Journal of Biological Control, 25 (3): 239-241, 2011

Research Note

Relative antagonistic effect of different isolates of *Trichoderma viride* and *T. harzianum* against *Phytophthora capsici* – a bell pepper pathogen

R. K. SRIVASTAVA[1*], R. K. SINGH[1] and R. D. PRASAD[2]

[1]*Department of Plant Pathology, Crop Research Station Bahraich 271801, Uttar Pradesh, India.*
[2]*Directorate of Oilseeds Research, Rajendranagar, Hyderabad 500 030 Andhra Pradesh, India.*
[*]*Corresponding author E-mail:* rksingh05@gmail.com

ABSTRACT: Isolates of *Trichoderma viride* and *T. harzianum* were tested for their myco-parasitic ability and relative antagonistic effect that showed all the *Trichoderma* isolates inhibited significantly the growth of the pathogen and it ranged from 62.73% (*T. viride* 1) to 45.37% (*T. viride* PDBC TV 23). Germination per cent ranged from 78.8 (*T. viride* 3) to 98.9 (*T. viride* PDBC TV 23) when treated with bio-agents, whereas in pathogen check it was only 73.3%. Maximum vigor index (547.3) was recorded in *T. viride (*PDBC TV 23), whereas in pathogen check it was 84.7 only. Fungicide treatment exhibited almost equal disease incidence and in pathogen check, it was as high as 68.9%, while minimum (16.7%) plant mortality was recorded in seeds treated with *T. viride* 1. In fungicidal treatment 33% plant mortality was recorded while in pathogen check it was highest (46.7%). The results obtained clearly indicated that the efficacy of different isolates of the same species also showed variation when tested against the same pathogen. Therefore, it may be concluded that before application in the field the potentiality of every strain of the bioagents should be tested against the target pathogen.

KEY WORDS: Antagonist, *Trichoderma* spp., *Phytophthora capsici,* Bell pepper

(Article chronicle: Received: 21-4-2011; Sent for revision: 28-5-2011; Accepted: 7-6-2011)

Bell pepper, *Capsicum annuum* L., occupies a prominent position among green vegetables because it is a constituent of many foods, adds flavor, colour, vitamin C, and pungency to the world food industries. In India, it is cultivated in several states including Mizoram, Uttar Pradesh, Karnataka, Maharashtra, etc. The crop suffers from a number of pathogens but *Phytophthora capsici* causes diseases of devastating nature affecting all parts of the plant starting from nursery to harvest causing root and crown rot as well as aerial blight of leaves, growing parts, fruits and stem. Earlier studies revealed that about 40-60% yield losses occurred due to *P. capsici. Phytophthora* blight of bell pepper has increased in occurrence and severity in recent years both in India and abroad mainly because of intensive production of suitable varieties and due to development of fungicide resistant isolates. Superiority of bio-control strategies over conventional methods of plant disease control has prompted us to screen and select potential *Trichoderma* isolates for the management of *P. capsici. Trichoderma* spp. that are common saprophytic fungi found in almost any soil and rhizosphere microflora, have been investigated as potential bio-control agents because of their ability to reduce the incidence of disease, common soil – borne pathogens (Spiegal and Chet, 1998; Ashrafizedeh *et al*., 2005; Dubey *et al.,* 2007). The present study is therefore under taken to evaluate the relative antagonistic effect of different isolates of *Trichoderma viride* and *Trichoderma harzianum* against *P. capsici*.

Trichoderma isolates were isolated from rhizosphere soil of healthy crops during cropping season from the fields on *Trichoderma* specific medium and subsequently purified. These isolates were identified on the morphological characteristics (Bisset, 1991a, b) and used for mass culturing of the fungi. *Trichoderma viride* and *T. harzianum* were cultured separately in 250 ml Erlenmeyer flask on wheat bran media. Wheat bran, saw dust and distilled water were taken in proportion of 3:1:3.5 (W/W/V) and mixed thoroughly in a plastic can. This mixture was kept in 250 ml Erlenmeyer flask and sterilized at 15 lb psi for 30 min. Each flask was inoculated with 65 mm mycelia disc of either *T. viride*

or *T. harzianum* obtained from margins of 7 days old culture colony and incubated at 28°C±1°C for 15 days.

Thus pathogen, *P. capsici* was obtained from affected plant samples and cultured on carrot agar medium.

Dual culture tests (Dennis and Webster, 1971) were performed to test the myco-parasitic ability of the *Trichoderma* spp. A pot study was conducted to test the relative antagonistic effect of *T. viride* and *T. harzianum* and plant growth of bell pepper and suppression of *P. capsici* under green house. A rapid *in vivo* method of screening and selection of bioagents was adopted by roll paper towel method (ISTA, 1976). Seeds inoculated with pathogen alone (check) with all bioagents separately were placed on moist blotter sheets. Another moist blotter sheet was kept to cover the seeds and then rolled. Blotter bundles were kept in growth chamber set at 25±1°C at 80% RH. Data on seed germination and seedling mortality were recorded.

The data in percentage (disease incidence and germination) was subjected to angular transformation and data on per cent germination, seedling growth and vigor index was calculated following Abdul–Baki and Anderson (1973) on 14th day. The difference among the treatments was tested by calculated CD from ANOVA.

Vigour index = (Mean shoot length + Mean root length) x Germination (%)

The result showed that all the *Trichoderma* isolates significantly inhibited the growth of *P. capsici* (Table 1). Per cent inhibition ranged from 62.73 (*T. viride* 1) to 45.37 (*T. viride* PDBC TV 23). *P. capsici* mycelia growth inhibition by *T. harzianum* was reported by Cruz and Cisterna (1998) and Ahmad *et al*., (1999). The production of sporangia near interaction zone was greatly reduced. Lysis of sporangial wall was also evident, as many empty sporangia were present. The germination of seeds in all the treatments except *T. viride* 3 was significantly high as compared to pathogen check. Germination percent (Table 1) ranging from 78.8 (*T. viride* 3) to 98.9 (*T. viride* PDBC TV 23) was obtained with bio-agent seed treatments where as in pathogen check (control) it was only 73.3%. There was a significant increase in shoot and root length in all bioagents treatments compared to pathogen check. Highest shoot and root length (2.11, 3.39 cm) was recorded in (*Trichoderma viride* PDBC TV 23) while lowest (0.60, 2.10 cm) was recorded in *T. harzianum* 1 treatment while in pathogen treated control 0.16 cm and 1.14 cm shoot and root length were recorded respectively. Maximum vigor index (547.3) was recorded in *T. viride* (PDBC TV 23) treatment followed by *Trichoderma* isolate 2 (517.7). Vigor index ranging from 261.2 to 547.3 was obtained with various bioagents treatment. Pathogen check recorded a vigor index of 84.7 only. All bioagents treatment and fungicide treatment recorded significantly less disease incidence as compared and to pathogen check. The disease incidence ranged

Table 1. Inhibition of colony growth of *Phytophthora capsici* in dual culture, efficacy of bioagents on plant mortality under green house conditions and effect of seed treatment and with *Trichoderma* species on Bell pepper plant growth and disease incidence

Sl. No.	Antagonists	% Inhibition	Plant	(%)	Shoot	Root	Vigor	% Disease
1.	*T. viride* 1	62.7 (52.4)	16.7 (23.85)	98.7 (86.1)	15.3	2.84	432.3	5.6 (13.6)
2.	*T. viride* 2	57.5 (49.3)	43.3 (41.15)	97.7 (82.9)	1.97	3.32	517.7	11.1(19.40)
3.	*T. viride* 3	57.1 (50.3)	33.3 (35.22)	78.8 (62.2)	1.57	2.37	321.2	32.0 (34.4)
4.	*T. viride* 4	59.3 (43.9)	36.7 (37.22)	96.6(81.4)	1.96	2.47	427.8	22.7 (28.4)
5.	*T. viride* (PDBCTV 6)	56.1 (48.5)	40.0 (39.15)	95.5 (77.9)	1.76	3.07	462.9	7.3 (15.6)
6.	*T. viride* (PDBCTV23)	45.4 (42.3)	30.0 (33.0)	98.9 (86.5)	2.11	3.39	547.3	22.2 (27.9)
7.	*T. harzianum* 1	56.9 (49.4)	30.0 (33.0)	95.9 (80.6)	0.16	2.10	261.2	39.4 (38.8)
8.	*T. harzianum* (PDBCTH 10)	58.7 (40.5)	16.7 (33.00)	97.3 (82.3)	0.91	2.95	473.9	12.0 (20.2)
9.	Fungicide Ridomil @ 2.0 g/Kg seed	–	33.3 (35.2)	91.1 (72.8)	1.41	2.96	397.1	7.7 (16.1)
10.	Pathogen check	–	47.7. (43.08)	73.3 (8.9)	0.16	1.14	84.7	68.9 (56.1)
	C.D. (0.05)	4.4	8.4	10.0	0.36	0.45	58.9	4.0

Value in the parentheses is angular transformations
Average of 30 seedlings from each treatment

between 5.6 and 39.4% in bioagents treatment. Lowest disease incidence ranged between 5.7 and 7.3% was recorded in *Trichoderma* isolate 1 and *T. viride* (PDBC TV 6) treatments respectively which were not significantly different. The results obtained, (Table 1) clearly indicated that all the bioagents and fungicide treatment were significantly superior in reducing plant mortality as compared to pathogen check but their efficacy varied with the bioagents. Under green house conditions minimum (16.7%) plant mortality was recorded when the plants were subjected to *T. viride* 1 and *T. harzianum* (PDBC TH 10) followed by *T. harzianum* 1 and *T. viride* (PDBC TV23) where it was 30%. In fungicidal treatment 33% plant mortality was recorded while in pathogen check it was highest (46.7%).

Cristinzino (1987), Kim *et al.* (1990) and Ahmad *et al*. (1999) reported significant results both under laboratory and greenhouse conditions with different *Trichoderma* isolates in controlling *P. capsici*.

ACKNOWLEDGEMENT

The authors are grateful to Director, National Bureau of Agriculturally Important Insects, Bangalore, for providing laboratory facility and technical assistance.

REFERENCES

Abdul – Baki, A. and Anderson J. D. 1973. Vigor determination in Soybean seed by multiple criteria. *Crop Science*, **13**: 630–633.

Ahmed, A. S., Perez-Sanchez, Egea, C. and Candela, M. E. 1999. Evaluation of *Trichoderma harzianum* for controlling root rot caused by *Phytophthora capsici* in pepper plants. *Plant Pathology*, **48**: 58–65.

Ashrafizadeh, A., Etebarian, H. R. and Zamanzadeh, H. R. 2005. Evaluation of *Trichoderma* isolates for biocontrol of *Fusarium* wilt of melon. *Iranian Journal of Phytopathology*, **41**: 39–57.

Bisset, J. 1991a. A revision of the genus *Trichoderma*. II. Infrageneric classification. *Canadian Journal of Botany*, **69**: 2357–2372.

Bisset, J. 1991b. A revision of the genus *Trichoderma*. III. Section Pachybasium. *Canadian Journal of Botany*, **69**: 2373–2417.

Cristinzino, G. 1987. Studies on biological control of *Phytophthora capsici*. *Capsicum Newsletter*, **6**:65.

Cruz, A. M. and Cisterna, O. V. 1998. Integrated control of *Phytophthora capsici* in pepper. *Agricultura Technica Santiago*, **58**: 81–92.

Dennis, C. and Webster, J. 1971. Antagonism properties of species groups of *Trichoderma*, III. Hyphal interactions. *Transactions of British Mycological Society*, **57**: 363–369.

Dubey, S. C., Suresh, M. and Singh, B. 2007. Evaluation of *Trichoderma* species against *Fusarium oxysporum* f. sp. *ciceris* for integrated management of chickpea wilt. *Biological Control*, **40**: 118–127.

ISTA, 1976. International Rules for seed testing. *Seed Science and Technology*, **4**: 3–49.

Kim, C. H., Jee, H. J., Park, K. S. and Lee, E. J. 1990. Studies on biological control of *Phytopthora* blight of red pepper and performance of antagonistic agents in fields. *Korean Journal of Plant Pathology*, **6**: 201–206.

Spiegel, Y. and Chet, I. 1998. Evaluation of *Trichoderma* spp. as biocontrol agent against soil borne fungi and plant parasitic nematodes in Israel. *Integrated Pest Management Review*, **3**: 69–75.