

Biological control of leaf blight caused by *Alternaria tenuissima* (Kunze ex. Pers.) Wiltshire in pigeonpea

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ABSTRACT: Three biocontrol agents, *Trichoderma viride* Rifai, *Trichoderma harzianum* Rifai and *Gliocladium virens* Miller, Gidden and Foster were evaluated against *Alternaria tenuissima* (Kunze ex. Pers.) Wiltshire, the cause of leaf blight in pre-rabi pigeonpea [*Cajanus cajan* (L.) Millsp.] *in vitro* and under field conditions. In dual culture, *T. viride* overgrew the colony of *A. tenuissima* within 72 hours of incubation followed by *G. virens* and *T. harzianum*, which took more than 96 hours to completely overgrow the colony of test fungus. The radial growth of *T. viride* was more in mono and dual culture than *G. virens* and *T. harzianum*. Microscopic examination revealed that *T. viride* caused lysis and protoplasmic disintegration of the mycelia of *A. tenuissima*. Under field conditions, two sprays of *T. viride* @ 4g/l water gave 35.59 per cent control of leaf blight of pigeonpea followed by *G. virens* which showed 31.32 percent disease control.

KEY WORDS: *Alternaria tenuissima*, biocontrol, *Gliocladium virens*, pigeonpea, *Trichoderma viride*

Leaf blight of pigeonpea [*Cajanus cajan* (L.) Millsp.] caused by *Alternaria tenuissima* (Kunze ex. Pers.) Wiltshire is a serious disease in north Bihar limiting production and productivity, particularly when the crop is sown during first fortnight of September. Non-judicious use of pesticides leads to environmental pollution and health hazards. Biological control, in this context, is now gaining more importance as an ecofriendly means of disease management. Antagonistic studies between *Trichoderma* and *Alternaria* isolates from other hosts have been studied (Chattannavar *et al.*, 1980; Kumar and Singh, 1983 and 1984) but information on pigeonpea isolate of *Alternaria tenuissima* is lacking. In this paper, we report antagonism of *Trichoderma viride*, *Trichoderma harzianum* and *Gliocladium virens*

against pigeonpea isolate of *Alternaria tenuissima* *in vitro* and effect of these bio-agents in the control of *Alternaria* leaf blight of pigeonpea under field conditions.

MATERIALS AND METHODS

Alternaria tenuissima was isolated from infected leaves of pigeonpea on Potato Dextrose Agar (PDA) medium. The cultures of antagonists, *T. viride*, *T. harzianum* and *G. virens* were drawn from the laboratory cultures.

Studies *in vitro*

The antagonistic effect of *T. viride*, *T. harzianum* and *G. virens* against *A. tenuissima* was studied by dual culture technique (Morton and

Straube, 1955). Hyphal interaction between antagonist and the test fungus was studied by microscopic examination of the slides prepared from the junction of the antagonist and the test fungus and the areas overgrown by the antagonist.

Field studies

Field experiment was conducted at the Research Farm of Tirhut College of Agriculture, Dholi, Rajendra Agricultural University, Pusa, Bihar. The experiment was conducted in randomized block design (RBD) with three replications in 3.0x0.9m plots with 30cm row spacing. Pigeonpea variety, "Bahar" reported as susceptible to leaf blight was sown on September 12, 1996. Talc based preparation of *T. viride* obtained from Tamil Nadu Agricultural University, Coimbatore and *G. virens* biomass prepared in the Department of Plant Pathology were used. The bioagents *T. viride* and *G. virens* were used @ 4 and 1g/litre water, respectively, as foliar spray during the evening hours between 16.30 to 17.30 hours, followed by plain water spray in the next morning at 10.00 hours to maintain moisture on foliage. Two consecutive sprays at 12 days interval were given beginning from January 20, 1997. Final observation on percent disease intensity was recorded on March 11, 1997. The yield data were recorded after harvest of the crop.

RESULTS AND DISCUSSION

Studies on antagonism revealed that in dual culture, *T. viride* occupied more area on PDA (85mm) as compared to *A. tenuissima* (17mm) in 48 hours and completely overgrew the colony of test fungus earliest i.e. in 72 hours due to its faster growth rate and parasitism potential. The radial growth of *G. virens* and *T. harzianum* in dual culture was 64.60 and 59.83mm, respectively (Table 1). Attempt to reisolate *A. tenuissima* from the region overgrown by the antagonist always yielded the colony of antagonist alone on PDA, which indicated lysis of the test fungus in dual culture.

In monoculture, *T. viride* produced maximum colony diameter (89.33mm) in 48 hours of incubation

followed by *G. virens* and *T. harzianum*, which showed 80.33 and 76.66mm growth, respectively. *T. viride* overgrew the colony of *A. tenuissima* completely in 72 hours, whereas *G. virens* could overgrow 90 percent colony of the test fungus in 96 hours. Microscopic examination of slides prepared from the colony of *A. tenuissima* parasitized by *T. viride* revealed lysis and protoplasmic disintegration of the mycelia of test fungus. Mycoparasitism through physical contact by coiling and cell lysis in case of *Sclerotium rolfsii* and *Rhizoctonia solani* by *T. harzianum* has been reported (Dennis and Webster, 1971c; Upadhyay and Mukhopadhyay, 1986; Kaur, 1989). The cell lysis and protoplasmic disintegration of the mycelium of the *Alternaria* species by *T. harzianum* and *G. virens* were also reported (Hadar *et al.*, 1979; Chet *et al.*, 1981). The disintegration of the mycelia of the test fungus may be due to the action of enzymes and toxins produced by *Trichoderma* species, and production of volatile and non-volatile compounds which would increase antagonism against test fungus (Jacob, 1976; Dennis and Webster, 1971a, b; Upadhyay and Roy, 1995).

Field trial on the efficacy of biocontrol agents indicated that two sprays of both the bioagents, *T. viride* and *G. virens* were effective in providing moderate protection (31.32 to 35.59 %) against *Alternaria* leaf blight of pigeonpea. *T. viride* and *G. virens* proved to be on par reducing the disease severity. Both the treatments increased the pigeonpea yield significantly as compared to control. Maximum grain yield of 10 q/ha was recorded in *T. viride* treated plot (Table 2). Kumar and Singh (1984) reported 67.5 percent control of *Alternaria* blight by bioagents in potato.

The present study leads to the inference that the bioagents have the potential of mycoparasitizing and causing lysis of the hyphae of *A. tenuissima in vitro* and when applied as foliar spray in field controlled the *Alternaria* leaf blight disease of pigeonpea. Further investigations are needed to improve the biocontrol efficacy of these antagonists.

Table 1. Growth of antagonistic fungi in monoculture and with *A. tenuissima* in dual culture on PDA

Fungi	Colony diameter (mm) in 48 h			Colony of test fungus over grown by the antagonist in 96 h (%)
	Monoculture	Dual culture		
		Antagonists	<i>A. tenuissima</i>	
<i>Trichoderma viride</i>	89.33	85.00	17.0	100.0
<i>Trichoderma harzianum</i>	76.66	59.83	22.2	80.0
<i>Gliocladium virens</i>	80.33	64.60	19.9	90.0
<i>Alternaria tenuissima</i>	23.83	—	—	—
CD (P=0.05)	5.20	3.18	1.95	

Table 2. Effect of foliar spray of bioagents on the intensity of leaf blight of pigeonpea under field conditions

Treatment	Dose (g/l)	Disease intensity (%)*	Disease control over check (%)	Yield (q/ha)
<i>G. virens</i>	1.0	32.17 (34.55)**	31.32	9.63
<i>T. viride</i>	4.0	30.17 (33.31)	35.59	10.00
Control	—	47.00 (43.28)	—	7.04
CD (P=0.05)	—	2.78	—	2.07

* Average of three replications

** Angular transformed value in parentheses

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