J. Biol. Control, 22(2): 483-486, 2008

Research Note

Biological management of root and collar rot of cauliflower (*Rhizoctonia solani*) by a talc-based formulation of *Trichoderma harzianum* Rifai

SOMESHWAR BHAGAT[1] and SITANSU PAN[2]
Department of Plant Pathology, Bidhan Chandra Krishi Viswavidyalaya,
Mohanpur, Nadia 741252, West Bengal, India.
E-mail: skpan_06@rediffmail.com

ABSTRACT: The study on the management of collar rot of cauliflower, caused by *Rhizoctonia solani* by a talc-based formulation of *Trichoderma harzianum*, was carried out during the early rabi seasons of 2005-06 and 2006-07 under field condition at Mohanpur, West Bengal with isolates of *T. harzianum*. The seedling dip and soil application of *T. harzianum* (talc-based) @ 200g per plot significantly reduced the disease incidence (63.6%) at 50 DAT followed by pre-transplanting seedling tip in *T. harzianum* spore suspension @ 5g/l combined with soil application of talc formulation @ 100g/plot (52.7%) and soil application of the talc formulation of *T. harzianum* at 200g/plot (50.9%) treatment and there was corresponding yield increase in the respective treatments. The highest population density of *T. harzianum* was recorded in the plot treated with seedling tip and soil application (210 cfu/g soil) and the lowest in the control plot (7.5 cfu/g soil).

KEYWORDS: Biological management, cauliflower, root and collar rot, talc-based formulation, *T. harzianum*

The cauliflower (*Brassica oleracea* L. var. *botrytis*), is an important vegetable crop grown in many parts of India including West Bengal. This crop is severely attacked by a number of pest and diseases and hence considerable amount of chemical pesticides is being used to ward off the pest and disease problems. Among the diseases, root and collar rot of early cauliflower caused by *R. solani* is the most important one, which causes rotting of root and stem and toppling down of seedling and death of established plants in the field after transplanting, leading to heavy loss of crop yield. In the later stage, previously infected plants appears brownish to black with tough and woody stem, just above and below the soil line, commonly known as 'wire stem'. There is growing awareness that the use of biopesticides can provide more environmentally sound and economically feasible alternatives for many soil borne diseases. In this line, fungal bioagents could be successfully used in the management of soil borne pathogens under field conditions. The fungal bioagent, *Trichoderma harzianum*, has been established as a potential biocontrol agent and is being widely used for the

[1]Scientist (Plant Pathology), Central Agricultural Research Institute (ICAR), Port Blair, Andaman, India, 744101.
[2]Professor

management of many soils borne pathogens (Papavizas, 1985; Harman, 2000; Fravel, 2005). Therefore, present study was undertaken to isolate the *T. harzianum* isolates from the rhizosphere soil of cauliflower (Andaman and West Bengal) and to evaluate their biocontrol potential against the *R. solani*, causing root and collar rot of cauliflower *in vitro* and under field conditions.

T. harzianum isolates were isolated from the rhizosphere soil of cauliflower (Port Blair and West Bengal) on *Trichoderma* specific medium (TSM) by soil dilution technique. The fungal isolates were identified with the help of taxonomic monograph of Rifai (1969) and these isolates were maintained on PDA slants at 4°C for subsequent use.

A field experiment was conducted for the evaluation of a talc-based formulation of *T. harzianum*, for the management of root and collar rot of cauliflower, during early rabi seasons of 2005-06 and 2006-07, at Instructional Farm, Bidhan Chandra Krishi Viswavidyalaya, Mohanpur, Nadia, West Bengal. Seven treatments with three replications in a randomized block design was laid out with individual plot size of 6 m^2 and spacing of 60 x 40 cm^2. The test variety used was "Pusa Katki". The different treatments tested were: T_1 - Control without application of *R. solani*; T_2- Control with post transplanting application of *R. solani*; T_3- Pre-transplanting seedling dip in the spore suspension of *T. harzianum* @ 5 g/L of water + *R. solani*; T_4- Soil application of a talc-based formulation of *T. harzianum* @ 100 g /plot + *R. solani*; T_5- Soil application of a talc-based formulation of *T. harzianum* @ 200 g /plot + *R. solani*; T_6-A combination of treatments T_3 + T_4; T_7-A combination of treatments T_3 + T_5. The percentage mortality of plants upto 50 DAT was recorded and the reduction in the motrality of plants due to application of a talc-based formulation of *T. harzianum*, was calculated. The yield of cauliflower was also recorded after harvest and percentage increase in yield was also calculated.

The field efficacy of talc-based formulation of *T. harzianum* (TH-10) is presented in Table 1, which revealed that all treatments significantly reduced the per cent mortality of cauliflower over the control. Seedling dip @ 5g/L followed by soil application of *T. harzianum* (talc-based) @ 200g / plot, was found best (T_7). This treatment resulted in lowest root and collar rot incidence in cauliflower (27.8%) at 50 DAT and corresponding increase in yield, followed by T_6 (the seedling dip @ 5g/L followed by soil application of *T. harzianum* (talc-based) @ 100g /plot) that resulted in disease incidence of 36.1% and T_5 that had 37.5% disease incidence. The yield of cauliflower was also significantly increased in all treatments over control and highest yield was recorded in the T_7. The other best treatments were T_6 and T_5. The population density of *T. harzianum* (TH-10) was also found highest in T_7 treatment (Table 2) and lowest population density of the antagonist recoded in T_2 treatment (control). It is assumed that highest population density of antagonist leads to highest percentage reduction in inoculums of *R. solani* and ultimately reduction in root and collar rot of cauliflower disease incidence. It is evident from the present findings that a talc-based formulation of *T. harzianum*, could be used for the management of root and collar rot of cauliflower. Soil application of *T. harzianum* have an edge over the seed treatment, as these being natural soil inhabitants, establish and multiply more quickly in soil. This effect may be enhanced by integrating with farm yard manure (FYM). Prasad and Rangeswaran (2000) reported that the incidence of chickpea seedling rot and damping off was more than 57% in untreated plot whereas only 10-15% disease was recorded in two doses of granule per plot. The significant reduction in *R. solani* and *S. rolfsii* was observed when *T. harzianum* applied both as soil and bulb treatment (Chet *et al.*, 1982). Several other workers too have reported the significant reduction of diseases incited by *R. solani* under field condition, viz. seedling blight of mungbean (Jash and Pan, 2004), root rot of frenchbean (Mathew and Gupta, 1998), chickpea (Prasad and Ragheswaran, 1999 and 2000) etc., by using *Trichoderma* spp. Sreenivasaprasad and Manibhusanrao (1993) achieved success in suppression of *R. solani*, *S. rolfsii* and *P. aphanidermatum* in cotton, groundnut and tomato through soil and seed coating of *T. virens* and *T. longibrachiatum*.

Table 1 Efficacy of talc-based formulation of *T. harzianum* against root and collar rot of cauliflower

Treatments	Per cent mortality of cauliflower seedling at 50 DAT			Per cent decrease in cauliflower seedling mortality at 50 DAT			Yield (Kg/ha)			Per cent increase in Yield		
	Year 2005	Year 2006	Pooled	Year 2005	Year 2006	Pooled	Year 2005	Year 2006	Pooled	Year 2005	Year 2006	Pooled
T_1 - Control (without pathogen)	70.0 (56.8)	66.0 (54.3)	68.0 (55.5)	9.1	13.6	11.3	1600	1800	1700	3.2	9.1	6.2
T_2 - Control + Pathogen inoculum @100 g of sand-maize meal (10 sclerotia /g) product/plot	77.0 (61.3)	75.8 (60.5)	76.4 (60.9)	0.0	0.0	0.0	1550	1650	1600	0.0	0.0	0.0
T_3 - Pre-transplanting seedling dip @ 5 g (talc based formulation of *T. harzianum*, x 10^8 cfu/g) + pathogen (sand-maize meal) @ 100g/ plot	62.0 (51.9)	60.2 (50.9)	61.1 (51.4)	19.5	20.6	20.0	2560	2640	2600	65.2	60.0	62.5
T_4 - Soil application @ 100 g (talc-based) + pathogen (sand-maize meal) @ 100g / plot	51.5 (45.9)	48.5 (44.1)	50.0 (45.0)	33.1	36.0	34.5	3050	3350	3200	96.8	103.0	100.0
T_5 - Soil application @ 200 g (talc-based) + pathogen (sand-maize meal) @ 100g / plot	38.0 (38.1)	37.0 (37.5)	37.5 (37.8)	50.6	51.2	50.9	4050	4150	4100	161.3	151.5	156.2
$T_3 + T_4$	37.0 (37.5)	35.2 (36.4)	36.1 (36.9)	51.9	53.6	52.7	4350	4650	4500	180.6	181.8	181.2
$T_3 + T_5$	28.0 (31.9)	27.8 (31.8)	27.8 (31.8)	63.6	63.3	63.6	5500	5500	5500	254.8	233.3	243.7
SEM (±)	1.25	1.19	1.14	-	-	-	125.6	122.1	133.3	-	-	-
CD (P=0.05)	2.39	2.31	2.03	-	-	-	273.8	266.1	290.5	-	-	-

Figures in parentheses are angular transformed value

Table 2. Population density of *T. harzianum* in cauliflower soil

Treatments	Population (c.f.u x10^5/g of soil)*			Population (c.f.u x10^5/g of soil)**			Pooled data
	15 DAT	30 DAT	50 DAT	15 DAT	30 DAT	50 DAT	
T_1	2.7(0.4)	18.3(1.3)	14.3(1.1)	3.5(0.5)	20.5(1.3)	12.5(1.1)	13.4(1.1)
T_2	3.7(0.6)	11.0(1.0)	9.7(1.0)	4.0(0.6)	14.0(1.1)	7.5(0.9)	8.5(0.9)
T_3	27.3(1.4)	51.3(1.7)	47.3(1.7)	29.0(1.5)	56.4(1.7)	49.5(1.7)	48.4(1.7)
T_4	105.0(2.0)	137.0(2.1)	120.7(2.1)	111.3(2.0)	145.6(2.2)	127.6(2.1)	124.1(2.1)
T_5	146.0(2.2)	174.0(2.2)	161.0(2.2)	156.6(2.2)	186.5(2.3)	175.5(2.2)	168.2(2.2)
T_6	147.0(2.2)	201.7(2.3)	180.0(2.2)	169.5(2.2)	215.2(2.3)	191.2(2.3)	185.6(2.3)
T_7	160.0(5.1)	237.0(2.4)	227.0(2.3)	178.9(2.2)	240.0(2.4)	210.0(2.3)	218.5(2.3)
SEM (±)	3.0	3.0	3.2	3.2	3.1	3.2	3.0
C.D.at 5%	6.0	6.5	7.0	7.0	5.8	7.0	6.5

Figures in parentheses are log transformed value

* indicate the data of year 2005, ** indicate the data of year 2006

REFERENCES

Chet, I., Elad, Y. and Katan, A. 1982. Integrated control of soil borne and bulb borne pathogens in Irish. *Phytoparasitica*, **10**: 229-236.

Fravel, D. R. 2005. Commercialization and implementation of biocontrol. *Annual Review of Phtopathology*, 43:337-50

Harman, G. E. 2000. Myth and dogmas of biocontrol: Changes in perceptions derived from research on *Trichoderma harzianum* T-22. *Plant disease*, **84**: 377-393.

Jash, S. and Pan, S. 2004. Evaluation of mutant isolates of *Trichoderma harzianum* against *Rhizoctoria solani* causing seedling blight of green gram. *Indian Journal of Agricultural Sciences*, **74**: 190 – 193.

Mathew, K. A. and Gupta, S. K. 1998. Biological control of root rot of French bean caused by *Rhizoctonia solani*. *Journal of Mycology and Plant Pathology*, **28:** 202-205

Papavizas, G. C. 1985. *Trichoderma* and *Gliocladium*: Biology, Ecology and Potential for biocontrol. *Annual Review of Phytopathology*, **23**: 23 – 54.

Prasad, R. D. and Rangeswaran, R. 2000. Effect of soil application of a granular formulation of *Trichoderma harzianum* on *Rhizoctonia solani* incited seed rot and damping off of chickpea. *Journal of Mycology and Plant Pathology*, **30**: 216-220.

Prasad, R.D. and Ragheswaran, R. 1999. Granular formulation of *Trichoderma* and *Gliocladium* in biocontrol of *Rhizoctonia solani* of chickpea. *Journal of Mycology and Plant Pathology*, **29**: 222 – 226.

Rifai, M. A. 1969. A revision of the genus *Trichoderma*. *Mycological Papers*, **116**: 1-56.

Sreenivasaprasad, S. and Manibhusanrao, K. 1993. Antagonistic potential of *Gliocladium virens* and *T. longibrachiatum* to Phytopathogenic fungi. *Mycopathologia*, **109**:19-26.

(Received: 24.08.2007; Revised: 13.11.2007; Accepted: 07.12.2007)