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Research Note

Evaluation of *Trichoderma species* against *Fusarium udum* Butler causing wilt of pigeonpea

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ABSTRACT*:* One isolate each of *Trichoderma viride*, *Trichoderma harzianum* and *Trichoderma virens* were evaluated against twelve isolates of *Fusarium udum* collected from different districts of Bihar, Jharkhand and West Bengal by dual culture technique. All the bioagents inhibited the growth of *F. udum in vitro.* Dholi isolate of *T. harzianum* inhibited the growth of *F. udum* isolates Fu-5, Fu-12, Fu-14, Fu-21, Fu-24, Fu-27 and Fu-43 by 40.8, 74.5 , 49.4, 59.1, 60.5, 40.8 and 57.8 per cent, respectively and proved superior to other antagonists. *T. viride* was found to have potential in inhibiting the radial growth of *F. udum* isolates Fu-29, Fu-37, Fu-49 and Fu-57 while *T. virens* was more effective in inhibiting the growth of Fu-61. Combined application of *T. harzianum* and *T. viride* as seed treatment and soil application gave minimum disease incidence (26.4%) and maximum disease control (56%) followed by 54% disease control in *T. harzainum* seed treatment and soil application. However, these two treatments were on par with each others. The results also revealed that soil application of bioagents was more effective than seed treatment.

KEY WORDS: *Fusarium udum,* Pigeonpea, *Trichoderma* spp., wilt

Pigeonpea wilt caused by *Fusarium udum* Butler is one of the most economically important diseases in India inflicting heavy yield losses (Khare *et al.*, 1994). Several methods have been suggested to manage the disease by chemical seed treatment, soil solarization, inter/mixed cropping or crop rotation, and through host plant resistance (Vishwadhar and Chaudhary, 1998). Although these options have potential to reduce the disease incidence to some extent, wilt still continues to be one of the major biotic constraints to pigeonpea production. Bioagents have assumed special significance in the present day strategy of developing ecologically safe methods of plant disease management. Prospects of biological control of soil borne pathogens using *Trichoderma* species have been described (Papavizas, 1985). Several workers have reported the inhibitory effect of volatile and non-volatile compounds produced by *Trichoderma* spp. on several soil borne plant pathogens (Bose *et al*., 2005; Pan and Bhagat, 2008). The indigenous strains of *Trichoderma* spp. seem to function as better antagonists and disease control agents as they are well adapted to local conditions. Therefore, the present study was undertaken to isolate *Trichoderma* spp. from the rhizosphere soil of pigeonpea (Bihar and Jharkhand) and to establish their antagonistic potential against twelve isolates of *F. udum* collected from Bihar, Jharkhand and West Bengal.

Trichoderma viride Pers.Fr., *Trichoderma harzianum* Rifai, and *Trichoderma virens* Miller,Giddens and Foster were isolated from the rhizosphere soil of pigeonpea crop, by serial dilution plate technique (Haris and Sommers, 1968) on modified *Trichoderma*–specific medium (Saha and Pan,1997) and identified based on Rifai (1969) and Bissett (1991a,b,c). Pure cultures of *Trichoderma* species were maintained on potato dextrose agar (PDA) slants at 4^0C for subsequent use. These three isolates were screened against 12 isolates of *F. udum* representing 3 states (Fu–1, Fu–5, Fu–12, Fu–14, Fu–27, Fu–29, Fu–43, Fu–49, and Fu–57 isolated from Bihar, Fu–37 from Jharkhand and Fu–61 from West Bengal) by dual culture technique (Morton and Stroube, 1955). Observations on colony diameter of *F. udum* in single and dual culture were recorded after 144h of incubation and per cent inhibition of mycelial growth was calculated according to Vincent (1947).

Table1. Evaluation of *Trichoderma* species against different isolates of pigeonpea wilt pathogen *Fusarium udum*

Isolates	*T. harzianum*	*T. viride*	*T. virens*
FU-5	40.8	38.8	30.3
FU-12	74.5	63.3	60.3
FU-14	49.4	43.0	44.0
FU-21	59.1	41.0	44.0
FU-24	60.5	47.0	45.3
Fu- 27	40.8	29.4	33.3
FU-29	40.5	45.0	45.0
FU-37	26.8	46.0	40.0
FU-43	57.8	29.4	45.3
FU-49	42.7	46.0	46.0
FU-57	31.7	46.2	40.3
FU-61	78.3	52.3	79.2
LSD (P= 0.05)	7.07	6.5	7.03

Table 2. Evaluation of bioagents against *F. udum* in pots

Treatments	Rate	Method of application	Wilt incidence* (%)	Per cent disease control over control
T. viride (T_1)	4g kg^{-1}	ST	45.4 (42.3)	24.5
T. viride (T_2)	5g pot^{-1}	SA	32.3 (34.4)	46.1
$T_1 + T_2$ (T_3)	2g kg^{-1}+ 2.5g pot^{-1}	ST + SA	28.0 (31.90)	53.3
T. harzianum (T_4)	4g kg^{-1}	ST	40.0 (39.23)	33.3
T. harzianum (T_5)	5g kg^{-1}	SA	30.0 (33.0)	50.0
$T_4 + T_5$ (T_6)	2g kg^{-1} each + 2.5g kg^{-1}	ST + SA	27.3 (31.5)	54.5
T. viride + *T. harzianum* (T_7)	Each 2g kg^{-1}	ST	41.0 (39.8)	31.6
T. viride + *T. harzianum* (T_8)	Each 2.5g pot^{-1}	SA	29.0 (32.7)	51.6
$T_7 + T_7$ (T_9)	Each 4g kg^{-1}+ 5g pot^{-1}	ST + SA	26.4 (30.6)	56.0
Bavistin (T_{10})	2g kg^{-1}	ST	35.3 (34.6)	41.0
Control (T_{11})	--		60.0 (50.7)	-
LSD 0.05			4.42	

* Figures in parentheses are angular transformed values; ST = seed treatment; SA = soil application.

T. viride and *T. harzianum* isolates, which were found inhibitory to *F. udum in vitro,* were taken individually or in combination for further evaluation in pots. The local pathogenic isolate of *F. udum* (Fu–12) was multiplied on autoclaved sand-pigeonpea flour medium. The inoculum was mixed in sterilized soil @ 5 per cent w/w. Talc based preparation of the bioagent was mixed in FYM @ 5g kg^{-1} and incubated for 15 days and then mixed @ 200 gm per pot. The seeds of pigeonpea variety 'Bahar' were treated with the bioagent @ 5g kg^{-1} of seed and sown @ 15 seeds per pot. The untreated pots served as control. After germination 10 seedlings per pot were maintained. Each treatment was replicated thrice. Final observation on the number of wilted plants was recorded 90 days after sowing.

All the three isolates tested inhibited the growth of *F. udum* in dual cultures. *T. harzianum* (Dholi isolate) inhibited the growth of *F. udum* isolates FU-5, Fu-12, Fu-14, Fu-21, Fu-24, Fu-27 and Fu-43 by 40.8, 74.5, 49.4, 59.1, 60.5, 40.8, and 57.8 per cent respectively, and proved superior to other antagonists (Table 1). *T. viride* was found to have potential in inhibiting the radial growth of *F. udum* isolates Fu-29, Fu-37, Fu-49 and Fu-57 while *T. virens* was more effective in inhibiting the growth of Fu–61. The local isolate of *T. harzianum* was found antagonistic to most of the isolates of *F. udum in vitro*. Therefore, the local isolate of *T. harzianum* (Dholi isolate) was considered to be the most effective bioagent for *F. udum*. The results obtained are in aggrement with the finding of Jayalakshmi *et al*., (2003) who also stated that local isolate of *T. harzianum* was the most promising in inhibiting the mycelial growth (88.6%) of *F. udum in vitro*. Vishwadhar *et al*., (2006) studied the efficacy of the bioagents against ten *F. udum* isolates *in vitro* and reported that after 96 hour of incubation, the per cent inhibition of ten isolates of *F. udum* ranged between 35.5 - 54.8 by *T.viride*, 36.4 - 54.7 by *T. harzianum* and 36.4 - 57.3 by *T. virens.*

Talc based formulations of bioagents were used as seed treatment or soil application or both for the management of wilt of pigeonpea. Minimum disease incidence of 26.4% and maximum disease control of 56.0% was observed in combined application of *T. harzianum* and *T. viride* as seed treatment and soil application followed by 54% disease control in *T. harzianum* seed treatment and soil application (Table 2). However, these two treatments were on par. Seed treatment of pigeonpea with talc based preparation of bioagents alone gave lesser disease control. Prasad *et al.,* (2002) also reported that soil application of *T. harzianum* was more effective than seed treatment for pigeonpea wilt suppression. Soil application of *T. harzianum* has an advantage over seed treatment since the fungus is a natural soil inhabitant and establishes and multiplies more quickly in soil. The effect may be enhanced by integrating with farm yard manure. It is evident from the present findings that a talc based formulation of *T. harzianum* could be used as seed treatment or soil application or both for the management of wilt of pigeonpea.

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