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STUDIES ON THE EFFICACY OF *PAECILOMYCES LILACINUS* AS BIOCONTROL AGENT AGAINST A DISEASE COMPLEX CAUSED BY THE INTERACTION OF *ROTYLENCHULUS RENIFORMIS, MELOIDOGYNE INCOGNITA* AND *RHIZOCTONIA SOLANI* ON COWPEA[1]

by
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For several years there has been considerable interest in the use of soil fungi that parasitize the females and eggs of certain nematodes (Jatala *et al.*, 1979; Mankau, 1980; Tribe, 1980; Harman *et al.*, 1981). Jatala *et al.* (1979) reported on the efficacy of *Paecilomyces lilacinus* (Thoms) Samsom against *Globodera pallida* and *Meloidogyne incognita acrita* and later (Jatala, 1985) on its efficacy against different nematodes (*Globodera rostochiensis*, *Radopholus similis*, *Tylenchulus semipenetrans*) on various crops. As there are no reports on the use of *P. lilacinus* in a disease complex we have evaluated its potentiality in one involving *Rotylenchulus reniformis* (Linford *et* Oliveira); *Meloidogyne incognita* (Kofoid *et* White) Chitwood and *Rhizoctonia solani* Kuhn on cowpea, *Vigna unguiculata* (L.) Walp.

Materials and methods

Surface sterilized seeds of cowpea cv. Pusa Barsati were inoculated with the cowpea strain of *Rhizobium* and sown in 15 cm clay pots containing 1 kg of a 3:1:1 compost (autoclaved soil: river sand: farm yard manure). When seedlings were one week old they were individually or concomitantly inoculated with *Rotylenchulus reniformis*, *Meloidogyne incognita* (1000 nematodes/pot) or *Rhizoctonia solani* (1g mycelium/pot) (Table I). *P. lilacinus* was added to the treatments at 2g per pot, following the rate found by Khan (1986) to be the most effective against the three pathogens. Each treatment was replicated five times and the pots were randomized in a glasshouse.

After two months each plant was oven dried and dry weights of roots and shoots obtained. The number of root nodules due to *Rhizobium* were counted. The numbers of nematodes in the soil and in plant tissues were assessed and their reproduction factor ($R = \frac{Pf}{Pi}$) determined.

One hundred females and eggmasses of each nematode species were collected from the roots of plants inoculated with *P. lilacinus* and nematodes. These females and eggmasses were transferred separately to sterilized petri dishes containing autoclaved 1% water agar and incubated at 25°C. After seven days incubation the percentage of fungus-infected females and eggmasses was calculated. Data obtained were analysed statistically.

Results and discussion

Paecilomyces lilacinus which was not pathogenic on cowpea, reduced plant damage when inoculated simultaneously with the test pathogens, individually or concomitantly (Table I). In the absence of *P. lilacinus* there was a reduction in plant growth and root nodulation due to the pathogens which was significantly attenuated by the fungus. *P. lilacinus* parasitized a large percentage of the females and eggmasses of both *R. reniformis* and *M. incognita* with a consequent reduction in their multiplication (Table I).

Concomitance of any two or all three test pathogens caused significant reductions in plant growth and root nodulation but the presence of *P. lilacinus* in each case suppressed nematode multiplication and consequently reduced the plant damage caused by concomitance of pathogens. Considerable numbers of females and eggmasses were also found parasitized by *P. lilacinus*.

Thus the application of *P. lilacinus* significantly reduced plant damage caused by either of the test pathogens singly or in combination. It also reduced nematode multiplication and root galling. Its efficacy was, however, more pronounced against monopathogenic than against multipathogenic infections. *P. lilacinus* effectively reduced

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TABLE I - *Efficacy of* Paecilomyces lilacinus *for the control of disease complexes involving two nematodes and a fungus.*

Treatment	Dry weight «g»				Root-knot nematode population				Reniform nematode population					Percentage of infection (root-knot nematode)		Percentage of infection (reniform nematode)		Number of nodules /root system	Percentage reduction over control
	Shoot	Root	Total	Percentage reduction over control	Number of juveniles/ kg soil	Number of females /g root	Total	$R = \frac{Pf}{Pi}$	Number of juveniles kg soil	Number of females /g root	Total	$R = \frac{Pf}{Pi}$	Root-knot index	Females	Eggmasses	Females	Eggmasses		
Control	7.6	2.6	10.2	—	—	—	—	—	—	—	—	—	—	—	—	—	—	105	—
Pl*	7.2	2.6	9.8	4	—	—	—	—	—	—	—	—	—	—	—	—	—	103	2
Rr*	5.9	1.9	7.8	23	—	—	—	—	7633	230	7863	7.9	—	—	—	—	—	76	28
Rr + Pl	6.4	2.2	8.6	16	—	—	—	—	4367	126	4493	4.5	—	—	—	40	37	85	19
Mi*	4.7	1.5	6.2	39	15667	417	16084	16.1	—	—	—	—	3.4	—	—	—	—	71	32
Mi + Pl	6.2	2.0	8.2	19	6800	167	6967	7.0	—	—	—	—	2.0	56	75	—	—	91	13
Rs*	4.0	1.3	5.3	47	—	—	—	—	—	—	—	—	—	—	—	—	—	52	50
Rs + Pl	5.1	1.7	6.8	33	—	—	—	—	—	—	—	—	—	—	—	—	—	64	39
Rr + Mi	4.0	1.3	5.3	48	12534	343	12877	12.9	6067	190	6257	6.3	2.8	—	—	—	—	49	53
Rr + Mi + Pl	5.7	1.8	7.5	26	6267	156	6423	6.4	5067	120	5187	5.2	1.9	60	69	34	27	73	30
Rr + Rs	3.3	1.0	4.3	57	—	—	—	—	5433	177	5610	5.6	—	—	—	—	—	43	59
Rr + Rs + Pl	4.3	1.4	5.7	43	—	—	—	—	4800	107	4907	4.9	—	—	—	32	37	62	41
Mi + Rs	2.4	0.8	3.2	69	10866	283	11149	11.1	—	—	—	—	2.4	—	—	—	—	34	68
Mi + Rs + Pl	4.7	1.5	6.2	39	6434	143	6577	6.6	—	—	—	—	1.6	57	73	—	—	57	46
Rr + Mi + Rs	1.7	0.4	2.1	79	8467	220	8687	8.7	4733	150	4883	4.9	2.0	—	—	—	—	26	75
Rr + Mi + Rs + Pl	2.6	0.8	3.4	66	5900	130	6030	6.0	3933	97	4030	4.0	1.2	47	63	38	42	38	64
L.S.D. (at 5% level)			0.55					1.03				0.63	0.54	12.54	15.39	13.46	12.62	8.75	
L.S.D (at 1% level)			0.75					1.44				0.88	0.76	19.00	23.31	20.40	19.12	11.79	

* Pl = *Paecilomyces lilacinus*; * Rr = *Rotylenchulus reniformis*; * Mi = *Meloidogyne incognita*.

root-knot and reniform nematode populations by killing females, reducing their fecundity and parasitizing egg-masses. *P. lilacinus* not only reduced the intensity of *M. incognita* and *R. reniformis* infections but also was antagonistic against *R. solani*.

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