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RESEARCH PAPER

In vitro evaluation of different fungicides against *Colletotrichum gloeosporioides* causing anthracnose of pomegranate

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Abstract : *In vitro* evaluation of new synthetic fungicides against *Colletotrichum gloeosporioides* were carried out in the Department of Plant Pathology, College of Agriculture, Osmanabad during the year 2011-12. Among the non-systemic fungicides at 0.3 per cent concentration carbendazim + mancozeb showed 82.10 per cent inhibition of mycelial growth of fungus followed by chlorothalonil with 75.80 per cent and least inhibition of mycelial growth was recorded in captan 63.48 per cent. The systemic fungicides were evaluated against the pathogen at 0.05, 0.1, 0.15 per cent concentration. Among these concentration all fungicides were significantly found superior at 0.15 per cent concentration compared to 0.1 and 0.05 per cent concentration. The maximum per cent inhibition of growth of *C. gloeosporioides* was observed in propiconazole (74.86%) followed by benomyl (68.17%), iprodion + carbendezim (67.67%), thiophynate methyl (64.97%). The least per cent inhibition of fungus was recorded in bittertanol (44.12%) and hexaconazole (32.62%).

Key Words : *Colletotrichum gloeosporioides*, Fungicides, Anthracnose, Pomegranate

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INTRODUCTION

Anthracnose of pomegranate caused by *Colletotrichum gloeosporioides* (Penz.) is one of the most destructive disease of pomegranate (*Punica granatum*) inflicting considerable quantitative and qualitative losses. Mostly the disease occurred on leaves and fruits. Considering the economic importance of the fruit crop as well as disease, present investigation was undertaken for evaluation of systemic and non systemic fungicides *in vitro* against *C. gloeosporioides*. *In vitro* study was conducted in the laboratory of Department of Plant Pathology, College of Agriculture, Osmanabad.

MATERIAL AND METHODS

The efficacy of four non-systemic (one combi-product) and six systemic fungicides were tested against *C. gloeosporioides* for radial growth inhibition on the potato dextrose agar medium using poisoned food technique under *in vitro* condition. The non-systemic fungicides were tried at 0.1, 0.2 and 0.3 per cent

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Table A : List of systemic fungicides used for *in vitro* studies

Sr. No.	Common name	Chemical name	Trade name
1.	Benomyl	Methyl1-(butyl carbamamoyl)-2Benzimidazolecarbaonate	Benlate50% WP
2.	Propiconazole	1-(-2-(2,4-dichloropheny)-4-propyl-1,3-dioxolanyl methyl)- 1H-1-4 triazole	Tilt 25% EC
3.	Bittertanol	1-(dimethyl (1-2phenylene) bis-(iminocarbonothioryl) bis carbonate	Benicor25% WP
4.	Hexaconazole 5% EC	RS)-2-(2,6-dichlorophenyl-4prophyl,3-dioxolany 2-yl)methyl)-1H-1,2,6-	Contaf5%EC
5.	Thiophynate methyl	1-(biphenyl-4-yloxy)-3-3dimethy-1,2,4 trilzol-1-yl)	Topsin70%WP
6.	Iprodion25%+ Carbendazim25%	3(3,5-dichlorophenyl)-N-1(1 mehylethyl)-2 and Methyl 1-1-2 benzimidazole carbonate +zinc ion	Quintal 50%WP

Table B : List of non-systemic / combi fungicides used for *in vitro* studies

Sr. No.	Common name	Chemical name	Trade name
1.	Captan	N-(trichloro methyl thio) – 4 – cyclohexene 1,2, dicarboximide	Captaf 50 % WP
2.	Carbendazim 12% + Mancozeb 63%	Methyl 1-1-2 benzimidazole carbonate +zinc ion and manganese ethylene bis dithiocarbamate.	SAAF 75 %WP
3.	Chlorothalonil	Tetrachloroisophthalonitrile	Kavach 75% WP
4.	Propineb	Zinc propylene-bis-dithiocarbamate	Antracol 70 %WP

concentration, whereas, systemic fungicides were tried at 0.05, 0.1, 0.15 per cent concentrations. The list of fungicides used along with their chemical and trade names are given in Table A and B.

The poisoned food technique (Shravelle, 1961) was followed to evaluate the efficacy of non-systemic and systemic fungicides in inhibiting the mycelial growth of *C.gloeosporioides*. The fungus was grown on PDA medium for 12 days prior to setting up the experiment. The PDA medium was prepared and melted. The fungicidal suspension was added to the melted medium to obtain the required concentrations on commercial formulation basis of the fungicide. Twenty ml of poisoned medium was poured in each sterilized Petriplates. Suitable check was maintained without addition of fungicide. Mycelial disc of 5 mm was taken from the periphery of 12 days old colony was placed in the center of Petriplates and incubated at 27 ±1°C for 12 days and five replications were maintained for each treatment. The diameter of the colony was measured in two directions and average was recorded. Per cent inhibition mycelial growth of the fungus was calculated by using the formula by Vincent (1947) :

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

where,

I = Per cent inhibition (mm)

C = Radial growth in (mm) control

T = Radial growth (mm) in treatment.

RESULTS AND DISCUSSION

The results obtained from the present investigation as well as relevant discussion have been summarized under following heads :

In vitro evaluation of fungicides against *C. gloeosporioides* :

Screening of fungicides was done against *C. gloeosporioides* under laboratory condition by following poisoned food technique as described in "Materials and Methods". Six systemic and four non-systemic fungicides (one combi product) were evaluated against *C. gloeosporioides* in laboratory at three concentrations by poisoned food technique. Data with respect to inhibition of mycelial growth of *C. gloeosporioides* at three concentrations of four non systemic was recorded and presented in Table 1. Data from Table 1 revealed that, the efficacy of different non-systemic fungicides, concentrations and their interaction on per cent inhibition of mycelial growth of *C. gloeosporioides* differed significantly. Maximum per cent inhibition (73.99%) of *C. gloeosporioides* was recorded in combi product carbendazim + mancozeb which was significantly superior over all other fungicides followed by propineb (67.46%) and chlorothalonil (62.22%). Least per cent inhibition was noticed in captan (57.42%). However, the maximum per cent inhibition of mycelial growth was at 0.3 per cent concentration irrespective of fungicides. At 0.3 per cent concentration combi product carbendazim

+ mancozeb recorded highest per cent inhibition of mycelial growth (82.10%) of fungus which was significantly superior over other fungicides chlorothalonil (75.80%) followed by propineb (70.01%). The least inhibition of fungus was recorded in captan (63.48%). At 0.2 per cent concentration maximum per cent inhibition of mycelial growth (70.74%) of the fungus was recorded in carbendazim+ mancozeb, followed by propineb (69.55%) and captan (59.96%). The least inhibition of fungus was recorded in chlorothalonil (55.43%). At 0.1 per cent concentration maximum per cent inhibition of mycelial growth (68.96%) of the fungus was recorded in carbendazim + mancozeb, followed by propineb (56.56%) and chlorothalonil (55.43%). The least inhibition of fungus was recorded in captan (48.77%).

Data with respect to inhibition of mycelial growth of *C. gloeosporioides* at three concentrations of six systemic fungicides were recorded and per cent inhibition is presented in Table 2. It was observed that, fungicides, concentrations and their interaction differed significantly with respect to inhibition of the mycelial growth of *C.gloeosporioides.* Among six systemic fungicides, maximum per cent inhibition of growth of *C. gloeosporioides* was observed in propiconazole (74.86%) which was significantly superior to all other fungicides followed by benomyl (68.17%), iprodion + carbendazim (67.67%) and thiophynat methyl (64.97%). The least per cent inhibition of fungus was recorded in bittertanol (44.12) and hexaconazole (32.62%). Among the tested three concentrations, 0.15 per cent concentration of all fungicides was significantly found superior to 0.1 and 0.05 per cent. At 0.15 per cent concentration maximum per cent inhibition of mycelial growth (83.33%) of the fungus was recorded in benomyl followed by propiconazole (81.20%) which remained at par with each other. Further iprodion + carbendezim at 0.15 per cent (78.15%) remained significantly superior to thiophynate methyl (67.02%) and bittertanol (62.52%). The least per cent inhibition of fungus was recorded in bittertanol (62.52%) and hexaconazole (32.88%). At 0.1 per cent concentration maximum per cent inhibition of mycelial growth (75.48%) of the fungus was recorded in propiconazole followed by thiophynate methyl (64.42%) which remained at par with each other. Further

Table 1 : *In vitro* evaluation of non systemic and combi fungicides against *C. gloeosporioides*

Sr. No.	Fungicides	Colony diameter (mm)#			Mean	Per cent inhibition			Mean
		0.1%	0.2%	0.3%		0.1%	0.2%	0.3%	
1.	Captan	46.10 (27.46)	36.03 (21.12)	32.83 (19.16)	38.32	48.77	59.96	63.48	57.42
2.	Carbendazim 12% + Mancozeb 63%	27.93 (16.22)	26.33 (15.26)	16.11 (9.26)	23.46	68.96	70.74	82.10	73.99
3.	Chlorothalonil	40.11 (23.65)	40.11 (23.65)	21.78 (12.70)	34.00	55.43	55.43	75.80	62.22
4.	Propineb	33.44 (19.55)	27.40 (15.9)	26.99 (15.6)	29.28	56.56	69.55	70.01	67.46
5.	Control	90	90	90		00.00	00.00	00.00	
	Mean	36.89	32.46	24.37		57.43	63.92	72.84	
	S.E. ±	1.89	1.40	3.97					
	C.D. (P=0.01)	5.95	4.41	1.25					

Figures in parenthesis are arc sin values # Mean of three replications

Table 2 : *In vitro* evaluation of systemic fungicides against *C .gloeosporioides*

Sr. No.	Fungicides	Colony diameter (mm)#			Mean	Per cent inhibition			mean
		0.05%	0.1%	0.15%		0.05%	0.1%	0.15%	
1.	Benomyl	37.93 (22.29)	33.00 (19.27)	15.00 (8.62)	28.64	57.85	63.33	83.33	68.17
2.	Propiconazole	28.89 (16.79)	22.06 (12.75)	16.92 (9.74)	22.62	67.90	75.48	81.20	74.86
3.	Bittertanol	72.60 (46.58)	44.53 (26.45)	33.73 (19.71)	50.29	19.60	50.52	62.52	44.12
4.	Hexaconazole	70.36 (40.34)	54.46 (31.21)	57.10 (32.73)	60.64	21.55	39.48	32.88	32.62
5.	Thiophynate methyl	32.87 (19.19)	32.02 (18.68)	29.68 (17.27)	31.52	63.48	64.42	67.02	64.97
6.	Iprodion + Carbendazim	34.60 (20.25)	33.01 (19.29)	19.66 (11.34)	29.09	61.55	63.32	78.15	67.67
7.	Control	90	90	90	90	00.00	00.00	00.00	
	Mean	43.42 (27.61)	37.15 (23.38)	30.10 (19.16)		51.75	58.72	66.55	
	S.E. ±	1.44	1.76	1.30					
	C.D. (P=0.01)	4.37	5.34	3.96					

Figures in parenthesis are arc sin values # Mean of three replications

benomyl (63.33%) remained significantly superior to iprodion + carbendezim (63.32%) The least per cent inhibition of fungus was recorded in bittertanol (50.52%) and hexaconazole (39.48%). At 0.05 per cent concentration maximum per cent inhibition of mycelial growth (67.90%) of the fungus was recorded in propiconazole followed by thiophynate methyl (63.48%) which remained at par with each other. Further iprodion + carbendezim (61.55%) remained significantly superior to benomyl (57.85%) The least per cent inhibition of fungus was recorded in and hexaconazole (21.55%) bittertanol (19.60%).

These results are in agreement with those reported in past. Srinivasan and Gunasekaran (1998) reported that contaf (Hexaconazole) at 0.1, 0.15, 0.2 and 0.4 per cent concentration completely inhibited mycelial growth, indofil M-45 inhibited only upto 88 per cent at 0.5 per cent. Washathi and Bhargava (2000) reported fungicides *viz*., carbendazim (0.05-0.1%), mancozeb (0.2-0.25%), tetramethylthiuramdisulphate (0.25%) and benomyl (0.15%) showed complete inhibition of growth of *Colletotrichum dematium*. Similar results were also reported by Sudhakar (2000); Patel and Joshi (2002); Ashoka (2005); Prashanth (2007); Gud and Raut (2008); Prashanth *et al*. (2008 and 2013a and b) and Patel (2009).

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