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In vitro Efficacy of Fungicides against Dry Root Rot (*Macrophomina phaseolina*) of Soybean

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A B S T R A C T

Chemical control is one of the measures to manage the disease and avoid the losses. The evaluation study was therefore conducted *in vitro*. Ten fungicides were tested against the pathogen i.e. *Macrophomina phaseolina in vitro*. The highest inhibition (100%) of *M. phaseolina* was observed due to carbendazim 50% WP at different concentration (250, 500, 1000 ppm), mancozeb 75% WP (1500, 2000, 2500 ppm), ridomil-MZ 72% WP (1000, 1500, 2000 ppm) and carbendazim 12% + mancozeb 63% (1500, 2000, 2500 ppm) followed by propiconazole at 250 ppm (87.21 %), 500 ppm (89.92 %) and 1000 ppm (92.64 %) and rest of the treatments significantly inhibited colony growth over control.

Introduction

Oilseed crops have been the backbone of agricultural economy of India from time immemorial. Soybean is considered as the wonder legume because none of the other crops has multipurpose utilization.

It occupies an intermediate position between legumes and oil seed, containing in more protein (40%) then most of the legumes, but less oil (20%) then majority of the oil seed. Among all the oil seed crops, soybean is the most nutritive as it contains maximum lysine (64%). Above 40 per cent of the world supply of edible vegetable oil comes from soybean. In India diseases play an important role in Soybean cultivation and responsible to cause 25-60 per cent yield losses every year. In India, soybean is a known to be attacked by several diseases *viz*., wilt (*Fusarium solani* Mart. Sacc.), Anthracnose (*Colletotrichum dematium* Pers. Fr.), Sclerotium rot (*Sclerotium rolfsii* Sacc.), Dry root rot (*Macrophomina phaseolina* (Tassi.) Goid) among these, dry root rot caused by *Macrophomina phaseolina* (Tassi.) Goid is an important one. *M. phaseolina* (Tassi.) Goid is reported to be soil, seed and stubble borne fungus. The pathogen *M. phaseolina* generally affects the fibro vascular system of the roots and basal internodes affect the transport of nutrients and water to the upper parts of the plant.

Materials and Methods

The diseased samples were collected from College Research Farm, NAU, Navsari as well as farmers field during 2016. Affected plant of soybean showing typical dry root rot symptoms. The infected samples were brought to the laboratory and subjected to microscopic examination and tissue isolation.

The portion of the roots affected by root rot disease was cut into 5 mm small pieces. These pieces were then surface sterilized in 0.1 per cent mercuric chloride solution (HgC_{12}) followed by three changes in sterile water. Then these pieces were planted on sterilized Potato dextrose agar (PDA) in Petri dishes. The Petri dishes were incubated at 28 ± 2°C temperature in inverted position. After 3 days, sub culturing was done on Potato dextrose agar slants by transferring the young mycelial bit with the help of sterile inoculating needle. The culture tubes were kept at 28 ± 2°C temperature throughout the course of studies. Sub culturing was done at regular intervals of 15 days, using Potato dextrose agar slants. Potato dextrose agar medium was used as a basal medium for the fungicidal study by Poisoned food technique.

Potato dextrose agar medium was prepared in the 250 ml conical flask. 100 ml medium was taken in each flask. The medium then was sterilized at 15 lbs vapour pressure for 15 minutes. Required quantity of test fungicides were calculated and added in the sterilized medium separately. Flasks containing poisoned medium were shaken well to have even and uniform distribution of the fungicides. About 20 ml of poisoned PDA was poured in each of the sterilized Petri plates and allowed to solidify. The plates were inoculated by pure culture of *Macrophomina phaseolina*. For this purpose, 5 mm disc of one week old culture was cut with a sterilized cork borer. The disc was lifted and transferred aseptically in the centre of Petri plates containing the medium with test fungicides. Three plates were maintained for each treatment. The control plates without fungicides were also inoculated and kept for incubation. Treated plates were incubated at 28±2°C temperature. The observations on colony diameter were recorded after 5 days. The inhibition zone was calculated by using the following formula.

$$\text{Growth inhibition (\%)} = \frac{C-T}{C} \times 100$$

Where,

C = Growth of pathogen in control after incubation

T = Growth of pathogen in treatment after incubation

The data were statistically analysed in C.R.D

Results and Discussion

Among ten fungicides were evaluated at three different concentrations by poisoned food technique against *M. phaseolina*.

The results are presented in table 1, indicated that all fungicides evaluated significantly reduced the growth of *M. phaseolina* as compare to control but all the fungicides and their concentrations significantly differ within themselves. Among all concentration, the higher concentration of each fungicide produced maximum growth inhibition of the pathogen. From fungicides, mancozeb 75 % WP, carbendazim 50 % WP, ridomil-MZ 72 % WP and carbendazim 12 % + mancozeb 63 % at all the three concentration completely inhibited growth of the pathogen.

The next best in order of merit were propiconazole at 250 ppm (87.21 %), 500 ppm (89.92 %) and 1000 ppm (92.64 %) followed by trifloxystrobin 25 % +

tebuconazole 50 % at 500 ppm (79.84 %), 1000 ppm (83.72 %) and 1500 ppm (86.82 %), benomyl 50 % WP at 250 ppm (73.64 %), 500 ppm (79.84 %) and 1000 ppm (82.56 %), chlorothalonil at 1500 ppm (74.03 %), 2000 ppm (77.13 %) and 2500 ppm (79.07 %), copper oxychloride at 1500 ppm (68.99 %), 2000 ppm (69.77 %) and 2500 ppm (72.87 %), kresoxin methyle 50 % SC at 250 ppm (57.36 %), 500 ppm (63.95 %) and 1000 ppm (65.89 %) inhibiting the growth of *M. phaseolina*.

Table.1 Evaluation of different fungicides against *Macrophomina phaseolina in vitro*

Treat.	Fungicides	Concentration (ppm)	Average Colony diameter of pathogen (mm)	Growth inhibition over control (%)
T_1	Mancozeb 75% WP	1500	0.71* (0)	100
		2000	0.71 (0)	100
		2500	0.71 (0)	100
T_2	Copper oxychloride 50 % WP	1500	5.21 (26.7)	68.99
		2000	5.15 (26)	69.77
		2500	4.9 (23.3)	72.87
T_3	Trifloxystrobin 25% + Tebuconazole 50%	500	4.22 (17.3)	79.84
		1000	3.80 (14)	83.72
		1500	3.45 (11.3)	86.82
T_4	Chlorothalonil 75% WP	1500	4.78 (22.3)	74.03
		2000	4.49 (19.7)	77.13
		2500	4.30 (18)	79.07
T_5	Carbendazim 12%+ Mancozeb 63% WP (75%)	1500	0.71 (0)	100
		2000	0.71 (0)	100
		2500	0.71 (0)	100
T_6	Kresoxim methyl 50 SC	250	6.10 (36.7)	57.36
		500	5.61 (31)	63.95
		1000	5.46 (29.3)	65.89
T_7	Benomyl 50% WP	250	4.81 (22.7)	73.64
		500	4.22 (17.3)	79.84
		1000	3.94 (15)	82.56
T_8	Carbendazim 50% WP	250	0.71 (0)	100
		500	0.71 (0)	100
		1000	0.71 (0)	100
T_9	Propiconazole 25% EC	250	3.39 (11)	87.21
		500	3.02 (8.7)	89.92
		1000	2.61 (6.3)	92.64
T_{10}	Metalaxyl 8% + Mancozeb 64%, (72% WP)	1000	0.71 (0)	100
		1500	0.71 (0)	100
		2000	0.71 (0)	100
T_{11}	Control	-	9.30 (86)	000
S.Em.±		-	0.08	-
C.D. at 5%		-	0.24	-
C.V. %		-	4.64	-

Mean of three repetitions
*Figures are SQR + 0.5 transformed values
Figures in parenthesis are original values

Experiment details

a) Design	Completely Randomized Design (CRD)
b) Repetitions	3 (Three)
c) Treatments	11 (Eleven)
d) Method	Poisoned food technique

It is evident from the results that the growth inhibition of *M. phaseolina* increased as increase in the concentration of the chemicals. Mancozeb 75% WP, carbendazim 50% WP, carbendazim 12% + mancozeb 63% and metalaxyl 8% + mancozeb 64%, 72% WP were proved most effective.

Lambhate *et al.,* (2002) tested the efficacy of fungicides against *M. phaseolina*, root rot pathogen of cotton *in vitro* and reported that bavistin, ridomil M Z-72 and topsin-M at 0.1, 0.2 and 0.3 per cent showed cent per cent inhibition of mycelial growth of the fungus. Khalikar *et al.,* (2011) reported that carbendazim 50% WP @ 2g/kg, were superior in reducing pre and post emergence seedling rot and root rot disease (*M. phaseolina*) of cluster bean.

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