
Effect of fungicides on population dynamics of fusarial wilt pathogens of two economic crops

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The population of pathogens ie fusarial (*Fusarium oxysporum* f. sp. *ciceri* and *F. oxysporum* f. sp. *lycopersici*) declined gradually as the concentrations and incubation period increased. The selected fungicides viz., Thiram and Topsin-M were most effective at 800 mg/g concentration. Population of *F. oxysporum* f. sp. *ciceri* and *F. oxysporum* f. sp. *lycopersici* declined by 86.3% and 83.4% at this concentratin after 45 days. However, the other fungicides reduced the population of both the pathogen gradually to different levels with increase in incubation period and concentration of the fungicides.

Key words: Fungicides, population, fusarial wilt pathogens, chickpea, tomato

INTRODUCTION

The use of chemicals in controlling plant diseases create a toxic barrier between host and pathogen and eradicate the pathogen present on/in the host. Control the soil-borne phytopathogens by fungicides have been reported (Agrawal and Sarbhoy, 1976; Altman and Campbell, 1977; Dwivedi and Pathak, 1979; Pathak and Dwivedi, 1981; Kannaiyan and Prasad, 1983; Anahours *et al.*, 1984; Mishra and Rath, 1988; Dwivedi, 1991). Pulses and vegetables are amongst the essential needs of out diet for protein, vitamins and minerals requirements. But these crops are frequently attacked by soil borne fusaria that cause decline in yield as well as economy of the crops. Keeping this in view, the present paper aims to study the effects of some fungicides on population of *Fusarium oxysporum* f. sp. *ciceri* and *F. oxysporum* f. sp. *lycopersici* causing wilt diseases on chickpea and tomato respectively.

MATERIALS AND METHODS

The test pathogens viz., *Fusarium oxysporum* f. sp. *ciceri* and *F. oxysporum* f. sp. *lycopersici* were isolated from wilted chickpea and tomato plants and their cultures were maintained on Czapek-Dox agar slants. The pathogenicity tests were performed showing positive results with both the pathogens. Sampls of oat grains (150 g) were soaked overnight in distilled water in 500 ml Erlenmeyer flask, excess water was decanted off and the soaked grains were autoclaved (1.056 kg/cm^2 for 1 h) twice. The flasks were inoculated separately with 5 mm agar blocks cut from the actively growing margins of the

culture of the test pathogens. After two weeks of incubation at $25 \pm 1^\circ\text{C}$ hyphae of the pathogens grew luxuriantly on the oat grains. These were then air dried, pulverized in an electric grinder and kept in sterilized flasks for use as inocula of the test pathogens.

Five fungicides viz. Thiram (Tetamethylthiuram disulphide), Dithane M-45 (complex of zinc and maneb containing 20% manganese and 2.5% zinc), Topsin-M (thiophenate-methyl), Blue copper and Jkstein (carbendazim 50% w/w) were selected. Inoculum of each pathogen (0.1% w/w) and fungicides at the rate of 200, 400 and 800 mg/g concentrations were mixed thoroughly with sterilized soil and placed in sterilized earthen pots (150 g capacity) in triplicate. Control sets were also maintained, without addition of fungicides to determine the initial population of the pathogens. Soil moisture of the pots was maintained by adding equal amount of sterilized distilled water. Pots were covered with sterilized muslin cloth throughout the study to avoid aerial contamination. Population dynamics of the test pathogens was determined at 15, 30 and 45 d intervals.

Table 1. Effect of fungicides on population of *Fusarium oxysporum* f. sp. *ciceri* (Foc) and *Fusarium oxysporum* f. sp. *lycopersici* (Fol)
(initial population of Foc = 580 and Fol = 600 propagules g^{-1} dry soil)

Name of Fungicide		Incubation period (days)								
		15			30			45		
		Concentration (mg/g)								
		200	400	800	200	400	800	200	400	800
Blue copper	Foc	560*	520	480	450	340	300	210	170	130
		(03.5)	(10.4)	(17.3)	(22.5)	(41.4)	(48.3)	(63.8)	(70.7)	(77.6)
	Fol	545	500	425	365	295	270	185	170	180
		(09.2)	(16.7)	(29.2)	(39.2)	(50.9)	(55.0)	(69.2)	(71.7)	(70.0)
Dithane M-45	Foc	480	220	170	450	175	150	360	140	125
		(17.3)	(62.1)	(70.7)	(22.5)	(69.9)	(74.2)	(38.0)	(75.9)	(78.5)
	Fol	480	430	410	360	310	290	260	235	175
		(20.0)	(28.4)	(31.7)	(40.0)	(48.4)	(51.7)	(56.7)	(60.9)	(70.9)
Jkstein	Foc	500	460	400	460	350	300	310	270	220
		(13.8)	(20.7)	(31.1)	(20.7)	(39.7)	(48.3)	(46.6)	(53.5)	(62.1)
	Fol	565	535	500	440	370	275	225	180	140
		(05.9)	(10.9)	(16.7)	(26.7)	(38.4)	(54.2)	(62.5)	(70.0)	(76.7)
Thiram	Foc	520	490	408	350	210	200	150	110	80
		(10.4)	(15.6)	(29.7)	(39.7)	(63.8)	(65.6)	(74.2)	(81.1)	(86.3)
	Fol	560	525	490	415	385	340	290	240	200
		(06.7)	(12.5)	(18.4)	(30.9)	(35.9)	(43.4)	(51.7)	(60.0)	(66.7)
Topsin-M	Foc	480	430	280	410	400	210	300	250	180
		(17.3)	(25.9)	(51.8)	(29.4)	(31.1)	(63.8)	(48.3)	(56.9)	(69.0)
	Fol	520	485	415	380	290	265	205	160	100
		(13.4)	(19.2)	(30.9)	(36.7)	(51.7)	(55.9)	(65.9)	(73.4)	(83.4)

*Mean of triplicate

Values in parentheses are corresponding % inhibition of survivability compared to initial population

Table 2. 'F' value of the effect of fungicides on population of *Fusarium oxysporum* f. sp. *ciceri* (Foc) and *F. oxysporum* f. sp. *lycopersici* (Fol)

Fungicide		Source of variation	
		Incubation	Concentration
	Foc	169.3**	14.9*
Blue copper	Fol	3.9	70.5**
	Foc	10.9*	154.2**
Dithane M-45	Fol	31.1**	259.6**
	Foc	50.7**	19.8**
Jkstein	Fol	11.5*	128.9**
	Foc	88.3**	8.4*
Thiram	Fol	114.3**	478.7**
	Foc	16.9*	234.6**
Topsin-M	Fol	36.4**	314.5**

* Significant at $P = 0.05$, ** Significant at $P = 0.01$

Soil samples were powdered separately with pestle and mortar after each incubation period. Fifty mg of each soil sample was sprinkled on the selective medium for *Fusarium* (Nash and Snyder, 1962) in plates and incubated for a week at $25 \pm 1^\circ\text{C}$. Number of colonies grown in plates was recorded and population of the propagules g^{-1} dry soil (on c.f.u. basis) of the pathogens estimated. The data were analysed statistically using ANOVA test.

RESULTS AND DISCUSSION

The results depict that there was gradual reduction in the population of the pathogens at different concentrations of the fungicides and after different incubation periods (Table 1). The fungicides were most effective at the last incubation period (45 d) in both the cases. Amongst the fungicides tested, population of *Fusarium oxysporum* f. sp. *ciceri* was inhibited significantly ($P = 0.05$) by 86.3% at 800 $\mu\text{g/g}$ of thiram after 45 d followed by Dithane M-45 (78.5%), Blue copper (77.6%), Topsin-M (69.0%) and Jkstein (62.1%). Population of *F. oxysporum* f. sp. *lycopersici*, was checked significantly (Table 2) by 83.4% at 800 $\mu\text{g/g}$ of Toxin-M after 45 d followed by Jkstein (76.7%), Dithane M-45 (70.9%) and Thiram (66.7%). Blue copper checked the population by 71.7% at 400 $\mu\text{g/g}$ after 45 d. Other fungicides declined the population level gradually with increase in incubation period and concentrations of the fungicides.

Fungicidal role in controlling the soil-borne plant pathogens, depends upon their chemical nature as well do the sensitivity of the pathogen to a particular fungicide. Pathak and Dwivedi (1981) have studied the effect of fungicides on population dynamics of *Fusarium oxysporum* f. sp. *lycopersici* and found that it could be checked at 500 and 1000 ppm concentration. According to Ilyas *et al.* (1975), a considerable decline in the population of *Macrophomina phaseolina* in soils treated with pesticides including Thiram has been reported. Mishra and Rath (1988) have made a comparative *in vitro* study with 27

chemicals including some fungicides against different strains of *Fusarium* species isolated from different vegetables and reported promising results. The more pronounced reduction of population of both the test organisms at 400 µg/g after 45 d in the present study might be due to higher sensitivity of the pathogen at a particular stage of growth which could not otherwise be possible.

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