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Short Communication

Integrated management of chickpea wilt caused by *Fusarium oxysporum* F. sp. *Ciceri*

Praful Kumar and SS Mane

Abstract
The study was carried out to examine effect of seed treatment with the Fungicides viz; Thiram, Carbendazim and Biocontrol agents viz., Trichoderma viride, Pseudomonas fleorescens alone and their combination, to control wilt caused by *Fusarium oxysporum* F. sp. ciceri in chickpea plants (JG-62) growing in sick soil pots under green house conditions. The studies were revealed that the highest germination per cent (80%) was recorded in the combined treatmented with Carbendazim+T. viride and also recorded improvement on the growth parameters viz., shoot length, root length, shoot dry weight and root dry weight with (19.88cm and 24.42cm), (10.52cm and 15.02cm), (2.96g and 3.96g), (0.43g and 0.58g) respectively at 30 DAS and 60 DAS, along with significantly reduced wilting per cent over control (25.76%) and increased disease reduction per cent over control (74.24%) was noted in treatment of Carbendazim+T. viride compared with untreated control.

Keywords: *Fusarium oxysporum F. sp. Ciceri*, chickpea, green house, management

Introduction
Soil-borne plant pathogens are highly destructive to all kinds of crops and difficult to eradicate because they produce resting structures for their long time survival (Baker and Cooke, 1974) [3]. A large number of plant diseases have been successfully controlled through fungal and bacterial antagonists. *Trichoderma* species have been used in the management of crop plant diseases (Federico *et al*., 2007) [5]. Several strains of *Pseudomonas* also have been reported to suppress soil-borne diseases caused by fungal pathogen (O·Sullivan *et al*.,1992) [7]. Supplementation of fungicides at reduced rates in combination with biocontrol agents has significantly enhanced disease control, compared to treatments with biocontrol agent alone (Buck, 2004) [4].

The Effect of seed treatment with the Fungicides *viz;* Thiram, Carbendazim and Biocontrol agents *viz., Trichoderma viride, Pseudomonas fleorescens* alone and their combination were evaluated to control wilt caused by *Fusarium oxysporum* f. sp. *ciceri* in chickpea plants (JG-62) growing in sick soil pots under green house conditions. The repeated isolations were made, under aseptic condition, to isolate pathogen from wilted chickpea plants showing typical wilt symptom. The roots and stem of infected plants were washed in running tap water and cut into small bits of the size 2.5 mm. Surface sterilized (with 0.1 per cent mercury chloride) bit was placed on the each prepoured solidified potato dextrose agar (PDA) plates. These plates were then incubated at 27±2 ^{0}C for seven days. Isolated *Fusarium oxysporum* f.sp. *ciceri* culture were purified from single spore method and identified by the colony characteristics, as white cottony growth on PDA medium. Microscopically by conidia observation, were microconidia oval to cylindrical, straight to curved and produced on short, unbranched monophialides and macroconidia borne on branched conidiophores, were thin walled, 3-5 septate, fusoid and pointed at both ends (Trivedi and Rathi, 2015). The pathogen was subcultured on PDA slants and allowed to grow at 27 ± 2^{0}C temperature for 10 days. The mycelium bit of pure *Fusarium oxysporum* f. sp. *ciceri* were inoculated to autoclaved flask containing water soaked sorghum grains about 300g. Flask were incubated at 28± 2^{0}C and shaken to avoid clumping of grains and to facilitate early growth of the fungus for 10 days (Kamdi *et al.* 2012) [6]. The mass multiplied inoculum was added to sterilized soil at 1:10 proportion and thoroughly mixed thus the soil was made sick. The sick soil was filled in sterilized pots 1/4th of its capacity. The pots were watered lightly and incubated for 4 days. Seeds of susceptible chickpea cultivar JG-62 were treated and sown @ 10 seeds in each pot.

The pots sown with untreated seeds were also maintained as controls. Based on present study the results in table 1 indicated that the effect of all treatments found significant. Among the all treatments, the highest germination per cent (80%) was recorded in the combined treatmented with Carbendazim+*T. viride* and also recorded improvement on the growth parameters *viz.*, shoot length, root length, shoot dry weight and root dry weight with (19.88cm and 24.42cm), (10.52cm and 15.02cm), (2.96g and 3.96g), (0.43g and 0.58g) respectively at 30 DAS and 60 DAS, along with significantly reduced wilting per cent over control (25.76%) and increased disease reduction per cent over control (74.24%) was noted in treatment of Carbendazim+*T. viride* compared with untreated control. Above findings are supported by earliar experiment of Andrabi *et al.* (2011), that the growth parameters *viz;* shoot length, root length, shoot dry weight, root dry weight and plant dry weight were significantly improved with Carbendazim+*T. viride* treatment along with minimum disease incidence. Abed *et al.* (2013) [1] found that Trichoderma spp. and Carbendazim were significantly increased fresh and dry shoot-root weight and yield per plant against *Fusarium oxysporum* f.sp. *lycopersici*.

Table 1: Effect of seed treatments on chickpea plant

Treatments	Fungicide	Concentration	Percent seed germination	Shoot length (cm)#		Root length (cm)#		Shoot dry weight (g)#		Root dry weight (g)#		Percent Wilting over control	Disease reduction per cent over control
				30 DAS	60 DAS	30 DAS	60 DAS	30 DAS	60 DAS	30 DAS	60 DAS		
T_1	Thiram	0.3%	63.33 (52.73)*	15.30	19.06	8.66	14.70	2.16	3.02	0.36	0.43	39.83 (39.13)*	60.17
T_2	Carbendazim 50% WP	0.1%	70.00 (56.79)*	18.76	24.10	9.46	13.92	2.68	3.56	0.41	0.53	32.25 (34.60)*	67.75
T_3	*Trichoderma viride*	4g/kg	73.33 (58.91)*	18.74	23.44	9.82	14.12	2.52	3.74	0.41	0.57	35.06 (36.31)*	64.94
T_4	*Psuedomonas fluorescens*	10g/kg	60.00 (50.77)*	17.70	21.56	8.86	13.96	2.18	3.10	0.38	0.45	43.12 (35.74)*	56.88
T_5	Thiram + *P.fluorescens*	0.3%+10g/kg	63.33 (52.73)*	17.42	20.56	9.14	14.04	2.22	3.32	0.32	0.41	40.30 (39.41)*	59.70
T_6	Thiram + *T. viride*	0.3%+4g/kg	63.33 (52.73)*	19.16	23.54	9.68	14.56	2.72	3.82	0.43	0.52	35.32 (36.46)*	64.68
T_7	Carbendazim + *T. viride*	0.1%+4g/kg	80.00 (63.43)*	19.88	24.42	10.52	15.02	2.96	3.96	0.43	0.58	25.76 (30.50)*	74.24
T_8	Carbendazim + *P.fluorescens*	0.1%+10g/kg	66.67 (54.74)*	19.44	22.76	9.86	14.54	2.54	3.26	0.43	0.52	33.33 (35.26)*	66.67
T_9	Control		36.67 (37.27)*	13.78	17.98	6.84	11.96	1.08	1.88	0.19	0.28	100 (90.00)*	0.00
F test			Sig	Sig	Sig	Sig	Sig	Sig	Sig	Sig	Sig	Sig	
SE(m)±			0.57	0.31	0.27	0.34	0.20	0.12	0.13	0.01	0.01	5.37	
CD (P=0.01)			2.24	1.29	1.15	1.44	0.83	0.52	0.54	0.05	0.05	20.89	

(*=Figures in parentheses indicates arc sin transformed value)
(#= Average of 5 plants)

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