

Occurrence and Some Hydrolytic Properties of Fungi Associated with *Globodera rostochiensis* Cysts in Crop Rotation with Different Contribution of Potato

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Globodera rostochiensis as well as other cyst-forming nematodes is parasitised by fungi /CLOVIS and NOLAN, 1983; GOSWAMI and RUMPENHORST, 1978; LAAN, 1956; MORGAN-JONES and RODRIGUEZ-KABANA, 1986; WRONKOWSKA and JANOWICZ, 1986/. The practical meaning of this phenomenon is still a controversial question /TRIBE, 1980/. The increase of host plant contribution in the crop rotation up to monoculture is favourable for the development of fungi decreasing cyst nematodes populations /KERRY et al., 1982/. It seems that the pathogenic properties of these fungi are connected with their hydrolytic activity in relation to cyst wall and egg shell components /CHALUPOVA, 1985; KUNERT et al., 1985, 1987/.

The aim of this paper is to examine the influence of the increase of potato contribution from 20% to 60% in the rotation on the composition and hydrolytic properties of microflora associated with *G. rostochiensis* cysts.

Materials and methods

Cysts were obtained after potato harvest in 1987 from manured soil /sandy loam/ of experimental plots. Two variants were compared: A, control /rotation: potato^x, spring barley, rye, maize, rye/ and C /rotation: potato^x, spring barley, potato, maize, potato/ /x - studied plots/.

Fungi were isolated on water agar with antibiotics, from the surface of cysts and from eggs /aseptic transfer of the whole content of each cyst on medium by capillary pipette/.

The hydrolytic properties of fungi were indicated on solid media on the ground of the presence of a hydrolytic zone after 14 days' incubation at 22 °C. Proteolytic properties were studied on gelatin agar /KUNERT et al., 1987/, chitinolytic-on colloidal chitin /KUNERT et al., 1985/ and lipolytic-on tributyrin /BURBIANKA et al., 1983/.

Results and discussion

G. rostochiensis cysts were penetrated by common fungal saprophytes and facultative parasites, connected with potato rhizosphere /Table 1/.

Table 1

The percentage of fungi associated with the surface and eggs of *G. rostochiensis* cysts in soils under potato in different crop rotations

Species of fungi	A variant		C variant	
	cysts /163/	eggs /130/	cysts /180/	eggs /156/
<i>Acremonium strictum</i>	6		8	2
<i>Acremonium</i> sp.			1	
<i>Aureobasidium pullulans</i>		10		1
<i>Chrysosporium pannorum</i>	2	5		
<i>Cylindrocarpon destructans</i>	11	31	12	6
<i>Cylindrocarpon didymum</i>	5		8	20
<i>Exophiala</i> sp.	3		6	19
<i>Fusarium oxysporum</i>	26	22	19	17
<i>Fusarium solani</i>	10		8	5
<i>Gliocladium catenulatum</i>				3
<i>Humicola fuscoatra</i>				5
<i>Mortierella alpina</i>	7	12	16	2
<i>Paecilomyces lilacinus</i>	9	2	6	3
<i>Paecilomyces variotii</i>			3	
<i>Penicillium waksmanii</i>	2			
<i>Trichocladium asperum</i>			2	
<i>Trichoderma koningii</i>			1	1
<i>Trichoderma viride</i>			2	
<i>Verticillium chlamydosporum</i>	19	18	6	15
<i>Mycelium sterile</i> /amaranth/			1	1
<i>Mycelium sterile</i> /rose-beige/			1	

A and C - variants with 20% and 60% of potato in rotation, respectively;
- numbers of strains studied are given in brackets

Among 11 species of fungi isolated from the surface of control cysts, *Fusarium oxysporum* /20% of isolates/ and *Verticillium chlamydosporum* /19%/ were dominant. In variant C, 16 species were isolated, among which *F. oxysporum* /19%/ and *Mortierella alpina* /16%/ occurred most often. Both variants were more differentiated by the mycoflora of eggs. From these isolates *Cylindrocarpon destructans* /31%/ dominated in the control in variant C, however, *C. didymum* /20%/, *Exophiala* sp. /19%/, *F. oxysporum* /17%/ and *V. chlamydosporum* /15%/ prevailed. Fungal species obtained in this study were already mentioned in experiments with *G. rostochiensis* /CLOVIS and NOLAN, 1983; MORGAN-JONES and RODRIGUEZ-YABANA, 1986; WRONKOWSKA and JANOWICZ, 1986/ and other nematodes /PASSATIOVA and LYSEK, 1982; GINTIS et al., 1983; NIGH et al., 1980/.

Most of the isolated fungi parasitized the surface of the cysts and their inside, entering them by natural openings and, perhaps, by destroying the cyst wall. Colourless and brown, microsclerotes-forming mycelium, chlamydospores, contorted larvae and dead eggs with or without symptoms of parasitism /effect of mycotoxins? enzymes?/ were observed during the examinations of the cysts' contents.

In the presented experiment, 11% /A/ and 17% /C/ parasitized eggs - investigated directly after the disruption of cysts - were obtained

/WRONKOWSKA, 1989/. However, at the same time, the number of cysts and live larvae were considerably larger in variant C than in the control /JANOWICZ, unpublished information/.

It was found that, except for the fungi isolated from eggs, among which less than half hydrolysed chitin, in the other tests, independently from the variants of experiment and of the part of cysts from which the strains

Table 2
The percentage of proteo-, chitino- and lipolytic fungal strains, isolated from the surface and eggs of G. rostochiensis cysts

Medium	Activity of hydrolysis	A variant		C variant	
		cysts surface	eggs	cysts surface	eggs
Gelatin	s	56	60	14	35
	m	22	20	34	30
	w	11	20	52	26
	l	11	0	0	9
Chitin	s	11	0	0	4
	m	67	0	0	39
	w	11	40	81	5
	l	11	60	19	52
Tributyryn	s	56	20	14	17
	m	22	60	14	48
	w	22	0	72	26
	l	0	20	0	9

For A and C see Table 1; Activity of hydrolysis: strong hydrolysis, digestion exceeds colony, m - mean hydrolysis, digestion under the whole colony, w - weak hydrolysis, digestion under colony centre, l - lack of hydrolysis

were isolated, the studied media were digested by 80% to 100% of the isolates /Table 2/. Most cyst surface isolates from the control variant were found to be able to hydrolyse gelatin and tributyrin in a high degree and chitin in a medium degree. However, the strains from variant C, digested the investigated media weakly in general, although all these isolates had proteolytic properties, which was positively correlated with ovicidity /CHALUPOVA, 1985; KUNERT et al., 1985, 1987/. The differences in the hydrolytic activity among isolates from eggs were not large. The observed differences could be caused not only by the various composition of mycoflora associated with cysts, but also by the different hydrolytic activities of the same fungal species, that have been shown among F. oxysporum and Paecilomyces lilacinus strains /WRONKOWSKA, 1987; 1989/.

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