MANAGEMENT OF *Fusarium oxysporum* f. sp. *lycopersici,* THE CAUSAL AGENT OF WILT OF TOMATO

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ABSTRACT

All the systemic and compound fungicides tested caused significant reduction in mycelia growth of Fusarium oxysporum f. sp. lycopersici. Carbendazim proved most effective in reducing mycelia growth followed by propiconazole and in compound fungicides, carbendazim (12 %) + mancozeb (63 %) WP followed by azoxystrobin (11 %) + tebuconazole (18.3 %) were found effective. Trichoderma viride performed best in inhibiting the mycelial growth under in vitro followed by Trichoderma harzianum and Trichoderma virens. The fungal antagonists revealed higher antagonism as compared to bacterial bioagents in growth inhibition of Fusarium oxysporum f. sp. lycopersici.

***KEY WORDS:** Bio-control agents, Fungicides, Fusarium oxysporum f. sp. Lycopersici, Management, Tomato*

INTRODUCTION

Tomato crop occupies a very important place among all the vegetable crops grown in India; the average yield of this crop on farmers' fields is poor in comparison to the other countries. One of the main constraints for poor in yield is the biotic and abiotic stress. Among biotics stress, a large number of disease incited by fungi, bacteria, viruses and nematodes affect to attain the optimum yield. Among them, Fusarium *wilt is the most serious one causing great damage to the crop. Present study was undertaken to evaluate some fungicides and bio-agents against* Fusarium oxysporum *f. sp.* lycopersici *the causal agent of tomato wilt under* in vitro.

MATERIALS AND METHODS

The study was conducted in 2017-18 to test the effect of systemic fungicides, compound fungicides and bio-agents against mycelia growth of fungus using poisoned food technique. Required quantities of systemic fungicides (Carbendazim 50 WP, Difenoconazolec 25 EC, Propiconazole 25 EC, Azoxystrobin 23 SC, Tebuconazole 25.9 EC), compound fungicides (Carbendazim 12 % WP + Mancozeb 63 % WP, Metalaxyl 8 % WP + Mancozeb 64 % WP, Carboxin 37.5 % WP + Thiram 37.5 % WP, Azoxystrobin 11 % SC + Tebuconazole 18.3 % SC) and bio-agents (*Trichoderma viride*, *Trichoderma harzianum*, *Trichoderma virens*, *Pseudomonas fluorescens* and *Bacillus subtilis*). All fungicides were mixed separately in melted P.D.A. medium in conical flask to get 50, 100, 250, 500 ppm concentrations, respectively. Medium amended with fungicides was poured in sterilized petri dishes and allowed to solidify for 12 hrs. Each plate was then, inoculated with 5 mm disc of mycelia bit taken from 7 days old culture of *Fusarium oxysporum* f. sp. *Lycopersici* growing on PDA. Inoculated petri dishes were incubated at 27 ± 1°C. Colony diameter was measured after 7 days of incubation. Proper controls were maintained and per cent growth inhibition was calculated. Efficacy of bio-agents was tested by dual culture technique. The bio-agents and pathogen was grown separately on PDA medium. From seven days old culture 5 mm mycelial disc of the test pathogen were cut aseptically and placed opposite to each other approximately 60 mm apart on to petri plate containing 20 ml PDA. While in bacterial antagonists, the bacterial antagonist was streaked at one end of each petri plate poured aseptically with 20 ml PDA medium 24 hours prior to the pathogen inoculation. The plates with only pathogen were served as control. The plates were inoculated 25 ± 2°C and after 7 days, the radial growth was measured. The studies were conducted using Completely Randomized Design (CRD).

RESULT AND DISCUSSION

Result showed that all the five systemic fungicides, compound fungicides ant bio-control agents caused significant reduction in mycelia growth. Among fungicides, the maximum growth inhibition was recorded in carbendazim and propiconazole at all five concentrations over rest of the systemic fungicides tested. The most effective were carbendazim at different concentrations at 50 ppm (90.59 %), 100 ppm (91.76 %), 250 ppm (92.55 %), 500 ppm (92.75 %) and 750 ppm (93.53 %) and propiconazole at 50 ppm (85.88 %), 100 ppm (88.24 %), 250 ppm (90.20 %), 500 ppm (91.37 %) and 750 ppm (92.55 %) (Table 1). Azoxystrobin 23 SC showed the lowest growth inhibition at all different concentrations. Among different compound fungicides tested, carbendazim 12 per cent WP + mancozeb 63 per cent WP at all the five concentrations *viz.,* 50 ppm (89.80 %), 100 ppm (91.57 %), 250 ppm (92.75 %), 500 ppm (93.92 %) and 750 ppm (95.10 %) followed by azoxystrobin 11 per cent SC + tebuconazole18.3 per cent SC at 50 ppm (86.86 %), 100 ppm (89.22 %), 250 ppm (90.20 %), 500 ppm (91.57 %) and 750 ppm (92.75 %) inhibited significantly the growth of mycelia (Table 2). Song *et al*. (2004) found carbendazim as most effective fungicides in controlling the mycelial growth of *Fusarium oxysporum* f. sp. *lycopersici*. Raheja and Patel (2011) reported that complete inhibition growth of *Fusarium oxysporum* f. sp. *cumini* with carbendazim and combination fungicide carbendazim + mancozeb at 50 ppm concentration in *in vitro* condition.

Trichoderma viride observed the best bio-agent in inhibiting the pathogen growth (69.80 %) in *in vitro* followed by *T. harzianum* (65.29 %) and *T. virens* (52.16 %). *Pseudomonas fluorescens* had avarage impact on growth inhibition (46.67 %) of wilt pathogen (Table 3). Overall, all the three species of *Trichoderma* revealed higher antagonism as compared to bacterial bio-agents against *Fusarium oxysporum* f. sp. *lycopersici*. Similar observations were recorded on the inhibition of *Fusarium oxysporum* f. sp. *Lycopersici* by Bell *et al.* (1982) and Gurjar *et al*. (2004) found inhibition of *Fusarium oxysporum* f. sp. *vasinfectum* by *T. harzianum* and *T. viride*. Rajan *et al.* (2013) found significant inhibition of *Fusarium oxysporum* f. sp. *ciceri* by *Trichoderma viride* followed by *Trichoderma harzianum*. Barhate *et al*. (2015) reported that *T. viride* recorded the highest growth inhibition of *Fusarium oxysporum* f. sp. *lycopersici* followed by *T. harzianum*, *T. hamatum* and *T. koningii*.

CONCLUSION

Carbendazim proved most effective in reducing mycelia growth followed by propiconazole and in compound fungicides, carbendazim (12 %) + mancozeb (63 %) WP followed by azoxystrobin (11 %) + tebuconazole (18.3 %) were found effective. *Trichoderma viride* performed best in inhibiting the mycelial growth under *in vitro* followed by *Trichoderma harzianum* and *Trichoderma virens*.

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Table 1: Effect of systemic fungicides on growth inhibition of *Fusarium oxysporum in vitro* condition

Sr. No.	Fungicides	Growth Inhibition (%) Concentrations (ppm)					
		50	**100**	**250**	**500**	**750**	**Mean**
1	Carbendazim 50 WP	72.22 (90.59)*	73.43 (91.76)	74.26 (92.55)	74.51 (92.75)	75.42 (93.53)	73.97 (92.33)
2	Difenoconazole 25 EC	59.30 (73.92)	60.74 (76.08)	63.32 (79.80)	64.03 (80.78)	64.90 (81.96)	62.46 (78.50)
3	Propiconazole 25 EC	67.97 (85.88)	70.00 (88.24)	71.81 (90.20)	72.99 (91.37)	74.79 (92.55)	71.51 (89.65)
4	Azoxystrobin 23 SC	47.36 (54.12)	48.49 (56.08)	49.17 (57.25)	49.28 (57.45)	49.85 (58.43)	48.83 (56.67)
5	Tebuconazole 25. 9 EC	64.46 (81.37)	66.69 (84.31)	68.15 (86.08)	70.70 (89.02)	71.81 (90.20)	68.36 (86.17)
Mean		62.26 (77.17)	63.87 (79.29)	65.34 (81.17)	66.30 (82.27)	67.35 (83.33)	

	Fungicide (F)	**Concentration (C)**	**F × C**
S.Em.±	0.28	0.28	0.63
C. D. at 5 %	0.80	0.80	1.79
C.V. %	1.70		

Figures in parenthesis are retransformed values

Table 2: Effect of compound fungicides on growth inhibition of *Fusarium oxysporum in vitro* condition

Sr. No.	Fungicides	Growth Inhibition (%) Concentrations (ppm)					
		50	100	250	500	750	Mean
1	Carbendazim 12% WP + Mancozeb 63% WP	71.42 (89.80)*	73.18 (91.57)	74.45 (92.75)	75.82 (93.92)	77.35 (95.10)	74.44 (92.63)
2	Metalaxyl 8% WP + Mancozeb 64% WP	34.66 (32.35)	36.91 (36.08)	38.99 (39.61)	43.69 (47.25)	51.11 (60.59)	41.07 (43.17)
3	Carboxin 37.5% WP + Thiram 37.5% WP	45.11 (50.20)	51.23 (60.78)	59.81 (74.71)	70.76 (88.63)	72.40 (90.78)	59.86 (73.02)
4	Azoxystrobin 11% + Tebuconazole 18.3% SC	68.78 (86.86)	70.87 (89.22)	71.82 (90.20)	72.20 (91.57)	74.45 (92.75)	71.62 (90.12)
Mean		55.00 (64.80)	58.05 (69.41)	61.27 (74.32)	65.62 (80.34)	68.83 (84.80)	

	Fungicide (F)	Concentration (C)	F × C
S.Em.±	0.20	0.23	0.45
C. D. at 5 %	0.58	0.64	1.29
C.V. %	1.26		

****Figures in parenthesis are retransformed values***

Table 3: Effect of fungal and bacterial bio-agents on growth inhibition of *Fusarium oxysporum in vitro* condition

Sr. No.	Bioagents	Growth Inhibition (%)
1	*Trichoderma viride*	56.95 (69.80)*
2	*Trichoderma harzianum*	54.18 (65.29)
3	*Trichoderma virens*	46.50 (52.16)
4	*Pseudomonas fluorescens*	43.35 (46.67)
5	*Bacillus subtilis*	39.50 (40.00)
	S.Em.±	0.37
	C. D. at 5 %	1.16
	C.V. %	**1.33**

****Figures in parenthesis are retransformed values***

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