

***Trichoderma harzianum* and *Chaetomium* sp. as Potential Biocontrol Fungi in Management of Red Rot Disease of Sugarcane**

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Red rot is a major disease of sugarcane in sub-tropical and tropical regions. It is particularly rampant in Uttar Pradesh and Bihar. The control of plant pathogens through biotherapy (Cook and Baker, 1983; Mukhopadhyay, 1987) is a distinct possibility for the future and can be exploited in modern sugarcane cultivation. Sugarcane plant-associated microflora consists of complex and dynamic communities of fungi, bacteria and actinomycetes that inhibit the pathogen in the soil or on the surface of root, stem (specially nodal region) and leaves. In many cases, micro-organisms prevent plant disease either by producing antibiotics like substances or by excluding the pathogen from the site by antagonism. Singh *et al.* (1982) obtained higher population of *Trichoderma* spp. in the rhizosphere of healthy sugarcane plants as compared to red rot-affected plants. Singh (1983) tested the antagonistic potential of major groups of fungi, isolated from the rhizosphere of sugarcane plant against *Colletotrichum falcatum* Went. In the present investigation, some biocontrol agents were assessed for their antagonistic ability to control *C. falcatum* by sett treatment.

Three isolates of *Trichoderma harzianum* Rifai (isolated from sugarcane) and *Chaetomium* spp. (isolated from dry leaf of sugarcane) were tested for antagonism *in vitro* against *C. falcatum* Went (Isolate R-1, Co 1148) on oat meal agar by dual culture technique described by Mortan and Stroube (1955). Observations on growth and sporulation of *C. falcatum* were recorded.

The three isolates of *T. harzianum* and *Chaetomium* sp. were mass cultured on sterilized wheat-bran saw-dust-water mixture (3:1:3.5 W/W/V) contained in 500 ml conical flasks and incubated at $28 \pm 1^\circ\text{C}$ for 15 days. A

quantity of 100 g wheat-bran saw-dust per flask was optimum for the growth of the antagonists.

In order to study the efficacy of sett treatment with antagonists against the red rot pathogen, seed setts of Co1148 were first dipped in *C. falcatum* spore suspension (10^5 conidia/ml) prepared in 0.5% carboxy methyl cellulose for 10 min. All the inoculated setts were fully covered with a polythene sheet and incubated at room temperature ($10-32^\circ\text{C}$) for 24 h for development of incipient infections. After 24 h, development of initial infection was confirmed by microscopic examination. For sett treatment with antagonists, 500 g of 15 days-old wheat-bran saw-dust antagonist preparation was blended and mixed in 20 litres of water containing 0.5% carboxy methyl cellulose and the setts were dipped for 10 min and incubated for 24 h. For field trial, eighty setts were planted in each plot (5x3.6m). Six treatments i.e. (i) healthy setts, (ii) setts inoculated with *C. falcatum*, (iii) inoculated setts + sett treatment with *T. harzianum* TR I, (iv) inoculated setts + sett treatment with *T. harzianum* TR II, (v) inoculated setts + sett treatment with *T. harzianum* TR III and (vi) inoculated setts + sett treatment with *Chaetomium* sp. were included in a randomised block design with three replications. The setts were planted in rows 90 cm apart. Germination was recorded after 60 days of planting. The number of clumps, developed in the different treatments was recorded in the month of July. Total number of millable cane and yield were recorded at the time of harvest. Disease incidence was recorded on clump and cane basis at monthly interval. The infected clumps were uprooted to avoid secondary spread of the disease.

Results indicated that all the three isolates of *T. harzianum* inhibited the sporulation of *C.*

Table 1. Effect of sett treatment with antagonists on red rot development through incipient infections

Treatment	Germination %	Number of clumps	Disease incidence %		Average millable canes/ha (x 10 ³)	Yield t/ha
			on clump basis	on cane basis		
Healthy setts	34.4	52.7	1.3	0.5	112.8	78.5
<i>C. falcatum</i> (c.f.)	9.1	11.7	85.0	52.7	25.6	17.2
C.F. + <i>T.harzianum</i> TR I	15.8	19.0	56.5	38.2	66.7	56.5
C.F. + <i>T. harzianum</i> TR II	16.0	22.7	41.0	29.9	67.2	51.3
C.F. + <i>T. harzianum</i> TR III	13.0	18.3	56.0	33.4	65.6	54.5
C.F. + <i>Chaetomium</i> sp.	23.1	32.0	28.0	21.7	92.2	70.4
C.D. at 5%	4.9	8.5	14.4	11.3	17.4	14.8

falcatum and overgrew the pathogens in dual culture technique. Antagonistic activities of *Trichoderma* spp. against *C. falcatum* have also been earlier reported by Singh (1983). *Chaetomium* spp. did not show any inhibitory effect on the growth of *C. falcatum* in the first 3-4 days but after 4 days, presence of zone of inhibition was noticed. Similarly, normal sporulation of *C. falcatum* was observed upto 5 to 6 days. After 5-6 days, colour of sporulation turned light to dark black, due to antagonistic activity of *Chaetomium* sp. Possibly, this may be due to production of metabolites by *Chaetomium* sp. (Pietro *et al.*, 1992).

Chaetomium sp. and *T. harzianum* inoculation improved the germination of setts as compared to uninoculated red rot infected setts. Sett treatment with *Chaetomium* sp. reduced the disease incidence and also increased the yield (Table 1). Difference in yield between healthy check and *Chaetomium* sp. treatment was only 8 t/ha. Other treatments also showed positive response compared to pathogens inoculated check but much inferior to sett treatment with *Chaetomium* sp.

Shivanna and Shetty (1989) reported that seed treatment with *T.harzianum* and *T.viride* eliminated seed-borne inoculum of *Colletotrichum dematium* (Pers. ex Fr) Grove from cluster bean. Seed treatment with spore suspension of *Chaetomium globosum* Kunze improved germination and reduced the seed-borne microflora of cotton (Sohi *et al.*, 1988).

Present investigations indicated the positive role of *Chaetomium* sp. and *T. harzianum* in minimising the red rot pathogen in sugarcane. Therefore, a new vista in the management of red rot, the 'cancer' of sugarcane has been opened. Further investigations are in progress to exploit these antagonistic microflora in the management of red rot of sugarcane.

KEY WORDS:- Biocontrol, *Chaetomium* sp., *Colletotrichum falcatum*, Red rot, Sugarcane, *Trichoderma harzianum*

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REFERENCES

- COOK, R.J. and BAKER, K.F. 1983. The nature and practice of Biological control of Plant pathogens. American Phytopathological Society, St. PAUL, U.S.A.
- MUKHOPADHYAY, A.N. 1987. Biological control of soil-borne plant pathogens by *Trichoderma* sp. *Indian J. Mycol. Plant Pathol.*, **17**, 1-10.
- MORTON, D.J. and STROUBE, W.H. 1955. Antagonistic and stimulatory effects of soil microorganisms upon *Sclerotium rolfsii*. *Phytopathology*, **45**, 417-420.
- PIETRO, A. Di, GUT-RELLA, M., PACHLATKO, J.P. and SCHWINN, F.J. 1992. Role of an-

- tiotics produced by *Chaetomium globosum* in bio-control of *Pythium ultimum*, a causal agent for damping off. *Phytopathology*, **82**, 131-135.
- SHIVANNA, M.B. and SHETTY, H.S. 1989. Effect of selected bio- control agents and their combination with fungicides on the mycoflora and quality of seeds in cluster bean. *J. Biol. Control*, **3**, 113-116.
- SINGH, K., SINGH, N. and MISRA, S.R. 1982. Rhizosphere microflora associated with sugarcane plants affected by red rot. *Indian Phytopathol.*, **35**, 310-313.
- SINGH, N. 1983. Antagonistic activity of sugarcane rhizosphere soils against red rot pathogen. *Indian Bot. Repr.*, **2**, 142-144.
- SOHI, H.S., AULAKH, K.S. and RANDHAWA, H.S. 1988. Control of seed borne fungi of cotton by *Chaetomium globosum* and *Epicoccum purpurascens*. *Indian J. Ecology*, **15**, 111-113.