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Short Communication

Efficacy of *Trichoderma* spp. against fusarial wilts of chickpea (*Cicer arietinum* L.)

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Like other crops, chickpea is also attacked by various diseases and insect-pests, out of which fusarial wilt and pod borer of chickpea are most severe; there are many methods such as breeding and cultivation of resistant varieties, use of chemical fungicides and insecticides for management of fusarial wilt of chickpea. However, increasing use of chemical fungicides and insecticides in plant protection results in several serious hazardous problems. Continuous uses of these chemical substances disturb our ecological equilibrium, result in increase of human diseases, problems of resistance in pests, pathogens and weed population. This problem can be minimized by using biological control agents under an integrated pest/ disease management programme. Therefore, in the present investigation, it was observed that application of bio-pesticide formulations in the laboratory, as well as in the field conditions showed significant performance in controlling wilt diseases.

Key words: *Tricoderma viride, Tricoderma harzianum*, fusarial wilt.

INTRODUCTION

Agriculture is the largest private enterprise in India, it has been and will continue to be the lifeline of the Indian economy. Agriculture contributes nearly one fourth of the national gross domestic product (G.D.P), sustains livelihood of about two thirds of the population and is the backbone of the agro-based industries. In the food sector alone, agriculture contributes to about Rs.250 thousand crores annually. Today, the country is facing a challenging task of maintaining food security to meet the demand of its overgrowing population. Annual crop losses due to pests, diseases and weeds have been estimated at about Rs.50 thousands crores in the country.

India, a major pulse producing country, accounts roughly for 33% of the total world production. Among pulses, gram or chana is one of the important pulse crop grown in India. Gram also known as chickpea, (*Cicer arietinum* L. accounting for about 32% of the area and 44% of the production of pulses in the country. Gram is grown in rabi season in about 7.3 million ha with an annual production of about 6.2 million tones. India has more than 80% of the worlds chickpea area and 69% of the world crop is harvested from India and Pakistan. Madhya Pradesh, Rajasthan, Maharashtra, Punjab, Haryana and Tamil Nadu are the major chickpea growing states in the country. Among diseases, Fusarium wilt is a serious disease of chickpea in India, Iran, Pakistan, Nepal, Burma, Spain, Tunisia and Mexico. An estimated annual loss of 42 million rupees was reported from India. Attempts were made to estimate loss in yield on a per plant basis.

Early wilting causes more loss than late wilting. Seeds harvested from wilted plants were lighter and duller than those from healthy plants (Haware and Nene, 1980). The affected seedlings show drooping of the leaves and paler colour. They may collapse and lie flat on the ground. The roots do not show any external rotting but look apparently healthy. Such roots, when split vertically from the collar region downward show a brown discoloration of the internal tissues.

MATERIALS AND METHODS

The materials used and methods adopted in the present study entitled, "Efficacy of *Trichoderma* spp. against fusarial wilt of chickpea (*C. arietinum* L.) " conducted in the research laboratory of the Department

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Table 1. Inhibitory effect of *Trichoderma* spp. against radial growth (mm) of *Fusarium oxysporum* f.sp. *ciceri* at different interval.

Treatments	24 h		48 h		72 h		Over all %IOC
	Mean	%IOC	Mean	%IOC	Mean	%IOC	
T_1	10	11.76	11.67	25.53	12	43.75	27.01
T_2	9.67	14.71	12.33	21.27	14.33	32.81	22.93
T_3	7.67	32.35	9.00	42.55	10.00	53.12	42.67
T_0	11.33	00.00	15.67	00.00	21.33	00.00	
	S. Ed. (±) 0.707		S. Ed. (±) 1.155		S. Ed. (±) 1.269		
	C.D. at 5% 1.541		C.D. at 5% 2.516		C.D. at 5% 2.766		

of Plant Protection, Allahabad Agricultural Institute Deemed University, Allahabad, U.P. in 2009.

Isolation and identification of biocontrol agents for fungal antagonist *Trichoderma* spp.

Soil was randomly collected from the rhizosphere in vegetables field at a depth of 5 to 15 cm and well pulverized to use it further for serial dilution (Aneja, 2004). Isolation of *Trichoderma* spp. and *Fusarium oxysporum* was done from soil by serial dilution and plate count method described by Johnsan et al. (1958). 10 g rhizosphere soil was added to 100 ml sterilized water blank and was shaken well for 15 min. Serial dilutions were prepared to 10^{-6} by adding 1 ml of 10^{-6} dilution which was transferred, melted and cooled PDA was poured in each petriplate. The plates were rotated gently and allowed to solidify and was incubated at room temperature for 5 to 6 days when *Trichoderma* and *Fusarium* colonies were observed. The identification of *Trichoderma* spp. and *F. oxysporum* were done on the basis of colony characteristics and microscopic examination. Standard book and papers were consulted while the examination of these fungi (Aneja, 2004; Rifai, 1969; Barnett and Hunter, 1972). The dual culture method described by Dennis and Webster (1971), was used to test the antagonistic ability of *Trichoderma* sp., against the pathogens isolated from infected root of chickpea (*F. oxysporum*), using the PDA medium.

The pathogens and bio-agents were inoculated simultaneously at two equiv-distant peripheral points in 90 mm diameter Petri dishes. Each treatment was replicated three times, along with control of pathogen and bio-agents, respectively. The inoculated plates were incubated at 25±2°C and inhibition of respective pathogens by bio-agents was measured (cm) at 24 h interval till 3 days.

Inhibition zone recorded

The growth of *F. oxysporum* f. sp. *ciceri* against *Trichoderma harzianum* and *Trichoderma viride* (in mm) was recorded at 24, 48, and 72 h, in dual culture medium. Plates were incubated at 25±2°C and inhibition zone was recoded:

I.O.C. in percent = [(Growth in C. P – Growth in T. P)/ (Growth in C. P)] × 100

The data was statistically analyzed by randomized block design (Chandel, 2002).

RESULTS AND DISCUSSION

It is revealed from Table 1 that during the years of investigation *T. harzianum* (T_1), *T. viride* (T_2) and their combination (T_3) resulted into significant reduction in the growth of *F. oxysporum* f.sp.*ciceri*. The growth of the test fungus was reported highest (42.67 mm) in the control (T_0). The highest percentage of inhibition was found in T_3 (*T. harzianum* + *T. viride*) that was applied at different intervals that is 32.35% at 24 h, 42.55% at 48 h and 53.12% at 72 h respectively. This was followed by T_1 and T_2. *In vitro* studies of *Trichoderma* spp. in solid medium during both the years of investigation significantly inhibited the growth of *F. oxysporum* f.sp *ceceri.* Similar findings have also been reported by Singh et al. (2003) and Sonawane and Pawar (2001). They observed that *in vitro* condition of *T. viride* highly inhibit and suppress the growth of *F. oxysporum* and further *T. viride* was found to be significantly superior over *T. harzianum.* Observations under laboratory conditions were recorded for counting of cfu/g at monthly interval of different formulations prepared and measurement of the radial growth of wilt pathogen (*F. oxysporum*) at 24, 48 and 72 h interval. Significant inhibitory effect was recorded with both the species of *Trichoderma*; however the combination of *T. harzianum* and *T. viride* recorded maximum effect.

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