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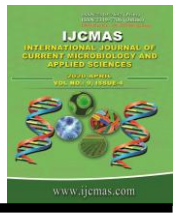

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Evaluation of Fungicides against *Macrophomina phaseolina* Inciting Root Rot of Sesame

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A B S T R A C T

Six fungicides *viz*., Tebuconazole + Trifloxystrobin 75 WG (Nativo), Hexaconazole 5% + Captan 70 % WP (Taqat), Carboxin 37.5% + Thiram 37.5% WP (Vitavax power), Iprovalicarb 5.5% + Propineb 61.25%WP (Melody duo), Carbendazim 50WP (Hycarb), Mancozeb 63% W.P. + Carbendazim 12% WP (Top too) were evaluated *in vitro* to test their efficacy against *Macrophomina phaseolina* by poisoned food technique. Results revealed that all the fungicides were effective in inhibiting mycelial growth of *M. phaseolina* to varying degrees. Complete inhibition (100%) of growth of pathogen over control was observed in Vitavax power followed by TopToo.

Introduction

Sesame (*Sesamum indicum* L.) have been cultivated since from 2350 B.C. for edible oil and food (Robbelen, 1989). It is regarded as the 'Queen of Oilseeds', the quality of its oil being highly stable with high nutritional and therapeutic value. It is an excellent source of vegetable oil and contains oil (43.4–58.8%), sugar (14–16%), protein (20–28%), and minerals (5-7%). Its seeds are rich source of food, edible oil, nutrition and have uses in health care also; the oil is quite stable due to the presence of antioxidants such as sesamin, sesamolin and sesamol (Suja *et al.,* 2004). Therefore, it is used to blend with other less stable vegetable oils to increase their stability and longevity (Chung and Choe, 2004).

Due to the presence of antioxidants and low level of saturated fatty acids, sesame oil reduces the incidence of hypertension and lowers the cholesterol level in human beings (Lemcke Norojarvi *et al.,* 2001; Sankar *et al.,*

2004). Wherever sesame is grown, it is liable to infected by various pathogenic fungi (AbdEl-Ghany *et al.,* 1974). Among these fungal diseases, charcoal rot/root rot of sesame caused by *M. phaseolina* is the most devastating disease (Dinakaran and Manoharan 2001) *M. phaseolina* is a facultative parasite which survives in the soil and in crop residues as sclerotia and it has also been reported to be seed-borne (Verma *et al.,* 2002). Sesame plants infected by this pathogen exhibits varied symptoms like seed rot, seedling decay, stem as well as root rot (Kolte, 1985; Verma *et al.,* 2005).

In India it is reported to be occurrence of about 50% diseases incidence which results in heavy yield losses (Chattopadhyay and Kalpna, 2002). At present chemical fungicides are the primary option with the farmers to combat diseases because of their easy adaptability and immediate therapy. The main objective of this study was to evaluate the six different fungicides at two different concentrations for testing their efficacy against mycelial growth inhibition of *Macrophomina phaseolina* under *in vitro* conditions.

Materials and Methods

In vitro evaluation of fungicides, botanicals and biocontrol agents

In vitro screening of fungicides against *M. phaseolina*

The following fungicides mentioned below in Table 1 were evaluated against *M. phaseolina* under *in vitro* conditions by poisoned food technique (Vincent, 1927) at two concentrations *i.e.* recommended and half the recommended dose. Three replications were maintained for each treatment with control. Six fungicides *viz*., Tebuconazole + Trifloxystrobin 75 WG (Nativo), Hexaconazole 5% + Captan 70 % WP (Taqat), Carboxin 37.5% + Thiram 37.5% WP (Vitavax power), Iprovalicarb 5.5% + Propineb 61.25%WP (Melody duo), Carbendazim 50WP (Hycarb), Mancozeb 63% W.P. + Carbendazim 12% WP (Top too) at recommended, and half-recommended dosages were evaluated separately against root rot pathogen, *M. phaseolina* under *in vitro* conditions by poisoned food technique (Vincent, 1927).

For each treatment, 100 ml of potato dextrose agar was taken in 250 ml conical flask and sterilized in an autoclave. Fungicide was added to the sterilized medium at lukewarm temperature under aseptic conditions and mixed thoroughly by shaking to obtain the above mentioned concentrations. The poisoned medium was equally distributed in the Petri plates and allowed to solidify.

Three replications were maintained for each treatment. Discs of 5mm diameter of the actively growing test fungal cultures were cut with sterilized cork borer separately and transferred to the centre of the poisoned medium in each of the Petri plates. Similarly, control was maintained by placing 5 mm discs of test fungal culture in centre of the plates containing the medium without fungicide. All the Petri plates were incubated at 28±1ºC in BOD incubator.

The diameter of fungal colony was measured in each of the treatment when the pathogen growth in control plate was full. The colony diameter inhibited in fungicide treated plates as compared to control was taken as a measure of fungi toxicity. Per cent inhibition over control was calculated by following the equation (Vincent, 1927):

$$I = \frac{C-T}{C} \times 100$$

Where,

I = Per cent inhibition over control
C = Radial growth of pathogen in control (mm)
T = Radial growth of pathogen in treatment (mm)

Results and Discussion

In vitro evaluation of fungicides, botanicals and biocontrol agents

In vitro screening of fungicides against *M. phaseolina*

The efficacy of six fungicides was tested *in vitro* by poisoned food technique and the results are presented in Table 2 and Plate 1. All the fungicides were effective in inhibiting radial growth of *M. phaseolina*to varying degrees. Significant difference was observed among the fungicides except two fungicides Vitavax power and Toptoo which were found to be on par with each other in inhibiting the mycelial growth of the pathogen.

Complete inhibition (100%) of growth of pathogen over control was observed in Vitavax power treatment at 2000ppm (Table 2 and Figure 1). This was followed by Top too (98.79%), In the order of merit other fungicides found inhibitory were carbendazim (97.59%), Nativo (94.23%) and Taqat (66.38%). Melody duowas least effective (28.45%) at both (1000ppm and 2000ppm) the concentrations in inhibiting the growth of the pathogen.

Table.1 Details of the fungicides used in bioassay studies under *in vitro* condition against *M. phaseolina*

Sl. No.	Common name	Trade name	Treatment number	Dosage (ppm)
1	Tebuconazole + Trifloxystrobin 75 WG	Nativo	T_1	2000
			T_2	1000
2	Hexaconazole5% + Captan70% WP	Taqat	T_3	2000
			T_4	1000
3	Carboxin 37.5% + Thiram 37.5% WP	Vitavax power	T_5	2000
			T_6	1000
4	Iprovalicarb 5.5% + Propineb 61.25%WP	Melody duo	T_7	2000
			T_8	1000
5	Carbendazim 50WP	Hycarb	T_9	2000
			T_{10}	1000
6	Mancozeb 63% W.P. + Carbendazim 12% WP	Top too	T_{11}	2000
			T_{12}	1000

Table.2 Effect of fungicides on the mycelial growth of *Macrophomina phaseolina* under *in vitro* conditions

Sl No.	Fungicide	Recommended concentration (ppm)	Treatment number	Linear mycelial (mm) growth	Inhibition of *Macrophomina phaseolina*over control (%)	Half the Recommended concentration (ppm)	Treatment number	Linear mycelial growth (mm)	Inhibition of *Macrophomina phaseolina*over control (%)
1	Tebuconazole + Trifloxystrobin 75 WG	2000	T 1	5.19 *	94.23	1000	T 2	6.05 a	93.27
2	Hexaconazole5 % + Captan70% WP	2000	T 3	30.25	66.38	1000	T 4	34.14	62.06
3	Carboxin 37.5% + Thiram 37.5%	2000	T 5	0.00	100	1000	T 6	1.09	98.79
4	Iprovalicarb 5.5% + Propineb 61.25%WP	2000	T 7	64.39	28.45	1000	T 8	73.36	18.48
5	Carbendazim 50WP	2000	T 9	2.17	97.59	1000	T 10	5.51	93.87
6	Mancozeb 63% W.P. + Carbendazim 12% WP	2000	T 11	1.09	98.79	1000	T 12	2.17	97.59
7	Control	-----		90.00				90.00	
	CD (p = 0.05)			1.23				1.33	1.79
	SE(m) ±			0.40				0.43	0.58
	CV (%)			2.51				2.47	1.29

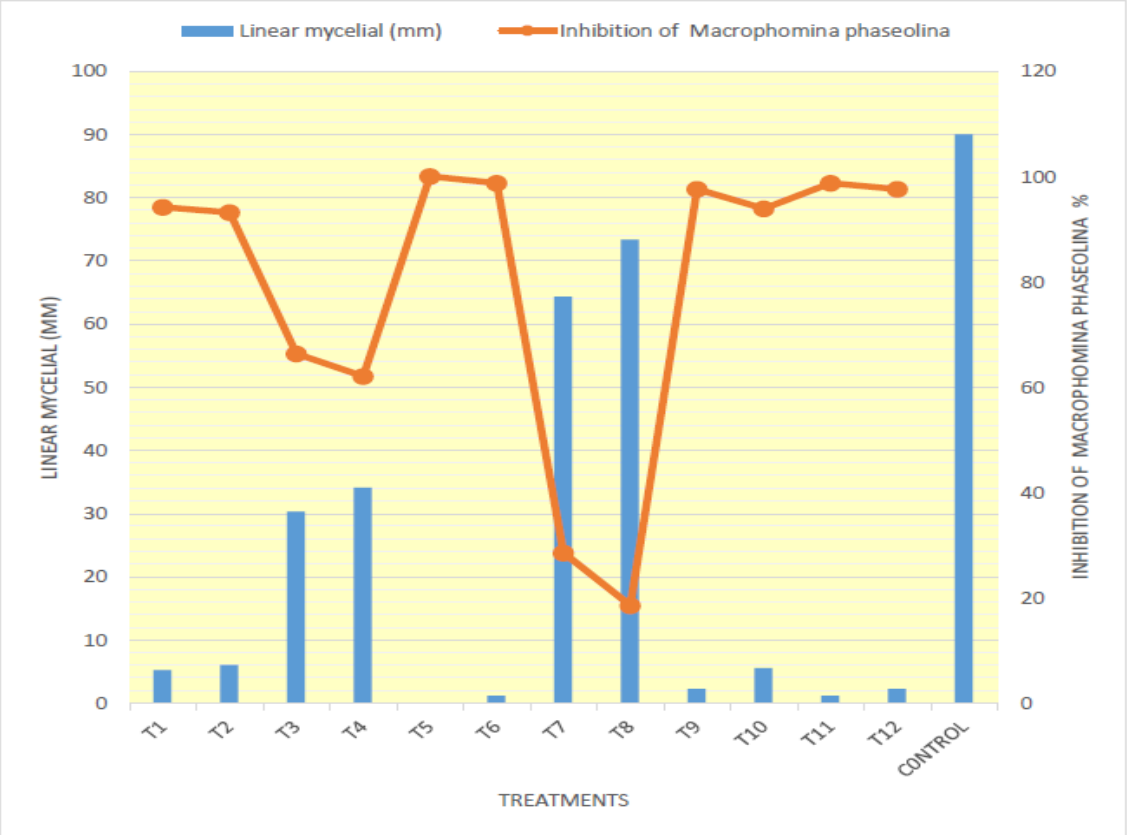

Figure.1 Effect of fungicides on the mycelial growth of *Macrophomina Phaseolina* under *in vitro* conditions

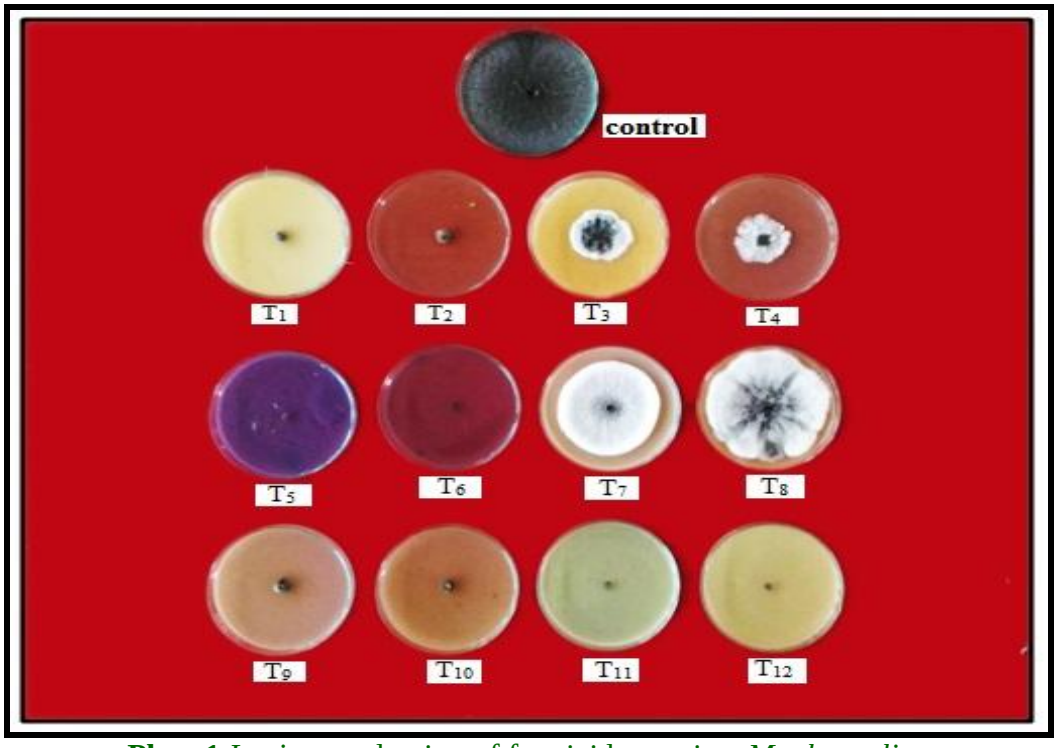

Plate.1 *In vitro* evaluation of fungicides against *M. phaseolina*

Similar results were obtained by Deepthi *et al.,* (2014) who reported that Vitavax power and Penflufen gave 100% inhibition of mycelial growth of *M. phaseolina* and the field evaluation of different fungicides indicated that Vitavax power gave highest sesame seed germination (85.10%) and less pre and post emergence mortality (14.88% and 27.66%), and yield loss (32.09%) against *M. phaseolina.*

Suryawanshi *et al.,* (2008)observed that fungicides carbendazim (0.1 %), mancozeb (0.2%) and thiram (0.3%) caused highest inhibition (94.18%) and were at par with each other. This was followed by thiophanate methyl (93.56%) against *M. phaseolina* inmungbean. Choudhary *et al.,* (2014)also reported that seed treatment with carbendazim 50WP (0.15%) + thiram (0.15%) recorded minimum disease incidence of *Macrophomina* root rot in sesame with 11.15% and 9.91% followed by carbendazim 50WP (23.06% and 21.01%).

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