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Effect of *Trichoderma viride* Liquid Formulations on Percent Growth Inhibition of Soil Born Pathogens

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A B S T R A C T

An experiment was conducted during 2016-17 in the department of Plant Pathology, College of Agriculture, Nagpur. The experiment was laid out in Completely Randomized Design (CRD) with 10 treatments and three replications. Shelf life studies of *Trichoderma viride* was executed by using different carriers viz. paraffin oil, mustard oil, groundnut oil, diesel, soybean oil, sunflower oil, talc powder mixed with broth 40ml + 5ml dispersant + 3ml suspender + 8ml surfactant in each oil. All the treatments significantly helped in inhibiting the radial mycelial growth of *Fusarium oxysporum* f. sp. *ciceri*, *Rhizoctonia bataticola* and *Pythium debarianum* over control. Among the treatments, paraffin oil and soybean oil were recorded maximum inhibition against *Fusarium oxysporum* f. sp. *ciceri* (93.90 and 92.63 per cent, respectively) as compared to control than other organism.

Introduction

Trichoderma is a genus of asexually reproducing fungi that is present in all type of soils. Recent discoveries show that they are opportunistic, avirulent plant symbionts, as well as being parasites of other fungi. At least some strains establish robust and long-lasting colonizations of root surfaces and penetrate into the epidermis and a few cells below this level. They produce or release a variety of compounds that induce localized or systemic resistance responses. These root microorganism associations cause substantial changes to the plant proteome and metabolism. Plants are protected from numerous classes of plant pathogen by responses that are similar to systemic acquired resistance and rhizobacteria-induced systemic resistance. Root colonization by *Trichoderma* spp. also frequently enhances root growth and development, crop productivity, résistance to abiotic stresses and the uptake and use of nutrients.

As most of the crops are infected by the soil borne plant pathogens that primarily attack the vulnerable seeds or seedlings, *Trichoderma* can be applied directly to target area, i.e., to seeds or seedlings and a single application using an existing delivery system (seed treatment, biopriming, furrow treatment) can significantly reduce crop losses. A number of successful products based on different species of *Trichoderma* have been commercialized in India and elsewhere (Kumar *et al.*, 2013). In

powdered fungal inoculants commercially 40 product are being and worldwide available for biocontrol of plant pathogens. In addition, there are several other microbial product, for plant growth promotion and nutrient mobilization. The fungus *Trichoderma* is most frequently used for control of plant pathogen.

At least 12 commercial products containing *Trichoderma* spp. as main active ingredient control a variety of pathogens, including Botrytis, *Fusarium*, *Gaeumanomyces, Pythium, Rhizoctonia, Sclerotinia, Sclerocium, Verticillium* and wood rotting fungi. Formulations of *Trichoderma* vary considerably depending on their intended use.

For example, a combination of *T. viride* and *T. harzianum*is formulated as liquid for soil incorporation, as dowels for insertion of into a wood, as wettable powder in a syringe for injection into a grape and as a wettable powder, which is formulated into a paste and applied with a paintbrush to wound (Trichoseal) (Chandra, 2011). Wettable powder inoculants contain 50-80 per cent technical grade powder 15-45 per cent filler, 1-10 per cent dispersant and 3-5 per cent surfactant by weight.

Materials and Methods

The present study was conducted in Plant Pathology Laboratory, College of Agriculture, Nagpur during the year 2016-2017. Pure culture of *Trichoderma viride* was collected from Plant Pathology Section, College of Agriculture Nagpur. The pure culture was mass multiplied for further studies.

Dual culture by filter paper disc method

Plates of PDA were inoculated with a 5 mm disc from five-day-old cultures of the phytopathogens taken from 10 mm from the edge of the plate.

After two days a 5 mm filter paper disc of the *Trichoderma viride* formulation was placed 55 mm from the phytopathogens disc. *Fusarium oxysporum* f. sp. *ciceri, Rhizoctonia bataticola, Pythium debaryanum* and the biocontrol strains were inoculated at the same time. Paired cultures were incubated at room temperature for six days.

The growth of the fungi was recorded by measuring the radial growth of the pathogens. The percentage growths of the pathogens were calculated as follows: % Growth = Radius of the growth in the direction of the test strain/radius of the growth in the absence of the test strain x 100 (Behzad *et al.*, 2008).

Results and Discussion

Effect of *Trichoderma viride* liquid formulation

All the treatments significantly helped in inhibiting the radial mycelial growth of *Fusarium oxysporum* f. sp. *ciceri, Rhizoctonia bataticola* and *Pythium debarianum* over control.

Observations recorded in table 1 showed that treatment T_2 (T_1 + Paraffin oil) was found significantly superior to the rest of treatment in checking the growth of *Fusarium oxysporum* f. sp. *ciceri, Rhizoctonia bataticola* and *Pythium debaryanum*. It showed 5, 6, and 7mm mean colony diameter against the control (82, 82 and 82 mm) with percent inhibition of 93.90, 92.68, 82.00 at 7^{th} DAI, respectively it was followed by the treatment T_6 (T_1 + Soybean oil), T_4 (T_1 + Groundnut oil) and T_8 (T_1 + departmental culture (Talc based) with mean mycelial growth of these three organism like 6,7,8 mm in T_6, 25.42, 26.42, 27.4, mm in T_4, 27.71, 28.71, 29.71, mm in T_8, with per cent inhibition of 92.82, 91.46, 90.24 in T_6, 69, 67.78, 66.58 in T_4, 66.2, 64.98, 63.76, in T_8 respectively.

Table.1 Effect of *Trichoderma viride* liquid formulation on percent growth inhibition on 7th DAI

Tr. No.	Treatment	Mycelial growth (mm)			Growth inhibition		
		Fusarium oxysporum* f. sp. *ciceri	***Rhizoctoa bataticola***	***Pythium debaryanum***	***Fusarium oxysporum*f. sp. *ciceri***	***Rhizoctoa bataticola***	***Pythium debaryanum***
T_1	Broth +Dispersant + Suspender + Surfactant	35	36	37	57.31	56.09	54.87
T_2	T_1+ Paraffin oil	5.00	6.00	7.00	93.90	92.68	82.00
T_3	T_1+ Mustard oil	28.18	29.18	30.2	65.63	64.40	63.17
T_4	T_1+ Groundnut oil	25.42	26.42	27.4	69	67.78	66.58
T_5	T_1 + Diesel	32.23	33.24	34.21	60.69	59.46	58.28
T_6	T_1 + Soybean oil	6.00	7.00	8.00	92.82	91.46	90.24
T_7	T_1+ Sunflower oil	42.11	43.11	44.11	48.64	47.42	46.34
T_8	Departmental culture (Talc)	27.71	28.71	29.71	66.20	64.98	63.76
T_9	Market Product(liquid)	42.00	43.60	44.5	48.78	46.82	45.73
T_{10}	Control	82.00	82.00	82.00			
	F test	Sig	Sig	Sig			
	SE ± m	0.41	0.37	0.38			
	CD (P=0.01%)	1.63	1.46	1.47			

These treatment further followed by the other treatments like T_3 (T_1 + Mustard oil), T_5 (T_1 + diesel oil), T_1 (Broth + dispersant + suspender + surfactant), T_9 (T_1 + Market product (liquid)), T_7 (T_1 + Sunflower oil), with mean mycelial growth of 28.18, 29.18, 30.2 in T_3, 32.23, 33.24, 34.21 in T_5, 35, 36, 37 in T_1, 42, 43. 60, 44.5 in T_9, 42.11, 43.11, 44.11 in T_7 with percent inhibition of 65.63, 64.41, in T_3 63.17, 60.69, 59.46, 58.28, in T_5 57.31, 56.09, 54.87, in T_1, 48.78, 46.82, 45.73 in T_9 48.64, 47.42, 46.34 in T_7 respectively.

The present investigation are in accordance with the results of earlier workers like Rajput *et al.,* (2010), Sychev and Shadoshnik, 1982; Lo *et al.,* 1996; Bari *et al.,* 2000; Shamsuzzaman *et al.,* 2003; Ngo *et al.,* Shalini *et al.,* 2006. Siameto *et al.,* (2010), Perveen *et al.,* (2012), Srivastava *et al.,* (2012), GaSwade *et al.,* (2012), Tapwal *et al.,* (2015), Dixit *et al.,* (2015) showed that the bioagent like *Trichoderma viride* inhibit the mycelial growth of the soil born pathogen. They revealed that the maximum growth reduction in the *Fusarium oxysporum* f. sp. *ciceri, Rhizoctonia bataticola.* Perveen *et al.,* (2012) showed that the antagonistic activity of *Trichoderma viride* against *Fusarium oxysporum* was excellent. Similar results were also obtained by Siameto *et al.,* (2010) and Srivastava *et al.,* (2012).

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