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Effect of Fungicides and Bio-Control Agent Against Dry Root Rot (*Rhizoctonia solani* Kuhn.) of Chilli (*Capsicum annuum* L.)

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Abstract *Rhizoctonia* spp. is an economically important pathogen widely distributed throughout the world and cause devastated disease. An attempt was made to manage the disease by holistic approach. An experiment was conducted during 2014-15. The different treatments were tested viz., fungicides (Vitavax and Carbendazim) and bio-agent (*Trichoderma viride*) as individual and combination against dry root rot of chilli. The minimum plant mortality was found in *T. viride* (2 kg/ha incubated on 1q of FYM for soil application) + Vitavax Power (3 g/kg seed) with 5 and 10% at 60 and 90 day after transplanting, respectively which was most effective as compare to all treatments.

Keywords Chilli, *Rhizoctonia*, Dry root rot, Fungicides, *Tricoderma* spp.

Introduction

Chilli (*Capsicum annuum* L.) is mainly cultivated for its vegetable green fruits and for the dry chilli as the spice of commerce. It is a rich source of Vitamin C, A and B. In India it is important cash crop which is grown for the both domestic and export market [1]. Chilli is valued for pungency which is imparted by an alkaloid, capsaicin and the red pigments (Capsanthin, Capsorubin and Capxanthin). These properties increase the demand for chilies all over the world. Chillies are widely used as spice, condiment, culinary, supplement, medicine, vegetable and are ornamental plants too. Chilli crop suffers with many fungal, bacterial and viral diseases resulting in huge yield losses. Among the fungal diseases, the root-rot incited by *Rhizoctonia solani* Kuhn is a major constraint in the production of chilli seedlings. *R. solani* is essentially soil-borne pathogen which inflicts heavy losses under favorable condition. Although some chemicals are known to control *R. solani*, they are not effective always. Furthermore, being a vegetable crop, using chemicals for disease control is probably not advisable in view of the residue problems. Bio-control of plant pathogens using antagonistic fungi, therefore, assumes significance. Among the antagonistic fungi, *Trichoderma* spp. has shown promise as a bio-control agent of *R. solani* in chilli [2].

Materials and Methods

Isolation of fungus

Rhizoctonia solani was isolated from the infected

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Table 1. Effect of treatments on dry root rot of chilli caused by *Rhizoctonia solani*. Figures in parentheses are angular transformed values.

Tr. No.	Treatments	Mean plant mortality (%) 60 DAT	90 DAT	Mean	Per cent plant mortality decrease over control 60 DAT	90 DAT	Mean
T_1	*Trichoderma viride* (ST & SA)	35.00 (36.27)	40.00 (39.23)	37.5 (37.76)	36.36 (37.08)	38.46 (38.33)	37.41 (47.71)
T_2	Carbendazim (ST & Soil drenching)	30.00 (33.21)	35.00 (36.27)	32.5 (34.76)	45.45 (42.39)	46.15 (42.80)	45.80 (45.60)
T_3	Vitavax Power (ST)	25.00 (30.00)	30.00 (33.21)	27.5 (31.63)	54.55 (47.60)	53.85 (47.21)	54.20 (47.40)
T_4	Carbendazim (ST) + *Trichoderma viride* (SA)	15.00 (22.78)	20.00 (26.56)	17.5 (24.73)	72.73 (58.51)	69.23 (56.30)	70.98 (57.41)
T_5	Vitavax power (ST) + *Trichoderma viride* (SA)	5.00 (12.93)	10.00 (18.43)	7.5 (15.90)	90.91 (72.45)	84.62 (66.90)	87.77 (69.54)
T_6	Control	55.00 (47.86)	65.00 (53.72)	60.00 (50.77)	0.00	0.00	0.00
	SEm±	5.13	9.95				
	CD at (p=0.05)	15.26	29.57				
	CV %	18.26	34.48				

roots/seedlings of chilli collected during the experiment. The diseased roots were thoroughly washed first in the running tap water and finally with sterilized water. The infected tissues of the roots were cut in to small pieces of 0.5–2 mm size and surface sterilized with 0.1% mercuric chloride solution for two minute and washed repeatedly thrice in sterile distilled water and aseptically placed in petri plates containing sterilized PDA and incubated at 28 ± 2°C. The culture thus obtained was purified by single spore isolation and identified as *R. solani* based on the morphological description given by Holliday, [3] and Sneh et al. [4].

Application of fungicide and biological agent

The fungal antagonist talk based formulation *T. viride* was obtained from Bio-pesticide Lab. Department of Entomology, Rajasthan College of Agriculture (Udaipur). The common treatments involved soil and seed application of carbendazim WP 50, vitavax and *T. viride* used as 2 kg ha^{-1} incubated on 1 qt. Farm Yard Manure (FYM) to check any soil or seed borne infection.

Treatment details: T_1 - *T. viride* 12 g/kg as seed treatment (ST) and 2 kg ha^{-1} incubated on 1 qt. FYM for soil application (SA), T_2 - Carbendazim 2 g/kg as seed treatment and 5 mg/ml soil drenching, T_3 - Vitavax power 3 g/kg seed treatment, T_4 - *T. viride* 2 kg ha^{-1} incubated on 1 qt. FYM soil application + Vitavax power 3 g/kg as seed treatment, T_5 - Carbendazim 2 g/kg as seed treatment + *T. viride* 2 kg ha^{-1} incubated on 1 qt. FYM as soil application, T_6 - Control.

Observation and data analysis

The experiment was carried out in complete randomized design (CRD). Per cent plant motality was assessed by using a 0–5 scale where: 0=no symptom; 1= 0–25% of root browning; 2= 26%–50% of root browning' 3=51%–75% of root browning; 4=76%–100% of root browning and 5= 100% of root browning [5]. The chilli seedlings were grown in pot culture and the results were recorded after 60 and 90 days after transplanting (DAT). Per cent plant mortality was recorded by:

$$\text{Per cent plant mortality} = \frac{\text{Number of diseased/dead plant}}{\text{Total number of plant observed}} \times 100$$

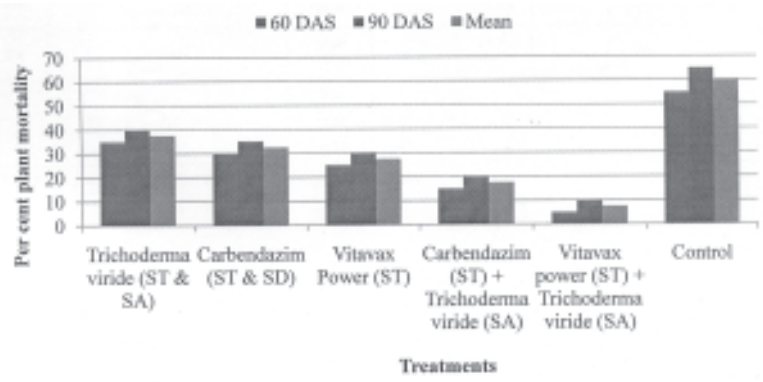

Fig. 1. Management of dry root rot of chilli through integrated approach.

Results and Discussion

The results revealed that all the treatments were statistically significant and decreased per cent plant mortality as compared to untreated check (control). At 60 and 90 date after transplanting, least per cent plant mortality was recorded in T_5-Vitavax Power + *T. viride* (5 and 10%) found most effective. These results are similar to Faruk et al. [6] and Champawat and Sharma [7] who employed biocontrol agents for the disease control and revealed the inhibitory effect was probably due to hyerparasitism/mycoparasitism, competition for space and nutritional source and antagonistic chemicals produced and released into the environment. *Trichoderma* spp. have been reported to produce antibiotic compounds (Trichodermin), extracellular enzymes (chitinase, cellulase) unsaturated monobasic acids (Dermadine), and polypeptides (Alamethicine, Suzukacillin), that either damage plant pathogen or enhance their population in biota. T_5 gave the satisfactory result of combined application of *T. viride* (12 g/kg seed) + Vitavax Power (3 g/kg seed) showed minimum root rot as compared to control. Similar results found in compatibility of fungicides (Carbendazim), Neem products and biocontrol agents (*T. harizanum* and *T. viride*) against soybean root-rot [8]. The subsequently effective treatment (T_4 was Carbendazim + *T. viride* with 15 and 20% plant mortality at 60 and 90 DAT, respectively. T_3 (Vitavax) and T_2 (Carbendazim) alone found moderately effective pn per cent plant mortality (25 and 30% at 60 DAT; 30 and 35% at 90 DAT) and results sapports by Vrataric et al. [9] and Singh et al. [10], While, T_1 (*T. viride*) alone was found least effective as compare to T_5 (combination of Vitavax + *T. viride*) with maximum plant mortality 35 and 40% at 60 and 90 DAT, respectively. Furthermore, Rini and Sulochana [11]; Shabir et al. [12] reports that application of *Trichoderma* sp. reduces the pathogen population in soil by means of mycoparasitism and production of antibiotic which may be reduce the soil borne pathogens in soil. Integrated treatments were better effective over their individual application as well as over the untreated control.

Similarly, at 60 and 90 days after transplanting per cent plant mortality decrease was calculated as compare to control. The treatment (T_5) Vitavax + *T. viride* was found most effective for decrease plant mortality. While maximum decrease in plant mortality was recorded 90.91 and 84.69% at 60 and 90 DAT, respectively. The treatment (T_4) Carbendazim + *T. viride* had decrease the plant mortality of 72.73 and 69.23% at 60 and 90 DAT, respectively. The least effective treatment (T_1) was *T. viride* had minimum decrease in plant mortality 36.30 and 38.46% at 60 and 90 DAT, respectively, (Table 1; Fig. 1). The results of the present study are similar to finding of Mathur and

Gurjar [13]; Das and Soma [14]; Lal et al. [15].

The overall most effective treatment (T_5) was Vitavax power (ST) + *T. viride* (SA) recorded minimum plant mortality (7.5%, mean) and per cent plant mortality decrease over untreated control (87.77%, mean).

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