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Efficacy of some botanicals and *Trichoderma* species against soil borne pathogens infecting chickpea

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ABSTRACT

Wilt caused by *Fusarium oxysporum* f. sp. *ciceri*, collar-rot by *Sclerotium rolfsii* and dry root rot by *Rhizoctonia bataticola* were the important soil borne diseases of chickpea crop. The experiment on efficacy of botanicals and *Trichoderma* spp. against these soil borne pathogens was undertaken in laboratory. The extract of *Allium sativum* (15%) inhibited the growth of *F. oxysporum* f. sp. *ciceri* and *S. rolfsii* completely and of *R. bataticola* by 88.8%. The extract of *Azadirachta indica* inhibited the growth of *F. oxysporum* f. sp. *ciceri*, *S. rolfsii* and *R. bataticola* by 55.5, 33.3 and 58.8% respectively. Of the *Trichoderma* species used, *T. harzianum* and *T. viride* were most efficient in inhibiting the growth of *Fusarium oxysporum* f. sp. *ciceri* by 60 and 58%, respectively. *Trichoderma lignorum* and *T. virens* inhibited the growth of *S. rolfsii* by 68 and 67% while the growth of *R. bataticola* was inhibited to the extent of 76% by *T. viride* and *T. harzianum*.

Key words: Antagonists, Botanicals, Chickpea, *Fusarium oxysporum* f. sp. *ciceri*,, *Rhizoctonia bataticola*,, *Sclerotium rolfsii*

Chickpea (*Cicer arietinum* L.) is the most important pulse crop of India with 6.93 million ha area and 5.60 million tonnes production and 808 kg/ha yield. In Maharashtra, the production of chickpea is 7.13 lakh tonnes from 10.88 lakh ha area with a productivity of 655 kg/ha. Various factors are responsible for low yield of chickpea. Among them, the soil borne diseases caused by *Fusarium oxysporum* f. sp. *ciceri* inciting wilt, *Sclerotium rolfsii* causing collar rot and *Rhizoctnia bataticola* causing dry root rot are important (Nene *et al.* 1989). Management of soil borne diseases is difficult. The presence of antifungal compounds in higher plants has been recognized as an important factor in disease control (Mahadevan 1982). Lately, there has been an enhanced enthusiasm in the use of botanicals and natural fungicides for plant disease control. A number of plants are known to possess antifungal activities which could be exploited commercially (Jharia *et al.* 1999). Biological control of pathogens has now become one of the most successful methods for controlling soil borne diseases. Several important plant diseases caused by *Pythium, Phytophthora, Rhizoctonia, Fusarium* and *Sclerotinia* have been reported to be managed effectively by *T. viride, T. harzianum and T. hamatum* (Arya and Kaushik 2001). The effectiveness of *T. harzianum* and *T. viride* as biocontrol agents in controlling chickpea wilt has been reported earlier (Singh *et al.* 1977 and Paulkar 2000). Therefore, the study was undertaken to assess efficacy of botanicals *viz.*, *Allium sativum, Nerium indicum, Azardirachta indica, Ocium sanctum, Eucalyptus* spp. *Zingiber officinale* and *Trichoderma* spp. on these soil borne pathogens infecting chickpea crop.

MATERIALS AND METHODS

Fusarium oxysporum f. sp. *ciceri*, *S. rolfsii* and *R. bataticola* were isolated from field infected plants collected from research farm of MPKV, Rahuri. These were purified and then pathogenicity proved using chickpea var. JG 62. The pure cultures of these pathogens were maintained on potato dextrose agar slants and used for further studies. The extract of the botanicals *viz.*, *Allium sativum* (bulb), *Nerium indicum* (leaves), *Azardirachta indica* (leaves), *Ocimum sanctum* (leaves), *Eucalyptus* spp. (leaves), and *Zingiber officinale* (rhizome) were prepared as suggested by Gerard *et al.* (1994). The extracts were prepared by crushing the plant material in mechanical grinder with equal quantity of distilled water w/v and then strained through cheese cloth. The extracts were subjected to low speed centrifugation at 1000 rpm for 15 minutes and clear supernatant were diluted with sterile distilled water so as to obtain the required concentration. Plant extracts were assayed by poisoned food technique. Supernatant (10 ml) of plant extract (unsterilized) was mixed separately in 90 ml sterilized potato dextrose agar medium and were poured into Petri plates. Control was run side-by-side using only distilled sterilized water (without extract).

The study was conducted *in vitro* condition to assess the effect of botanicals and *Trichoderma* spp. on soil borne pathogens infecting chickpea. Autoclaved PDA was poured into Petri plates and allowed to solidify. The 5 mm disc of *F. oxysporum* f.sp. *ciceri*, *Sclerotium rolfsii* and *Rhizoctonia bataticola* was kept at the centre of Petri plates and three discs of *Trichoderma viride, T. harzianum, T. lignorum, T. koningi, T. virens* and *T. hamatum* were placed at equidistance from centre disc and incubated for seven days. Plates containing only pathogen served as control. The treatments were replicated thrice. The radial mycelial growth of pathogens and antagonists was measured for every 24 hours up to seven days. The per cent inhibition was calculated as per the formula of Arora and Upadhyay (1978).

RESULTS AND DISCUSSION

The results (Table 1) clearly indicated that the growth of *F. oxysporum* f. sp. *ciceri* and *S. rolfsii* was completely inhibited by extract of *A. sativum* whereas the growth inhibition in case of *R. bataticola* was 88.8%. Similarly, *A. indica* inhibited the growth of *F. oxysporum* f. sp. *ciceri*, *S. rolfsii* and *R. bataticola* to the extent of 55.5, 33.3 and 58.8 % over un-inoculated control. Bhatnagar *et al.* (2004) reported effectiveness of *A. indica* against *F. oxysporum* f. sp. *cumini* causing wilt in cumin. The fungal antagonists *viz.*, *T. harzianum* and *T. viride* inhibited the growth of *F. oxysporum* f. sp. *ciceri* by 60% and 58% (Table 2). Similar results were obtained earlier by Singh *et al.* (1977) indicating inhibition of *F. oxysporum* f. sp. *ciceri* by *T. harzianum*. Effective control of chickpea *Fusarium* wilt by *T. harzianum* and *T. viride* was reported earlier by Prasad *et al.* (2002) and Shinde *et al.* (2005). The growth of *F. oxysporum* f. sp. *ciceri* was inhibited to the extent of 55% by *T. koningii* and *T. hamatum* and 53 and 50% by *T. lignorum* and *T. virens*. *Trichoderma lignorum* and *T.virens* inhibited the growth of *S. rolfsii* by 68% and 67%, respectively. Similar results were reported by Rao *et al.* (2004). *Trichoderma harzianum*, *T. viride*, *T. hamatum* and *T. koningii* inhibited the growth of *S. rolfsii* by 59, 55, 54 and 53%, respectively.

There was 76% inhibition of *R. bataticola* by *T. viride* and *T. harzianum*. In control, the mean growth of *R. bataticola* was 87 mm. Chaudhary *et al.* (2004) reported effectivity of *Trichoderma* spp. and *Gliocladium virens* against *Fusarium*

Table 1. Antagonistic effect of botanicals on soil borne pathogens infecting chickpea

Plant extract (at 15% conc.)	*F. oxysporum* f.sp. *ciceri*		*Sclerotium rolfsii*		*Rhizoctonia bataticola*	
	Mean Colony diameter (mm)	Inhibition (%)	Mean Colony diameter (mm)	Inhibition (%)	Mean Colony diameter (mm)	Inhibition (%)
Allium sativum L. (Garlic)	0.0	100.0	0.0	100.0	10.0	88.8
Nerium indicum (*Kanher*)	90.0	0.0	50.0	16.6	85.0	5.5
Azardirachta indica (*Neem*)	40.0	55.5	40.0	33.3	37.0	58.8
Ocium sanctum (*Tulas*)	90.0	0.0	60.0	0.0	90.0	0.0
Eucalyptus spp. (*Nilgiri*)	90.0	0.0	50.0	16.6	90.0	0.0
Zingiber officinale (Ginger)	70.0	22.2	50.0	16.6	90.0	0.0
Control	90.0	--	60.0	--	90.0	--
SE±	0.61	--	0.65	--	1.23	--
C. D. at 5 %	1.86	--	1.98	--	3.73	--

Table 2. Antagonistic effect of *Trichoderma* spp. on soil borne pathogens in chickpea

Trichoderma species used	*F. oxysporum* f.sp. *ciceri*		*Sclerotium rolfsii*		*Rhizoctonia bataticola*	
	Mean colony diameter (mm)	Inhibition (%)	Mean colony diameter (mm)	Inhibition (%)	Mean colony diameter (mm)	Inhibition (%)
T. viride	24.0	58	38.0	55	21.0	76
T. harzianum	22.0	60	35.1	59	21.0	76
T. lignorum	25.9	53	27.3	68	25.0	71
T. koningii	25.2	55	40.0	53	27.8	68
T. virens	28.0	50	28.0	67	29.4	66
T. hamatum	25.0	55	39.0	54	25.5	73
Control	55.7	-	85.0	-	87.0	-
SE±	0.95	--	3.47	--	0.39	--
C. D. at 5 %	2.94	--	10.69	--	1.20	--
C. V. (%)	5.55	--	14.98	--	2.01	--

spp., *Rhizoctonia bataticola, Sclerotium rolfsii, R. solani* and *Fusarium udum*. The growth of *R. bataticola* was inhibited to the extent of 73, 71, 68 and 66% by *T. hamatum, T. lignorum, T. koningii* and *T. virens*, respectively.

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