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Effect of plant protection chemicals on the growth of *Trichoderma* spp.

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The effects of thirteen pesticides on the growth of three species of *Trichoderma* have been studied and Carpropamide, Validamycin and Indoxacarb did not restrict their growth and sporulation. Mancozeb, Tebuconazole and Thiophanate-methyl inhibited their growth while others had a varied response.

Key words : *Trichoderma*, compatibility, pesticides

INTRODUCTION

Several plant diseases have been successfully controlled by *Trichoderma* sp. and it has come to the fore as a potential biocontrol agent. Its use in the management of soil borne plant pathogens has been exemplary as fungicidal drenching for the same has not met the satisfaction of the farming community. As fungicides, insecticides and herbicides continue to be the major plant protection chemicals in the pest control scenario, their effect on the growth of *Trichoderma* spp. need to be assessed. In the present study, an effort has been directed towards generating a database regarding the compatibility of *Trichoderma* spp.with a few commercial agrochemicals.

MATERIALS AND METHODS

In vitro testing was done by using three species of *Trichoderma* namely *Trichoderma* viride, *T. virens* and *T. harzianum*. Isolates of each, showing aggressive growth and good sporulating characters were selected for the study. Fourteen different treatments including eight fungicides, three insecticides and two herbicides were selected for the experiment along with one untreated control. The pesticides were used in their recommended dosages namely Carpropamid 300SC @ 0.08%, Myclobutanil 10WP @ 0.1%, Validamycin 3SL @ 0.2%, Cymoxanil 8% + Mancozeb 64% WP @ 0.3%, Hexaconazole 2SC @ 0.15%, Thiophanate-methyl 75WP @ 0.1%, Mancozeb 35SC @ 0.3%, Tebuconazole 250EC @ 0.15%, Indoxacarb 14.5SC @ 0.1%, Bifenthrin 10EC @ 0.2%, Dicofol 18.5EC @ 0.25%, Fluchloralin 45EC @ 0.5% and Pendimethalin 30EC @ 0.8%. The desired quantities of these agrochemicals were added in the previously molten potato dextrose agar (PDA) medium separately and poured in Petriplates (diameter 90 mm.). Five replications of each treatment were done. The inoculation was done with 8 mm. disc of the selected isolates of *Trichoderma* and the plates were incubated at 26° ± 2° C. Observations were recorded 96 h after inoculation.

RESULTS AND DISCUSSION

The growth of *Trichoderma virens, T. viride* and *T. harzianum* has been affected to a varying extent by different pesticides, which is enumerated as follows:

Effect of fungicides

Of the eight fungicides tested the new formulation of Mancozeb 35SC completely inhibited the growth of *T. viride* and *T. virens* but allowed a marginal growth of *T. harzianum* (Table 1). Inhibition of *Trichoderma* sp. by Mancozeb at 500 ppm has been reported (Gupta *et al.*, 1995).

Table 1 : Effect of pesticides on the growth of *Trichoderma* spp.

Treatments	Dose(%)	Mean Radial growth (mm) after 96 h		
		T. viride	*T. harzianum*	*T. virens*
T-1 : Carpropamid 300SC	0.08	40.0	40.0	39.5
T-2 : Myclobutanil 10WP	0.1	36.5	12.0	2.0
T-3 : Validamycin 3SL	0.2	21.5	20.5	25.0
T-4 : Cymoxalin 8% + Mancozeb 64% WP	0.3	17.5	0	13.5
T-5 : Hexaconazole 2SC	0.15	12.0	2.0	0
T-6 : Thiophanate-methyl 75WP	0.1	0.5	1.5	0.5
T-7 : Mancozeb 35SC	0.3	0	1.0	0
T-8 : Tebuconazole 250EC	0.15	0	0	0.5
T-9 : Indoxacarb 14.5 SC	0.1	40.0	40.0	40.0
T-10 : Bifenthrin 10EC	0.2	9.0	7.5	9.0
T-11 : Dicofol 18.5EC	0.25	7.5	8.0	3.0
T-12 : Fluchloralin 45EC	0.5	4.0	3.0	0
T-13 : Pendimethalin 30EC	0.8	4.0	6.5	4.0
T-14 : Control	–	41.0	40.0	41.0
SE		1.09	0.53*	0.73
CD (5%)		1.84	0.90	1.23

*Average of 5 replications

Out of the two new molecules of fungicides used, Carpropamid 300SC did not inhibit the growth of the three species of *Trichoderma* as compared to control and profuse sporulation could be observed. On the other hand, Tebuconazole 250SC inhibited the growth of all the three species.

Thiophanate-methyl 75 WP checked the growth of both the *T. virens* and *T. viride* while *T. harzianum* was found to be feebly compatible to the fungicides. A brown colouration developed around the inoculation of both the *T. virens* and *T. viride*. A very close analogue of Thiophanate-methyl i.e. Carbendazim, however, had mixed responses- it may be toxic to *Trichoderma* sp. (Dubey and Patel, 2001 ;Viji *et al.*, 1997.) or have no antagonistic effect on it (Alagarsamy and Sivaprakasam, 1988.).

Validamycin 3SL allowed a moderate growth of *T. virens, T. viride* and *T. harzianum* as compared to control and may be considered a compatible antibiotic against the bio-fungicides. Sporulation is also observed in all the three species, but only on or around the inoculum. *T. virens* exhibited two sporulating rings, very close to each other. Similar compatibility of Validamycin was reported by Ghatak *et al.* (2009).

Myclobutanil 10WP, Cymoxanil 8% + Mancozeb 64% WP and Hexaconazole 2SC had a differentiating effect on *Trichoderma* sp. Myclobutanil did not interfere with the growth and sporulation of *T. viride* at all as compared to control. However, it did have a moderating influence on *T. harzianum* and did not allow it to grow as profusely as *T. viride*. The growth of *T. virens* was also relatively checked by Myclobutanil. Cymoxanil-Mancozeb combination checked the growth of *T. harzianum* completely, but the other two species had a moderate growth in presence of the fungicide. On the other hand, Hexaconazole inhibited the growth of both the *T. harzianum* and *T. virens*, but allowed the growth of *T. viride*. On the contrary, Ghatak *et al.* (2009) reported that Hexaconazole was non-compatible to all the isolates of *Trichoderma* used in the study.

Effect of insecticides

Out of the three insecticides used in the experiment, Indoxacarb 14.5SC did not restrict the growth of *T. viride*, *T. harzianum* and *T. virens* as compared to control (Table 1) but the amount of sporulation in case of *T. harzianum* was more than other two species. The specific reason for this is not known but similar stimulation of growth and sporulation of *Trichoderma* by some insecticides like Phorate, Carbofuran etc., has been reported (Das and Mukherji, 2000.).

Both Bifenethrin 10EC and Dicofol 18.5EC were

moderately responsive to the growth of *Trichoderma* spp. but the latter restricted the growth of *T. virens.* as compared to other species. In case of Dicofol, profuse sporulation was observed in *T. harzianum* and *T. viride* inoculum, but not in *T. virens* inoculum. It may be due to the inhibition of some specific enzymes at a particular concentration of the chemicals (Omar and Abd-Alla, 2000).

Effect of herbicides

Both the herbicides used i.e. Fluchloralin 45EC and Pendimethalin 30EC had an inhibitory effect on all the three species of *Trichoderma* and the former did not allow any growth of *T. virens* (Table 1). Scanty sporulation was observed in all the cases except that of *T. virens* and Fluchloralin combination. Six strains of *Trichoderma* sp. were inhibited by Pendimethalin *in vitro* at 50% concentration of their recommended dose (Gulhane *et al.,* 2004.).

Pesticide form an integral part of pest management for sustainable development. At the same time, to reduce the chemical load of the environment, biopesticides are gradually carving a niche for themselves. The coexistance of the two is perhaps the pivotal stone for future management of biotic maladies. Thus, the compatibility fixture needs to be drawn between the chemical and biopesticides. The above investigation provides an insight about the *in vitro* compatibility of some selected pesticides with *Trichoderma* spp. and the promising compatible ones should be tested in vivo to give a holistic picture of same.

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