9	:−6
Pg 51; B163-140															7:19	+2:−4

Explanations:
A — the numbers in the numerator before colon; B — the numbers in the numerator after colon; C — the numbers in the denaminator before colon; D — the numbers in the denaminator after colon.

than the communities isolated from the fields Powroźnik (No. 1), Płaj (No. 23) and Długopole (No. 36). An analysis of the degree of the biotic influence (individual biotic effect) of the test fungi on the *C. destructans* Pk90 is given in Table 1. Fungi of those plots where the self regeneration of the fir was bad (Nos. 1, 23 and 36) in almost all cases inhibited the development of *C. destructans* less than the same species of fungi from the plots where the self-reforestiation was good (Nos. 6, 25 and 37). In the extreme cases this differentiation was in the range of: from —2 to +6 in *Absidia spinosa*, from —4 to —1 in *Acremonium charticola*, from —5 to —2 in *Aspergillus cfr. candidus*, from —6 to —3 in *Aureobasidium pullulans*, from —6 to —2 in *Chloridium chlamydosporis*, from —1 to +4 in *Mortierella gracilis*, from —5 to +6 in *M. horticola*, from +3 to +7 in *Mortierella hygrophila*, from —2 to +1 in *Mortierella isabellina*, from —2 to +3 in *M. zonata*, from —5 to —2 in *Oidiodendron maius*, from —1 to +3 in *Penicillium decumbens* and from —6 to —2 in *Thysanophora penicillioides*.

Differences in the degree of biotic influence on the fungus *C. destructans* Pk90 were observed also among individual mycelia of the same species isolated from the soil, rhizosphere, roots or mycorhiza of the same soil environment. The largest difference was observed on the experimental plot Powroźnik: in *Mortierella marburgensis* isolated from the soil it had an estimate of +5, and from the mycorhiza of +2. *M. verticillata* isolated from the roots on the plot Płaj was estimated at +6, and from the mycorhiza at +4. *M. humilis* from the roots on the plot Długopole at +3, and from the rhizosphere at +1, and *M. parvispora* on the same plot at +2 from the soil and at —2 from the roots. *Chrysosporium pannorum* isolated from the soil on the plot Kopciowa was estimated at +3, and from the rhizosphere at —2. *Mortierella humilis* isolated from the roots and the rhizosphere on the plot Potok Jałowiecki got an estimate of +4, and from the mycorhiza of +6. *Penicillium decumbens* from the soil on the plot Wyszki of —1, and from the rhizosphere of +3. On the same plot *P. spinulosum* from the soil had +2 whereas from the rhizosphere +6, *P. vinaceum* from the rhizosphere +2 and from the roots —1. One can also conclude from Table 1 that the fungi promoting the development of *C. destructans* Pk90 (determined with minus values) were represented to a higher degree in all control communities on the plots where no self-regeneration of silver fir occurred (Nos. 1, 23 and 36) than on the ones with good self-seed development (Nos. 6, 25 and 37).

A comparison of the total of biotic effects given in Table 2 shows that the most differentiating influence on the growth of *C. destructans* was that of the fungal communities isolated from the roots and from the rhizosphere. An addition of the total biotic effects of the individual fungal communities results in an approximate estimate of the index

of environmental resistance against the tested fungus *C. destructans* Pk90. Using this index it can be assumed that the parasitic fungus *C. destructans* had four times better conditions for its development on the plots where the reforestation of silver fir was poor (Nos. 1, 23 and 36) than on the plots where this regeneration was good (Nos. 6, 25 and 37). The obtained figures were from —1043 to —2815 in the first case, and from —603 to +635 in the second case.

Table 2

Comparison of summaric biotic effects of fungal communities isolated from the soil environment in the studied stands on the growth of *Cylindrocarpon destructans*

Fungi isolated	Intensity of natural fir regeneration	Name and No. of plot	Summaric biotic effect of fungal communities from: soil	rhizosphere	roots	mycorrhizae	Sum from columns 3 to 6
1	1	2	3	4	5	6	7
in 1973 year	poor	Długopole (36)	−97	−240	−706	—	−1043
	good	Wyszki (37)	+295	+14	+326	—	+635
in 1974 year	poor	Powroźnik (1)	−292	−649	−1348	−526	−2815
		Płaj (23)	−384	−287	−747	−448	−1866
		Długopole (36)	−241	−334	−1580	−572	−2727
	good	Kopciowa (6)	+3	−141	−349	−116	−603
		Potok Jałowiecki (25)	−169	−124	+140	−231	−384
		Wyszki (37)	−270	−88	+176	−379	−561

DISCUSSION

The adequacy of the applied method was confirmed by the consistence of the results of laboratory tests with the real situation in the field. *Cylindrocarpon destructans* was much more frequently isolated on the plots Nos. 1, 23 and 36, where the decay of fir seedlings was high. On the contrary, this fungus occurred sporadically on the plots where the seedlings were healthy. There is no doubt that the strain Pk90 of *C. destructans* is a pathogenic one (K o w a l s k i, 1978). The result of the biotic test could be, however, influenced also by the time of sampling. This was suggested by comparison of the total biotic effects of fungi communities isolated in 1973 and 1974 on the plots Długopole and Wyszki (Table 2). However the index of fungal communities influence of the soil environment on *C. destructans* points to better conditions of this pathogen in the Długopole plot in both years. Results obtained in these investigations permit a partial explanation of the causes of unsuccessful self regeneration in some silver fir stands in the mountains. They correspond in this respect to the investigation made

by Mańka et al. (1968), concerning the lack of self reforestiation of yew (*Taxus baccata* L.). The authors suppose, however, that in that case a bad regeneration of yew was connected with the disappearing of the root fungus *Mycelium radicis atrovirens* in the soil environment. In a previous study (Kowalski, 1980b) it was also found that this fungus occurred more frequently on the plots where the regeneration of silver fir was good than on the plots with bad self regeneration.

An investigation of the relationship between the fungal communities constituting the soil environment and the parasitic fungi of the silver fir seedling roots can serve as a criterion for estimating the changes in forest environment with respect to the possibilities of silver fir self regeneration in mountain stands.

The appearance of several fungal species inhibiting the development of *C. destructans* on the plots with good self regeneration of silver fir provides information on the unsusceptibility of some fungi to the antibiotic substances exuded by *C. destructans* into the substrate (Evans, White, 1966). Similar fungi, although considerably less numerous, were observed also on the plots with an abundant incidence of *C. destructans* (Table 1). As a mater of fact, according to investigations the influence of soil fungi on the development of the parasite is determined by both the qualitative and quantitative composition of the fungal community constituting a given soil environment.

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Badanie wpływu zbiorowiska grzybów środowiska glebowego w wybranych drzewostanach górskich na wzrost grzyba pasożytniczego Cylindrocarpon destructans (Zins.) Scholt.

Streszczenie

Grzyby izolowano z gleby, ryzosfery, korzeni i mikoryz 2-6 letniego samosiewu jodły, na powierzchniach badawczych, w wybranych drzewostanach jodłowych w Karpatach Zachodnich i w Sudetach, w których jodła odnawiała się w sposób samosiewny dobrze i w których brak było takich odnowień. W celu określenia wpływu zbiorowiska grzybów badanego środowiska glebowego na wzrost grzyba pasożytniczego *Cylindrocarpon destructans*, powodującego zamieranie samosiewu jodły, posłużono się metodą szeregów biotycznych. W wyniku przeprowadzonych badań stwierdzono (tab. 1), że gatunki grzybów pochodzące z powierzchni, na których jodła się źle odnawiała (nr 1, 23, 36), prawie z reguły w mniejszym stopniu ograniczały wzrost *C. destructans* Pk90 aniżeli te same gatunki grzybów pochodzące z powierzchni badawczych, na których odnowienie samosiewu było dobre (nr 6, 25, 37). Również na powierzchniach badawczych nr 1, 23, 36, w każdym przypadku w badanym porównywalnym zbiorowisku, było więcej grzybów sprzyjających wzrostowi *C. destructans* Pk90 (wartości ujemne), aniżeli na powierzchniach badawczych nr 6, 25 i 37. Najbardziej różnicująco na wzrost *C. destructans* Pk90 oddziaływały zbiorowiska grzybów wyizolowanych z korzeni i z ryzosfery samosiewu jodły (tab. 2).