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Effect of Antagonists in Combination with Carbendazim Against *Macrophomina phaseolina* Infection in Cowpea

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ABSTRACT

Pelleting of cowpea seeds with *Trichoderma viride* Pers: fr. either alone or in combination with carbendazim inhibited the growth of *Macrophomina phaseolina* Tassi (Goid.) *in vitro*. The treatment increased the germination and reduced the post emergence mortality under pot culture conditions. Carbendazim did not show any adverse effect on the antagonists *T. viride* and *T. harzianum* Rifai under *in vitro* and also in pot culture studies. Seed pelleting with carbendazim in combination with antagonist reduced the seedling mortality besides enhancing the growth characteristics like shoot length, root length and dry matter production.

KEY WORDS : *Trichoderma viride*, *T. harzianum*, carbendazim, growth inhibition, *Macrophomina phaseolina*, mortality, growth characters

Any biocontrol agent must be effective and compatible with modern production practices so that its use can be integrated into the production system. Recently, a novel blending technique has been reported in which the biocontrol agents were used simultaneously with seed dressing fungicides without any toxic effect on antagonists (Papavizas and Lumsden, 1980). The present study was therefore undertaken to find out the efficacy of seed pelleting with antagonists and carbendazim in the control of root rot of cowpea incited by *Macrophomina phaseolina* Tassi (Goid.).

MATERIALS AND METHODS

M. phaseolina was isolated from infected cowpea plant and multiplied in sand maize medium. The fungal inoculum was added to the soil in pots at 10g/kg of soil and allowed to grow for a week. Pelleting of cowpea (Co 4) seeds was done with carbendazim (Bavistin 50% WP) at 2 g/kg of seed and with the spore suspension of antagonists containing 10^6 spores/ml individually and also in combination. In the combination treatments with carbendazim and antagonists, carbendazim was treated first and 24 h later with antagonists. The conidial suspension of antagonist was centrifuged at 2500 g for 15 min and resuspended in sterile distilled water containing carboxy methyl cellulose (CMC) at 0.1%. Five ml of spore suspension/ 100 g of seeds was tried in this experiment (Sivan *et al.*, 1984). The experiment consisted of eight treatments inclusive of three antagonists *viz*., *T. viride* (CMI isolate), *T. viride* (native isolate) and *T. harzianum*, a seed dresser, carbendazim and also their combinations. The seeds after treatment were shade dried overnight. The effect of treatments were tested under *in vitro* conditions. The potato dextrose agar medium seeded with *M. phaseolina* was poured in the Petri dishes and the treated seeds were placed in the centre of the Petri dish. Three replications were maintained for each treatment. The inhibition zone of *M. phaseolina* was recorded on 3rd and 6th day after plating.

The same treatments were also tried under pot culture conditions and each treatment was replicated thrice. The treated seeds were sown in the pots inoculated with *M. phaseolina* as mentioned elsewhere. The germination, pre-emergence and post emergence mortality were recorded 10 and 40 days after sowing (DAS). Further, the shoot length and root length of the plants were recorded 50 DAS. Then the plants were pulled out from the pots and they were dried in the hot air oven at 65°C. The dry weight of the plants from each treatment was recorded.

RESULTS AND DISCUSSION

The results from the *in vitro* study showed that the antagonists were not affected due to carbendazim treatment (Table 1). *T. viride* reduced the growth of *M. phaseolina* in the Petri plates on the 3rd and 6th days of inoculation and recorded 36.9 and 75.6% reduction over control. Carbendazim reduced the growth of *M. phaseolina* on 3rd day and was found to be more effective than the antagonists but the data on 6th day revealed that all three antagonists were found to be more inhibitory to *M. phaseolina* than carbendazim.

The inhibition of *M. phaseolina* was found to be maximum in the combination treatments than in the antagonists on 3rd day but the effect changed on 6th day in which the treatment with the antagonist gave maximum inhibition ranging from 53.5 to 68.0%. Among the antagonists, *T. viride* showed the maximum inhibition zone of 68.0 mm.

The data on mortality of seedlings showed that germination was slightly affected due to *M. phaseolina* in the initial stages (Table 2). Seeds treated with carbendazim + *T. viride* (N) showed maximum germination of 91.8% as against 73.6% in control under inoculated conditions. In the initial stages, the combination treatments effectively reduced pre-emergence mortality. On 40th day after sowing also, the post emergence mortality was found to be less in combination treatments than with antagonists alone. It was interesting to note that the seeds treated with *T. viride* and carbendazim + *T. viride* resulted in less post emergence mortality indicating the compatibility of carbendazim with *T. viride*. Regarding the data on growth characters also, seed pelleting with *T. viride* either alone or in combination with carbendazim recorded the maximum shoot length, root length and dry matter production. Both the above treatments were found to be statistically on a par. All the treatments recorded increased shoot length, root length and dry matter production over control.

The benefit of antagonists in the suppression of disease symptoms has been widely reported (Baker and Cook, 1974; Papavizas and Lumsden, 1980). Bhaskaran and Seetharaman (1986) reported that seed treatment with *T. harzianum* effectively inhibited the growth of *M. phaseolina* in Petri plates besides enhancing the germination rate in pots from 40 to 72 per cent. Ramadoss and Sivaprakasam (1986) reported effective control of *M. phaseolina* infection in cowpea with carbendazim. The effect of integration of *Trichoderma* with chemicals was also reported by several workers (Ohr *et al.*, 1973; Papavizas *et al.*, 1982; Papavizas and Lewis, 1983). The control of *Armillaria mellea* (Vohl ex Fr.) Kummer with a combination of methyl bromide and *Trichoderma* was found to be a classical example of integrated pest management involving the use of a pesticide with a biocontrol agent (Papavizas *et al.*, 1982).

The use of a fungicide and a biocontrol agent like *T. harzianum* was reported to control damping off in several vegetables caused by *Rhizoctonia solani* Khun. (Henis *et al.*, 1978; Elad *et al.*, 1980). In the present study also, seed pelleting with *T. viride* either alone or in combination with carbendazim reduced the seedling mortality besides enhancing the growth. The change in soil reaction that was expected due to the increased avtivity of introduced *Trichoderma* might be one of the reasons for the increased seedling growth characters besides production of some growth regulating substances by the antagonists (Papavizas and Lumsden, 1980).

The integration of several control technologies may be required to increase yield and quality and also to minimize environmental hazards. The use of tolerant strains of *Trichoderma* with a selective pesticide may offer a distinct possibility of control in cases where no single component is effective. More research is needed on the integration of *Trichoderma* with chemical approaches to improve the prospects for disease control.

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TABLE 1. In vitro effect of antagonists in combination with carbendazim against *M. phaseolina* in cowpea

Treatment	on 3rd day		on 6th day	
	Radial growth of *M. phaseolina* in mm	Inhibition zone in mm	Radial growth of *M. phaseolina* in mm	Inhibiton zone in mm
Trichoderma viride (CMI)	61.5	28.5 [c]	30.5	59.5 [ab]
T. viride (N)	55.8	34.2 [b]	22.0	68.0 [a]
T. harzianum	68.2	21.8 [d]	36.5	53.5 [b]
Carbendazim 2 g / kg	51.0	39.0 [ab]	53.0	37.0 [c]
Carbendazim + *T. viride* (CMI)	47.8	42.4 [a]	39.0	51.0 [bc]
Carbendazim + *T. viride* (N)	46.5	43.5 [a]	31.5	58.5 [b]
Carbendazim + *T. harzianum*	50.5	39.5 [a]	47.5	42.5 [c]
Control	88.5	--	90.0	--

In a column, means followed by a common letter are not significantly different at 5% level (DMRT)

TABLE 2. Effect of carbendazim and antagonists on germination and post emergence mortality

Treatments	Germination (%)	Post-emergence mortality (%)
T. viride (CMI)	79.8 cd	29.7 c
T. viride (N)	84.0 bc	19.2 ab
T. harzianum	74.6 de	31.6 c
Carbendazim 2 g / kg	85.3 bc	16.4 ab
Carbendazim + *T. viride* (CMI)	87.6 ab	16.7 ab
Carbendazim + *T. viride* (N)	91.8 a	13.0 a
Carbendazim +*T. harzianum*	76.3 de	23.2 b
Control	73.6 e	77.8 d

In a column, means followed by a common letter are not significantly different at 5% level (DMRT)

TABLE 3. Influence of carbendazim and antagonists on growth characters

Treatments	Shoot length (cm)	Root length (cm)	Dry matter production g/plant
T. viride (CMI)	29.7 c	5.9 c	1.85 b
T. viride (N)	35.7 ab	6.8 ab	2.22 a
T. harzianum	34.5 ab	6.1 bc	2.18 ab
Carbendazim 2 g / kg	33.0 bc	6.6 ab	2.07 ab
Carbendazim + *T. viride* (CMI)	36.9 ab	6.5 a	2.10 ab
Carbendazim + *T. viride* (N)	38.6 a	7.2 a	2.35 a
Carbendazim + *T. harzianum*	29.9 c	6.3 bc	2.20 ab
Control	24.0 d	5.0 d	1.46 c

In a column, means followed by a common letter are not significantly different at 5% level (DMRT)

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