

## Effect of Bioagent on Growth of *Fusarium oxysporum*, *Sclerotium rolfsii* and *Rhizoctonia solani* in Chickpea

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### Abstract

*Trichoderma* species are known for antagonistic activity to many soil borne fungi and therefore it is been used as a bioagent. After day 7 of inoculation, maximum inhibition in radial growth of *Fusarium oxysporum* f. sp. *ciceri* and *Sclerotium rolfsii* was observed with *Trichoderma viride* (P) but in *Rhizoctonia solani*, maximum inhibition in radial growth of the fungus was observed with *Trichoderma harzianum* (P).

**Key words :** Chickpea, Bioagent, Growth.

Chickpea is well recognized as a valuable source of protein particularly in the developing countries where majority of the population depends on the low-priced foods for meeting dietary requirements. Its significance is more among Indians due to their reliance on vegetarian diets along with low purchasing capacity of more than 250 million (27%) people living below the poverty line. Like other pulses, supplementation of chickpea with cereal-based diet is considered one of the possible and promising options to mitigate the problems associated with protein energy malnutrition (PEM). Being legume, chickpea improves physical, chemical and biological properties of the soil and thus plays an important role in sustaining soil productivity. Wilt complex pathogens i.e. *Fusarium oxysporum*, *Sclerotium rolfsii* and *Rhizoctonia solani* is the dominant factor for reduction in grain yield of chickpea. *Trichoderma* species are known for antagonistic activity to many soil borne fungi and therefore it is been used as a bioagent. *T. viride*, *T. harzianum*, *T. hamatum*, *Aspergillus niger* and *P. fluorescens* were effective antagonists and significantly inhibited the growth of *M. phaseolina*, *F. oxysporum* and *S. rolfsii* in dual culture technique while *T. viride* and *T. harzianum* were most effective by producing volatile and non-volatile antibiotics (1—3).

### Methods

All *in vitro* studies on *Fusarium oxysporum*,

*Sclerotium rolfsii* and *Rhizoctonia solani* were conducted in the Department of Botany, Government E.R.R. Postgraduate College, Bilaspur (Chhattisgarh) during 2006-07. The cultures of *Trichoderma viride* and *T. harzianum* were obtained from the Department of Plant Pathology, Chandra Sekhar Azad University of Agriculture and Technology, Kanpur (UP) and Marathwada Agriculture University, Parbhani (MH). Three local isolates one each from Narayanpur (Bastar), Research Farm, IGAU, Raipur and Dhamdha (Durg) were collected. Antagonistic activity of these isolates against *Fusarium oxysporum* f. sp. *ciceri*, *Rhizoctonia solani* and *Sclerotium rolfsii* was evaluated, under *in-vitro* conditions by dual culture technique (4). In this technique, different isolates of *Trichoderma* spp. viz., *Trichoderma viride* and *Trichoderma harzianum* (Kanpur isolates), *Trichoderma viride*, *Trichoderma harzianum* (Parbhani isolates) and local isolates of *Trichoderma* (Raipur, Bastar, Durg) were screened for their antagonistic activity. Twenty ml of potato dextrose agar was poured in each of sterilized petriplates of 90 mm diameter. On solidification, 7 days old culture of both the antagonist and test pathogen were inoculated separately on one half of the plate at the same time. A 5 mm disc of young vigorously growing culture was taken from the margin and placed in the petriplate opposite to each other. The plates were incubated at room temperature. All the isolates of *Trichoderma* spp. were tested for their effectiveness against the pathogen. Observations on the diametric growth of antagonists

**Table 1.** Effect of different antagonists on radial growth and inhibition of *Fusarium oxysporum* f.sp. ciceri by dual culture technique. K—Kanpur isolate ; P—Parbhani isolate ; rpr—Raipur isolate ; drg—Durg isolate ; nrp—Narayanpur isolate. Average of three replications ; DAI—Day after inoculation.

Antagonist isolates	Growth (mm) and inhibition (%)			5 DAI			7 DAI		
	3 DAI <i>Fusa-</i> <i>rium</i>	<i>Tricho-</i> <i>derma</i>	Inhibi- tion (%)	<i>Fusar-</i> <i>ium</i>	<i>Tricho-</i> <i>derma</i>	Inhibi- tion (%)	<i>Fusa-</i> <i>rium</i>	<i>Tricho-</i> <i>derma</i>	Inhibi- tion (%)
<i>Fusarium</i> × <i>Trichoderma</i> <i>harzianum</i> (K)	26.6	49.0	14.5	28.0	57.2	23.7	31.5	67.7	20.9
<i>Fusarium</i> × <i>Trichoderma</i> <i>viride</i> (K)	25.7	63.2	17.4	31.7	65.0	13.6	33.2	67.0	16.6
<i>Fusarium</i> × <i>Trichoderma</i> <i>harzianum</i> (P)	24.7	57.7	20.6	30.5	59.5	16.9	32.5	66.0	18.3
<i>Fusarium</i> × <i>Trichoderma</i> <i>viride</i> (P)	26.0	56.0	16.4	31.5	57.5	14.2	30.5	69.7	21.4
<i>Fusarium</i> × <i>Trichoderma</i> spp. (rpr)	22.0	67.7	29.3	31.0	69.2	15.5	32.7	70.0	17.8
<i>Fusarium</i> × <i>Trichoderma</i> spp. (drg)	21.7	67.2	30.2	30.5	73.7	16.9	33.2	6.3	16.6
<i>Fusarium</i> × <i>Trichoderma</i> spp. (nrp)	25.7	65.5	17.4	30.0	70.7	18.3	30.7	70.7	22.9
Control	31.1			36.7			39.8		

and the test pathogen were measured at days 3, 5 and 7 of inoculation (DAI). The per cent inhibition of growth of test pathogen in presence of *Trichoderma* spp. was calculated over control as follows.

$$\text{Per cent growth inhibition} = \frac{\text{Growth of test pathogen in control plate} - \text{Growth of test pathogen in presence of } Trichoderma \text{ spp.}}{\text{Growth of test pathogen in control plate}} \times 100$$

## Results and Discussion

### *Effect on Radial Growth and Inhibition of Fusarium oxysporum*

Table 1 reveals that at 3 DAI, the radial growth of *F. oxysporum* f.sp. ciceri was maximum with *Trichoderma harzianum* (K) (26.6 mm) followed by *Trichoderma viride* (P) (26.0 mm) and *Trichoderma viride* (K) (25.7 mm) and *Trichoderma* spp. (nrp) (25.7 mm). Maximum growth inhibition (30.2%) of *F. oxysporum* f. sp. ciceri was observed with *Trichoderma* spp. (drg) followed by *Trichoderma* spp. (rpr) (29.3%). Whereas, least inhibition was recorded with *Trichoderma harzianum* (K) (14.5%) followed by *Trichoderma viride* (P) (16.4%). Higher inhibition of *F. oxysporum* f.sp. ciceri was recorded with *Trichoderma harzianum* (K) (23.7%) followed by *Trichoderma* spp.(nrp)

(18.3%) at 5 DAI, But at 7 DAI. *Trichoderma viride* (P) (23.4%) and *Trichoderma* spp. (nrp) (22.9%) showed highest inhibition and least inhibition was observed with *Trichoderma viride* (K) and *Trichoderma* spp. (drg) i.e. 16.6 per cent. Similar findings were also reported earlier (1—3, 5).

### *Effect on Radial Growth and Inhibition of Sclerotium rolfisii*

A marked variation in radial growth of *S. rolfisii* was recorded when grown alone or in combination with different species and strains of *Trichoderma* spp. at different time intervals (Table 2). The radial growth of *S. rolfisii* was considerably higher (42.3 mm) when cultured alone or in combination with *Trichoderma viride* (P), *Trichoderma harzianum* (P) and *Trichoderma* spp. (nrp) after 3 DAI. However, the growth of *S. rolfisii* was slow (25.5 mm) when grown in association with *Trichoderma* spp. (rpr). In all the treatments, *Trichoderma* spp. and its strains grow faster than *S. rolfisii*. The radial growth of *Trichoderma* spp. (drg), *Trichoderma viride* (P) was fast compared to other isolates. However, it was poor in case of *Trichoderma* spp. (nrp) when grown in dual culture with *S. rolfisii*. Maximum inhibition in radial growth of *S. rolfisii* was observed in presence of *Trichoderma* spp. (rpr)

**Table 2.** Effect of different antagonists on radial growth and inhibition of *Sclerotium rolfsii* by dual culture technique. K—Kanpur isolate ; P—Parbhani isolate ; rpr- Raipur isolate ; drg- Durg isolate ; nrp—Narayanpur isolate. Average of three replications ; DAI—Day after inoculation.

Antagonist isolates	Growth (mm) and inhibition (%)								
	3 DAI			5 DAI			7 DAI		
	<i>Sclerotium</i>	<i>Trichoderma</i>	Inhibition (%)	<i>Sclerotium</i>	<i>Trichoderma</i>	Inhibition (%)	<i>Sclerotium</i>	<i>Trichoderma</i>	Inhibition (%)
<i>Sclerotium</i> × <i>Trichoderma harzianum</i> (K)	35.0	44.7	17.3	38.0	50.5	34.6	41.0	54.5	38.3
<i>Sclerotium</i> × <i>Trichoderma viride</i> (K)	36.7	58.7	13.2	45.5	66.5	21.7	48.7	68.0	26.7
<i>Sclerotium</i> × <i>Trichoderma harzianum</i> (P)	41.0	45.0	3.1	45.2	50.0	22.2	52.2	54.5	21.4
<i>Sclerotium</i> × <i>Trichoderma viride</i> (P)	41.5	59.0	1.9	30.7	64.5	47.2	34.0	65.5	48.8
<i>Sclerotium</i> × <i>Trichoderma</i> spp. (rpr)	25.5	58.0	39.7	38.5	65.0	33.7	39.0	66.7	41.3
<i>Sclerotium</i> × <i>Trichoderma</i> spp. (drg)	35.2	59.5	16.8	50.0	63.0	13.9	52.2	69.5	21.4
<i>Sclerotium</i> × <i>Trichoderma</i> spp. (nrp)	41.0	5.0	3.1	40.0	55.0	32.2	42.0	57.8	36.7
Control	42.3			58.1			66.4		

(39.7%) followed by *Trichoderma harzianum* (K) (17.3%). *Trichoderma* spp. (nrp) and *Trichoderma harzianum* (P) were least effective in checking the vegetative growth of *S. rolfsii*. After 5 DAI, maximum inhibition in growth of *S. rolfsii* was recorded with *Trichoderma viride* (P) (47.2%) followed by *Trichoderma harzianum* (K) (34.6%) and *Trichoderma* spp. (rpr) (33.7%) but *Trichoderma* spp. (drg) (13.9%) was least effective in checking the growth of *S. rolfsii*. After 7 DAI, maximum inhibition in radial growth of *S. rolfsii* was observed with *Trichoderma viride* (P) (48.8%) followed by *Trichoderma* spp. (rpr) (41.3%) and least inhibition was recorded in presence of *Trichoderma*

*harzianum* (P) and *Trichoderma* spp. (drg) (21.4%).

#### Effect on Radial Growth and Inhibition of *Rhizoctonia solani*

The data on inhibition of growth of *R. solani* by different species and local isolates of *Trichoderma* are recorded in Table 3. At 3 DAI, the radial growth of *R. solani* was maximum (34.0 mm) when cultured individually but it was greatly reduced in presence of *Trichoderma* spp. (26.2—32.5 mm). The inhibition percent was maximum in presence of *Trichoderma* spp. (rpr) (23.0%) followed by *Trichoderma harzianum*

**Table 3.** Effect of different antagonists on radial growth and inhibition of *Rhizoctonia solani* by dual culture technique. K—Kanpur isolate ; P—Parbhani isolate ; rpr—Raipur isolate ; drg—Durg isolate ; nrp—Narayanpur isolate. Average of three replications ; DAI—Day after inoculation.

Antagonists isolate	Growth (mm) and inhibition (%)					
	3 DAI			5 DAI		
	<i>Rhizoctonia</i>	<i>Trichoderma</i>	Inhibition (%)	<i>Rhizoctonia</i>	<i>Trichoderma</i>	Inhibition (%)
<i>Rhizoctonia</i> × <i>Trichoderma harzianum</i> (K)	28.7	36.5	15.6	39.0	52.0	14.0
<i>Rhizoctonia</i> × <i>Trichoderma viride</i> (K)	32.5	65.5	4.5	38.0	77.0	16.2
<i>Rhizoctonia</i> × <i>Trichoderma harzianum</i> (P)	27.7	45.0	18.6	34.2	65.0	24.6
<i>Rhizoctonia</i> × <i>Trichoderma viride</i> (P)	30.0	50.0	11.8	37.5	64.2	17.3
<i>Rhizoctonia</i> × <i>Trichoderma</i> spp. (rpr)	26.2	53.5	23.0	37.0	76.5	18.4
<i>Rhizoctonia</i> × <i>Trichoderma</i> spp. (drg)	32.0	58.7	5.9	41.2	71.7	9.1
<i>Rhizoctonia</i> × <i>Trichoderma</i> spp. (nrp)	31.0	53.2	8.9	40.7	65.0	10.2
Control	34.0			45.3		

(P) (18.6%) and *Trichoderma harzianum* (K) (15.6%). *Trichoderma viride* (K) (4.5%) was least effective in checking the growth of *R. solani*. At 5 DAI, maximum inhibition in growth of *R. solani* was observed with *Trichoderma harzianum* (P) (24.6%) followed by *Trichoderma* spp. (rpr) (18.4%) and least inhibition was observed with *Trichoderma* (drg) (9.1%).

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