Int.J.Curr.Microbiol.App.Sci (2019) *8*(1): 1005-1010

International Journal of Current Microbiology and Applied Sciences
***ISSN: 2319-7706* Volume 8 Number 01 (2019)**
Journal homepage: http://www.ijcmas.com

Original Research Article https://doi.org/10.20546/ijcmas.2019.801.109

Compatibility of Different Systemic and Non Systemic Fungicides with *Trichoderma viride*

Shashank Mishra[1]*, Prashant Mishra[1], Ramji Singh[1], Gopal Singh[1] and S.K. Sachan[2]

[1]Department of Plant Pathology, [2]Department of Entomology, SVPUA&T, Meerut- 250110, Uttar Pradesh, India

**Corresponding author*

Keywords

Different systemic, Non systemic, Fungicides *Trichoderma viride*

Article Info

Accepted:
10 December 2018
Available Online:
10 January 2019

A B S T R A C T

Biological control involves the use of antagonistic microorganisms to attack and control plant pathogens, diseases and the disease producing activities they cause. It is an environmentally acceptable and ecologically viable approach which is compatible with different models of disease management i.e., organic, biological and integrated disease management (IDM) programmes. The chief antagonist used for disease management in Agriculture is the fungus *Trichoderma viride*, an effective and low cost biocontrol agent that can establish itself in different pathosystems. Nine fungicides namely Azoxystrobin, Iprodione, Tebuconazole, Hexaconazole, Propiconazole, Carbendazim and Thiopanate Methyl at 25, 50, 100 ppm and two fungicides viz., Captan and Mancozeb at 50, 100, 200ppm concentration were evaluated for their compatibility with the bioagent *Trichoderma viride* using poisoned food technique. The data showed that all fungicides significantly reduced the radial growth of *Trichoderma viride*. Mancozeb showed least inhibition (42.96%) at 200 ppm and compatible with *Trichoderma viride*. In case of five other fungicides Azoxystrobin, Tebuconazole, Hexaconazole, Propiconazole and Carbendazim completely inhibited the growth and not compatible with *Trichoderma viride*, while Thiopanate Methyl, Iprodione and Captan exhibited intermediate inhibitory effect and less compatible with *Trichoderma viride.*

Introduction

Sclerotinia sclerotiorum (Lib.) de Bary is a cosmopolitan necrotrophic fungal plant pathogen with a wide host range, including over 400 different plant species (Boland and Hall, 1994; Purdy, 1979). Increase in host range of *S. sclerotiorum* narrows down the opportunity for disease management using either crop rotation or resistant varieties. This pathogen is the causal agent of sclerotinia stem rot in lentil, leading to serious losses in yield due to lodging and premature shattering of seedpods (Gugel and Morrall, 1986). The stem rot fungus overwinters as sclerotia in the soil, in stubble at the soil surface and mixed with seed. Sclerotia can remain viable in the field for five years or more. Each year some sclerotia will germinate when conditions are suitable but others will remain dormant. Germination is either myceliogenic or may be carpogenic (spore-producing apothecia)

infections result from airborne spores produced by apothecia at the soil surface. Fungicides have a limited time period in which they are effective. *Trichoderma* spp. are important potential bioagents against these soilborne diseases. For the management of these diseases, farmers are using different fungicides but farmers are not getting satisfactory results. Therefore, farmers are applying talk based *Trichoderma* in soil with farm yard manure and other substrates for biological control of these soilborne diseases. For the use of these biocontrol agents in an integrated disease management programme, the bioagents must be compatible with the fungicides. Further, to minimise use of chemical fungicides, compatibility of *Trichoderma* with fungicides was studied.

Materials and Methods

Nine fungicides were evaluated against *Trichoderma* by Poisoned Food Technique.

Compatibility test

An *in vitro* experiment was conducted for the evaluation of compatibility of *Trichoderma viride* with nine fungicides by using poisoned food technique on potato dextrose agar medium. A weighed quantity of each fungicide was mixed in the PDA medium under aseptic conditions. For this PDA medium was amended with recommended doses of fungicides and poured in 90 mm culture plates. After solidification the agar medium in the culture plates the plates were inoculated with 5 mm culture disks of three days old culture of *Trichoderma viride* in the centre of petriplates and each treatment was replicated thrice. The plates without fungicide were served as control. The plates were incubated at 25±1ºC in BOD. After 3 days of incubation the diameter of the mycelial growth of *Trichoderma viride* was measured and average mycelial growth was recorded. The average data from the replicated plates was taken and the result was expressed as percent inhibition of mycelial growth over the control. The percentage growth inhibition of *Trichoderma* expressed by using the following formula given by Vincent (1947):

$$\text{Percentage growth inhibition} = \frac{C - T}{C} X100$$

Where
I = Percent Inhibition
C = Growth in control (mm)
T= Growth in treatment (mm)

Results and Discussion

Efficacy of nine systemic and non systemic fungicides was tested at different concentrations by Poisoned Food Technique (Table 1). The experimental findings (Table 2) indicated that all the fungicides significantly inhibited the mycelial growth of *Trichoderma viride* at all the concentrations tested, the results shows the per cent inhibition of mycelial growth of *Trichoderma viride* was recorded highest 78.52% Propiconazole followed by Azoxystrobin (76.66%), Hexaconazole (68.88%), Tebuconazole (68.52%), Carbendazim (64.44%), Thiophanate Methyl (54.44%) and Iprodione (42.58%) respectively at 25 ppm concentration. Least mycelial growth inhibition percent of *Trichoderma viride* 17.03% was recorded with treatment Mancozeb followed by 42.58% with the treatment Captan at 50 ppm concentration. In case of 50 ppm concentration of fungicides maximum mycelial growth inhibition 89.63 was recorded by Propiconazole followed by Tebuconazole (88.88%), Hexaconazole (84.44%), Azoxystrobin (77.77%), Carbendazim (76.66%), Thiophanate Methyl (74.44%) and Captan (71.47%). While least inhibition of mycelial growth of *T. viride* 46.30% was recorded with Mancozeb at 100 ppm concentration followed by 57.77% with Iprodione at 50 ppm concentration. The

fungicides viz., Azoxystrobin, Tebuconazole, Propiconazole, Hexaconazole and Carbendazim at 100 ppm concentration completely inhibited the growth of *Trichoderma viride*, showing no compatibility with *Trichoderma viride*, while Thiophanate Methyl at 100 ppm concentration exhibited intermediate inhibitory effect and inhibited the radial growth of *Trichoderma viride* 89.25%, followed by Captan (200 ppm) which shows mycelial growth inhibition 87.41% and Iprodione (100 ppm) 87.03%.

Both fungicide were at par to each other and were less compatible with *Trichoderma viride*. Least mycelial growth inhibition was recorded with Mancozeb at 200 ppm concentration 42.96%, so mancozeb found to be most compatible within the fungicides evaluated.

Out of the nine systemic and non systemic fungicides tested, all the fungicides significantly inhibited the mycelial growth of *Trichoderma viride* at all the three concentrations, the results shows that highest mycelial growth inhibition recorded with the treatment T_5 (Propiconazole) followed by the treatments Tebuconazole, Azoxystrobin, Hexaconazole, Carbendazim, Thiophanate methyl and Iprodione at 25 ppm concentration indicates their incompatibility with the *T. viride*. Least mycelial growth inhibition of *Trichoderma viride* was recorded with Carbendazim followed by Captan at 50 ppm concentration which shows that these two fungicides were compatible with the *Trichoderma viride*. In case of 50 ppm concentration of fungicides, highest mycelial growth inhibition was recorded with Propiconazole followed by Tebuconazole, Hexaconazole, Azoxystrobin, Carbendazim, Thiophanate methyl and Captan, it shows that these fungicides are incompatible with *T. viride*.

While least inhibition of mycelial growth of *T. viride* was recorded with Mancozeb at 100 ppm concentration followed by Iprodione at 50 ppm concentration so these fungicides are compatible with the *T. viride*. The fungicides Azoxystrobin, Tebuconazole, Propiconazole, Hexaconazole and Carbendazim at 100 ppm concentration completely inhibited the growth of *Trichoderma viride* and showing no compatibility with *Trichoderma viride*, while Thiophanate Methyl at 100 ppm concentration exhibited intermediate inhibitory effect and inhibited the radial growth 89.25% followed by Captan (200 ppm) mycelial growth inhibition 87.41% 144 hrs and Iprodione (100 ppm) mycelial growth inhibition 87.03%. Both fungicide were at par to each other and were less compatible with *Trichoderma viride*.

Table.1 List of fungicides

S. No.	Name of the Fungicide	Concentrations		
1	Azoxystrobin 23.1% W/W	**25 ppm**	**50 ppm**	**100 ppm**
2	Iprodione 500 SC	**25 ppm**	**50 ppm**	**100 ppm**
3	Tebuconazole 25% EC	**25 ppm**	**50 ppm**	**100 ppm**
4	Hexaconazole 5% SC	**25 ppm**	**50 ppm**	**100 ppm**
5	Propiconazole 25% EC	**25 ppm**	**50 ppm**	**100 ppm**
6	Carbendazim 50% WP	**25 ppm**	**50 ppm**	**100 ppm**
7	Thiophanate methyl 70% WP	**25 ppm**	**50 ppm**	**100 ppm**
8	Captan 50% WP	**50 ppm**	**100 ppm**	**200 ppm**
9	Mancozeb 75% WP	**50 ppm**	**100 ppm**	**200 ppm**

Table.2 Compatibility of *Trichoderma harzianum* with different fungicides

Conc.	25 ppm						50 ppm						100 ppm					
Time	48 hours		96 hours		144 hours		48 hours		96 hours		144 hours		48 hours		96 hours		144 hours	
Treatment ↓	Avg radial growth	% inhibition	Avg radial growth	% inhibi Tion	Avg radial growth	% inhibition	Avg radial growth	% inhibition	Avg radial growth	% inhibi Tion	Avg radial growth	% inhibition	Avg radial growth	% inhibition	Avg radial growth	% inhibition	Avg radial growth	% inhibition
T1	12.00	62.88	20.00	67.38	28.00	68.88	5.00	85.71	14.00	77.29	20.00	77.77	0.00	100	0.00	100	0.00	100
T2	28.33	12.37	39.00	36.4	51.67	42.58	20.00	42.85	30.00	51.35	38.00	57.77	6.00	82.17	9.00	85.32	11.67	87.03
T3	8.67	73.18	14.00	77.17	21.00	76.66	0.00	100	7.00	88.64	10.00	88.88	0.00	100	0.00	100	0.00	100
T4	12.33	61.86	20.67	66.29	28.33	68.52	4.67	86.65	8.00	87.02	14.00	84.44	0.00	100	0.00	100	0.00	100
T5	4.33	86.6	11.00	82.06	19.33	78.52	0.00	100	5.67	90.8	9.33	89.63	0.00	100	0.00	100	0.00	100
T6	14.00	56.69	21.00	65.75	32.00	64.44	7.33	79.05	10.67	82.69	21.00	76.66	0.00	100	0.00	100	0.00	100
T7	18.67	42.25	26.00	57.6	41.00	54.44	8.33	76.2	13.67	77.83	23.00	74.44	5.67	83.16	7.00	88.58	9.67	89.25
	50 ppm						100 ppm						200 ppm					
T8	20.33	37.11	32.33	47.28	51.67	42.58	12.33	64.77	15.67	74.59	25.67	71.47	8.33	75.25	10.67	82.6	11.33	87.41
T9	30.33	6.18	54.67	10.85	74.67	17.03	22.67	35.22	31.67	48.64	48.33	46.30	15.50	53.96	29.67	51.62	51.33	42.96
Control	32.33	0	61.33	0	90.00	0	35.00	0	61.67	0	90.00	0	33.67	0	61.33	0	90.00	0
$C.D._{0.05}$	1.172		1.686		1.566		1.291		1.502		1.520		1.129		1.039		1.253	
S.E.(m)	0.394		0.568		0.527		0.435		0.506		0.510		0.380		0.350		0.422	

Least mycelial growth inhibition was recorded with Mancozeb at 200 ppm was 42.96% and was most compatible within the fungicides evaluated. Similar work has been carried out by Ranganathswamy *et al.,* (2012) evaluated eighteen fungicides for their compatibility to *Trichoderma harzianum* and *Trichoderma virens in vitro,* and observed that carbedazim, benomyl, carboxin, propiconazole, chlorothalonil, hexaconazole, tricyclazole and tridemorph were incompatible with *Trichoderma* sp. showing 100 per cent inhibition of radial growth. While dinocap, copper oxychloride, fosetyl-Al, captan, thiram and metalaxyl were found to be least compatible showing more than 70 per cent inhibition of radial growth. Bordeaux mixture, azoxystrobin and mancozeb were moderately compatible, only wettable sulphur was found to be highly compatible with *Trichoderma* isolates. Madhavi *et al.,* (2011) observed that *Trichoderma viride* was highly compatible with mancozeb, on the other hand its mycelial growth was inhibited in the presence of captan and captan+ hexaconazole. *Trichoderma viride* was found totally incompatible with the systemic fungicide carbendazim which shows no mycelial growth. Nandeesha *et al.,* (2013) studied the *in vitro* efficacy of four systemic fungicide carbendazim, propiconazole and hexaconazole and tebuconazole and two non systemic fungicides viz. mancozeb, and captan. Among all fungicides mancozeb was found highly compatible with *Trichoderma viride*. Saravanan *et al.,* (2013) found that carbendazim was highly incompatible with *T. viride* at all concentrations tested as it completely inhibited the mycelial growth and to some extent mancozeb can be recommended in combination with *T. viride* in integrated pest and disease management programme.

In conclusion, in the present investigations experimental findings shows that Azoxystrobin, Tebuconazole, Propiconazole, Hexaconazole and Carbendazim are not compatible with *Trichoderma viride* so these fungicides cannot be applied with *Trichoderma viride* for integrated management of Sclerotinia stem rot of lentil while, Mancozeb was found to be most compatible with *Trichoderma viride* so can be applied for the integrated management of Sclerotinia stem rot of lentil and other crops.

References

Bolland G and Hall R 1994. Index of plant hosts to *Sclerotinia sclerotiorum*. *Canadian Journal of Plant Pathology* 16: 93-108.

Gugel, R. K. and Morrall, R. A. A. (1986). Inoculum-disease relationships in sclerotinia stem rot of rapeseed in Saskatchewan. *Can. J. Plant Pathol*. 8: 89–96.

Madhavi, G.B., Bhattiprolu, S.L., and Reddy, V.B. (2011) Compatibility of bio control agent *Trichoderma viride* with various pesticides. *Journal of Horticultural Sciences*.6(1): 71-73.

Nandeesha, B.S., Kumar, M.R., and Reddy, N.P. (2013) Evaluation of different fungicides and their compatiblility with potential *Trichoderma* spp. for the management of *Aspergillus niger*, Incitant of collar rot of groundnut. *Asian Journal of Biological and Life Sciences*.

Purdy, L.H. (1979). *Sclerotinia sclerotiorum*. History disease and Symptomology, host range, geographic distribution, and impact. *Phytopathol*., 69, 875-880.

Rangnathswamy, M., Patibanda, A.K., Chandrasekhar, G.S., Sandeep, D., Mallesh, S.B., and Kumar, H.B.H. (2012). Compatibility of Trichoderma isolates with selected fungicides in vitro. *International Journal of Plant Protection.* 5(1): 12-15.

Saravanan, L., Kalidas, P., Phanikumar, T., Deepthi, P., Babu, K.R. (2013) In vitro compatibility of *Trichoderma viride* with Agrochemicals. *Ann. Pl. Protec. Sci*. 22 (1): 190-239.

Vincent, J.M., (1947). Distortion of fungal hyphae in the presence of certain inhibitors. *Nature*, 150, pp. 850.

How to cite this article:

Shashank Mishra, Prashant Mishra, Ramji Singh, Gopal Singh and Sachan, S.K. 2019. Compatibility of Different Systemic and Non Systemic Fungicides with *Trichoderma viride*. *Int.J.Curr.Microbiol.App.Sci*. 8(01): 1005-1010. doi: https://doi.org/10.20546/ijcmas.2019.801.109