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Short Communication

Effect of soil drenching of fungicides on the survival of *Trichoderma viride*

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ABSTRACT

Effect of soil drenching of carbendazim, thiram and copper oxychloride on the survival and competitive saprophytic ability (CSA) of *Trichoderma viride* was investigated. Thiram caused a marked reduction of the survival and CSA of *T. viride*. Copper oxychloride supported the survival and CSA. Carbendazim had an intermediate effect. Toxic effect of thiram and carbendazim persisted for 30 days and thereafter *T. viride* showed reinfestation capacity.

Key words: Fungicides, survival, biocontrol, *Trichoderma viride,* soil.

Biological control is an important environmentally sound method of plant disease management. The fungal biocontrol agent *Trichoderma viride* Pers Fr., is commonly used in recent years for the management of crop diseases (Harman 1991; Sanker and Jeyarajan 1996). Biocontrol agents are effective against soil-borne diseases only when they survive in soil for a long time. Survival ability of the antogonists can be increased by creating a suitable environment either by the addition of adequate food materials or by suppressing the other microorganisms in the soil. Soil application of fungicides is still a practice for the control of many soil-borne diseases. Some of the carbamate fungicides have been shown to be moderately persistent (Haris 1970) and to have some effect on the microbial activities in soil (Bartha *et al.* 1967; Tu 1970). Soil application of carbofuran showed mycotonic effect on the growth and sporulation of *T. viride* (Sridar *et al.* 1995). This paper reports the effect of some of the fungicides on the survival and population dynamics of *T. viride* in soil.

Two hundred grams of air-dried, powdered and sieved garden soil was filled in plastic pots (10 cm dia.). The fungal biocontrol agent *Trichoderma viride* 1 obtained from Tamil Nadu Agricultural University, Coimbatore was multiplied in wheat bran-peat mixture (1:1 W/V) for 10 days at 30±1°C and mixed with pot soil @ 2 per cent by weight and incorporated thoroughly. The initial inoculum density of *T. viride* added was 4.5×10^5 conidia g^{-1} of wheat bran-peat preparation. The stock solutions (1000 ppm) of carbendazim, thiram and copper oxychloride were prepared and pipetted out at calculated dilutions to soil separately, to maintain the desired final level *viz.*, 500, 1000 and 1500 mg l^{-1}. Simultaneously, a control was also maintained without the addition of fungicide. The trial was conducted in a completely randomized block design with three replications. Soil samples were taken at the beginning of the experiment and thereafter at 10 day intervals up to 40 days. Soil dilutions were prepared (Warcup 1950) and the population of *T. viride* was assessed by plating on *Trichoderma* special medium (Elad and Chet 1983). The typical colonies formed on the plates were counted on 4th day of incubation.

Measurement of competitive saprophytic ability (CSA) was done by cellophane bit baiting method as described by Ahmed and Baker (1987). Cellophane bits (5 cm) were buried in pot soil (20 bits pot^{-1}) which were previously drenched with the fungicides and the biocontrol agent as in the previous experiment. The cellophane bits were removed after 10, 15 and 20 days of incubation and placed on *Trichoderma* special medium for the generation of the antagonist. The CSA index was calculated by using the formula suggested by Ahmed and Baker (1987).

Results indicated that thiram caused a marked reduction in the population of *T. viride* at all the concentrations tried (Table 1). There was a greater reduction in the population with the increase in the concentration of the chemical. The minimum

Abbreviations: CFU- Colony forming unit, CSA- Competitive saprophytic ability.

Table 1. Effect of fungicides on the survival and competitive saprophytic ability of *Trichoderma viride* in soil.

Fungicides	Concentration ppm	Population of *T. viride**/Sampling period (days) 0	10	20	30	40	CSA** Index
Carbendazim	500	45.4	38.6	27.5	20.3	26.3	0.180
	1000	44.8	34.5	23.3	17.6	21.4	0.130
	1500	45.3	30.6	19.6	14.3	17.8	0.095
Thiram	500	44.9	32.6	25.6	18.6	24.6	0.165
	1000	45.2	30.4	22.1	16.4	20.1	0.120
	1500	45.0	26.5	17.4	12.8	15.8	0.070
Copper oxychloride	500	44.8	52.6	58.8	65.3	68.7	0.375
	1000	44.9	51.4	56.3	62.1	64.8	0.340
	1500	45.3	49.5	53.7	59.0	62.4	0.325
Control		44.7	47.8	50.3	54.2	56.8	0.265
CD (p= 0.05)		1.23					0.012

* Population of *T. viride* as x 10^4 cfu g^{-1} soil
** Competitive Saprophytic Ability Index

population of 15.8 x 10^4 cfu g^{-1} soil was observed at 1500 ppm whereas the population in the control was 56.8 x 10^4 cfu g^{-1} soil. Carbendazim also reduced the population of *T. viride* and the maximum reduction was observed with the concentration of 1500 ppm (17.8 x 10^4 cfu g^{-1} soil). The CSA index of the antagonist was also markedly reduced by thiram followed by carbendazim and the CSA index was the least (0.07) with 1500 mg l^{-1} of thiram. The inhibition of growth and sporulation of *Trichoderma* due to incorporation of benzimidazole group of fungicides has been reported earlier (Yamaguchi 1978; Papavizas *et al.* 1982).

In contrast to thiram and carbendazim, soil drenching of copper oxychloride gradually increased the population from 0 to 40 days at all the concentrations used. The microbial equilibrium of soil is often subjected to alterations by the application of chemicals. The chemical treatment that eliminates pathogens and other groups of microorganisms undoubtedly create a partial biological vacuum in soil (Baker 1981). The biological vacuum thus created might have been successfully recolonized by *Trichoderma* than the others as observed in the present studies.

The population decrease of *T. viride* was seen only upto 30 days and thereafter it gradually increased corresponding to the concentration of thiram and carbendazim. This shows the reinfestation capacity of the antagonist, inspite of the presence of toxic residue. Reinfestation capacity is a favourable phenomenon and an important quality of an antagonist often looked for.

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