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Research Article

MANAGEMENT OF ROOT ROT IN COWPEA

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Abstract: The Research was conducted on Evaluation of fungicides against *Macrophomina phaseolina* of cowpea at Department of Plant Pathology, S. D. Agricultural University Sardarkrushinagar, Gujarat. Four systemic, four non-systemic and four combined fungicides at different concentrations were tested against *M. phaseolina* through poisoned food technique. Among the systemic fungicides, carbendazim 50 WP at all the four concentrations completely inhibited the growth of the pathogen. It was followed by propiconazole 25 EC with 84.50 and 92.35 per cent growth inhibition of pathogen at 250 and 500 ppm, respectively. Among the non-systemic fungicides mancozeb 75 WP at all the four concentrations completely inhibited growth of the pathogen followed by chlorothalonil 75 WP with 88.91 and 91.48 per cent growth inhibition of the pathogen at 1500 and 2000 ppm, respectively. Among combined fungicides carbendazim 12 % + mancozeb 63 % WP completely inhibited the growth of the pathogen followed by captan 50 % WP + hexaconazole 5 % WP with 90.87 and 92.96 per cent growth inhibition of pathogen at 500 and 1000 ppm, respectively.

Keywords: M. *phaseolina, Cowpea, Systemic fungicides, Non-systemic fungicides, Combined fungicides*

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Introduction

Cowpea [*Vigna unguiculata* (L.) Walp.] is one of the important vegetable and pulse crops of India. Cowpea plant is an excellent source of cattle fodder. It has also an ability to fix atmospheric nitrogen in the soil. Root rot disease of cowpea has become a major constraint in recent years for successful and profitable cultivation of cowpea. Cowpea is infected by many diseases caused by viruses, bacteria and fungi. Among the fungal diseases, the root rot caused by *Macrophomina phaseolina* (Tassi.) Goid. causes significant loss in yield. Concurrent heat and moisture stress favor development of charcoal or dry root rot disease often makes cultivation of cowpea un-economical. The first symptom of disease is yellowing of the leaves which droop in next 2 or 3 days and wither off. The plant may wilt within a week after the appearance of first symptom. When stem is examined closely, dark lesion may be seen on the bark at the ground level. If the plants are pulled from soil the basal stem and main root may show dry rot symptoms, the tissues are weakened and break off easily. In advanced cases sclerotial bodies may be seen scattered on the affected tissues causes significant yield losses. Hence, evaluation of fungicides to manage *M. phaseolina* were very much informative in cowpea. Therefore, bio-efficacy of fungicides against *M. phaseolina* is necessary for the disease management.

Material and Methods

To manage the root rot disease of cowpea caused by *Macrophomina phaseolina* an experiment was conducted at Department of Plant pathology C. P. College of Agriculture, Sardarkrushinagar Dantiwada Agricultural University, Sardarkrushinagar. Poisoned food technique was used to evaluate the *in vitro* efficacy of fungicides against *M. phaseolina*. Potato dextrose agar medium were prepared and distributed at the rate of 100 ml in 250 ml conical flask, autoclaved at 1.05 kg/cm^2 for 15 min then before solidification of media different fungicides of desired concentration were incorporated aseptically in different flasks. These flasks were shaken thoroughly and poured in petriplates 20 ml/plate likewise three plates for each treatment were maintained. One set of three plates were poured without any fungicides to serve as a control. After solidification of medium, the plates inoculated with seven days old pathogen separately.

The 5 mm diameter mycelial disc selected from peripheral growth of the plate by sterilized cork borer were used for inoculating the plates by keeping one disc per plate in the centre in inverted position, so as to make the mycelial growth touch the surface medium. The inoculated plates were incubated at room temperature for seven days.

Observations recorded

The colony diameter of the fungal pathogen on medium were recorded and per cent mycelial growth inhibition in each treatment were calculated by using following formula [1].

$PGI = [(C-T)/C] \times 100$

Where, PGI-Percent grown inhibition

C-Colony diameter in control (mm), T-Colony diameter in treatment (mm)

Results and Discussion

In the present investigation, four systemic, four non-systemic and four combined fungicides at different concentrations were tested *in vitro* for their comparative efficacy against the growth of *M. phaseolina* through poisoned food technique.

Bio-efficacy of systemic fungicides against *M. phaseolina*

Among all concentrations, the higher concentration of each fungicide produced maximum growth inhibition of the pathogen. From systemic fungicides, carbendazim 50 WP at all the four concentrations completely inhibited the growth of the pathogen. It was followed by propiconazole 25 EC with 69.27, 80.38, 84.50 and 92.35 per cent growth inhibition of pathogen at all the four concentrations as 50, 100, 250 and 500 ppm, respectively [Fig-1].

Bio-efficacy of non-systemic fungicides against *M. phaseolina*

From non-systemic fungicides, mancozeb 75 WP at all the four concentrations completely inhibited growth of the pathogen followed by chlorothalonil 75 WP with 79.20, 84.50, 88.91 and 91.48 per cent growth inhibition of the pathogen at all the four concentrations 500, 1000, 1500 and 2000 ppm, respectively [Fig-2].

Table-1 List of fungicides evaluated against Macrophomina phaseolina in vitro

SN		Common name	Concentration (ppm)			
A	Systemic fungicides					
	1	Thiophanate methyl 70 WP	50	100	250	500
	2	Propiconazole 25 EC	50	100	250	500
	3	Azoxystrobin 23 SC	50	100	250	500
	4	Carbendazim 50 WP	50	100	250	500
B	Non-systemic fungicides:					
	1	Mancozeb 75 WP	500	1000	1500	2000
	2	Chlorothalonil 75 WP	500	1000	1500	2000
	3	Thiram 75 WP	500	1000	1500	2000
	4	Copper oxychloride 50 WP	500	1000	1500	2000
B	Combine fungicides:					
	1	Carbendazim 12 % + Mancozeb 63 % WP	100	250	500	1000
	2	Metalaxyl 8 % + Mancozeb 64 % WP	100	250	500	1000
	3	Carboxin 37.5 % + Thirum 37.5 % DS	100	250	500	1000
	4	Captan 50 % WP + Hexaconazole 5 % WP	100	250	500	1000

Table-2 Evaluation of different systemic fungicides against M. phaseolina in vitro

SN	Fungicides	Growth inhibition (%)				Mean
		Concentration (ppm)				
		50	100	250	500	
T_1	Thiophanate methyl 70 WP	50.50^{g} (59.54)	55.01^{f} (67.13)	56.71^{ef} (69.87)	64.31^{d} (85.12)	56.63^{e} (69.74)
T_2	Propiconazole 25 EC	56.34^{f}(69.27)	63.71^{d}(80.38)	66.82^{c}(84.50)	73.95^{b}(92.35)	65.21^{b} (82.41)
T_3	Azoxystrobin 23 SC	47.56^{h} (54.46)	51.78^{g}(61.72)	55.09^{f}(67.24)	58.85^{e}(73.24)	53.32^{d} (64.31)
T_4	Carbendazim 50 WP	88.81^{a} (99.95)	88.81^{a} (99.95)	88.81^{a} (99.95)	88.81^{a} (99.95)	88.81^{a} (99.95)
T_5	Control	4.05^{i} (0.49)	4.05^{i} (0.49)	4.05^{i} (0.49)	4.05^{i} (0.49)	4.05^{e} (0.49)
Mean		49.45^{d} (57.73)	52.67^{c} (63.22)	54.30^{b} (65.94)	58.00^{a} (71.91)	-
		Fungicides		Concentration		Fungicides × Concentration
S.Em. ±		0.343		0.307		0.686
C.D. at 5 %		0.970		0.868		1.940
C.V. %		2.56				

Table-3 Evaluation of different non-systemic fungicides against M. phaseolina

TrNo	Fungicides	Growth inhibition (%)				Mean
		Concentration (ppm)				
		500	1000	1500	2000	
T_1	Mancozeb 75 WP	88.81^{a} (99.95)	88.81^{a} (99.95)	88.81^{a} (99.95)	88.81^{a} (99.95)	88.81^{a} (99.95)
T_2	Chlorothalonil 75 WP	62.87^{e} (79.20)	66.82^{d} (84.50)	70.55^{c} (88.91)	75.03^{b} (91.48)	68.81^{b} (86.02)
T_3	Thiram 75 WP	56.21^{g} (69.06)	60.04^{f} (75.06)	62.87^{e} (79.20)	66.89^{d} (84.59)	61.50^{c} (76.97)
T_4	Copper oxychloride 50 WP	48.31^{i} (55.76)	50.69^{h} (59.86)	55.31^{g} (67.60)	59.17^{f} (73.73)	53.37^{d} (64.23)
T_5	Control	4.05^{k} (0.49)	4.05^{k} (0.49)	4.05^{k} (0.49)	4.05^{k} (0.49)	4.05^{e} (0.49)
Mean		52.05^{d} (62.18)	54.08^{c} (65.58)	56.32^{b} (69.24)	58.39^{a} (72.52)	-
		Fungicides		Concentration		Fungicides × Concentration
S.Em. ±		0.316		0.282		0.631
C.D. at 5 %		0.892		0.798		1.785
C.V. %		2.29				

Table-4 Evaluation of different combine fungicides against M. phaseolina

TrNo	Fungicides	Growth inhibition (%)				Mean
		Concentration (ppm)				
		100	250	500	1000	
T_1	Carbendazim 12% + Mancozeb 63% WP	88.81^{a} (99.95)	88.81^{a} (99.95)	88.81^{a} (99.95)	88.81^{a} (99.95)	88.81^{a} (99.95)
T_2	Metalaxyl 8% + Mancozeb 64% WP	48.71^{h} (56.45)	52.18^{g} (62.40)	57.43^{f} (71.04)	62.63^{e} (78.86)	55.24^{d} (67.18)
T_3	Carboxin 37.5% + Thiram 37.5% DS	45.42^{i} (50.38)	50.72^{gh} (59.91)	58.80^{f} (73.16)	66.79^{cd} (84.46)	55.43^{c} (66.98)
T_4	Captan 50% + Hexaconazole 5% WP	69.30^{c} (83.99)	72.42^{b} (87.50)	74.62^{b} (90.87)	66.42^{d} (92.96)	70.94^{b} (88.83)
T_5	Control	4.05^{k} (0.49)	4.05^{k} (0.49)	4.05^{k} (0.49)	4.05^{k} (0.49)	4.05^{e} (0.49)
Mean		51.26^{c} (60.83)	53.64^{b} (64.85)	56.74^{a} (69.92)	45.27^{d} (72.52)	-
		Fungicides		Concentration		Fungicides × Concentration
S.Em. ±		0.340		0.304		0.681
C.D. at 5 %		0.962		0.861		1.925
C.V. %		2.63				

Bio-efficacy of combined fungicides against *M. phaseolina*

From combine fungicides [Table-3] carbendazim 12 % + mancozeb 63 % WP completely inhibited the growth of the pathogen followed by captan 50 % WP + hexaconazole 5 % WP with 83.99, 87.50, 90.87 and 92.96 per cent growth inhibition of pathogen at all the four concentrations 100, 250, 500 and 1000 ppm, respectively [Fig-3].

It is evident from the results that the growth inhibition of *M. phaseolina* increased as increase in the concentration of the chemicals. carbendazim, mancozeb and carbendazim + mancozeb proved most effective followed by propiconazole, chlorothalonil and captan + hexaconazole. The present investigation is more or less similar to the work done by earlier workers *viz*., Chaudhary *et al.* (2017) [2] conducted an experiment on ten fungicides tested against dry root rot of soybean caused by *Macrophomina phaseolina in vitro*. The highest inhibition (100 %) of *M. phaseolina* was observed in case of carbendazim 50 % WP, mancozeb 75 % WP, ridomil-MZ 72 % WP and carbendazim 12 % + mancozeb 63 % followed by propiconazole at 250 ppm (87.21 %), 500 ppm (89.92 %) and 1000 ppm (92.64 %) while rest of the treatments significantly also inhibited colony growth over control.

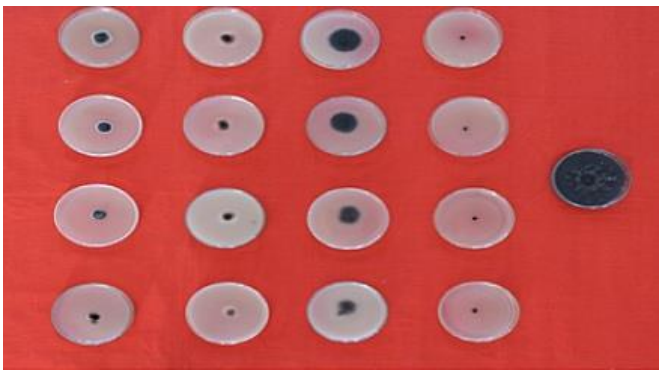

Fig-1 Evaluation of different systemic fungicides against *M. phaseolina in vitro*

Fig-2 Evaluation of different non-systemic fungicides against *M. phaseolina*

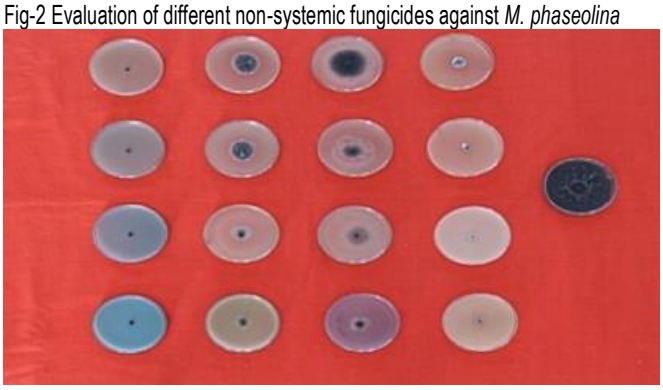

Fig-3 Evaluation of different combine fungicides against *M. phaseolina*

Conclusion

Twelve fungicides *viz*., four systemic, four non-systemic and four combine formulation were evaluated at four different concentrations by poisoned food technique *in vitro* for their efficacy against *M. phaseolina*. All the fungicides at four different concentrations were found significantly inhibitory to pathogen. Among all fungicides, carbendazim 50 WP, mancozeb 75 WP and carbendazim 12 % + mancozeb 63 % WP proved to be highly effective followed by propiconazole 25 EC, chlorothalonil 75 WP and captan 50 % + hexaconazole 5 % WP.

Application of research: Study of bio-efficacy of fungicides against *M. phaseolina* for the disease management

Research Category: Plant Pathology

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Study area / Sample Collection: C.P. College of Agriculture, Sardarkrushinagar, 385506, Gujarat, India

Cultivar / Variety / Breed name: Cowpea [*Vigna unguiculata* (L.) Walp.]

Conflict of Interest: None declared

Ethical approval: This article does not contain any studies with human participants or animals performed by any of the authors.
Ethical Committee Approval Number: Nil

References

[1] Bliss C.A. (1934) *Science*, 79, 39.
[2] Chaudhary D.H., Pathak D.M. and Chaudhary M.M. (2017) *International Journal of Current Microbiology and Applied Sciences*, 6(8), 1298-1301.