



Efficacy of different fungicides against *Alternaria alternata* and *Cercospora capsici* under *in-vitro* conditions.

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Abstract

Among the ten fungicides evaluated in *in-vitro* condition against *Alternaria alternata* causing leaf spot disease of chilli revealed that propiconazole at all concentration *viz.*, 500, 1000 and 2000 ppm was showed complete inhibition of mycelial growth followed by mancozeb at 1000 and 2000 ppm and difenconazole at 2000 ppm. Whereas, against *Cercospora capsici*, propiconazole, difenconazole, benomyl and SAAF (mancozeb + carbendazim) showed total inhibition of the mycelia growth of the pathogens at all three concentration *viz.*, 500, 1000 and 2000 ppm.

Keywords: Fungicides, *Alternaria alternata*, *Cercospora capsici*.

Introduction

Chilli (*Capsicum annuum* L.) is a vital agricultural commodity in India, the fruits are harvested as either green or dried. Among the major constraints in the production of chilli biotic factors plays an important role. Leaf spot disease caused by *Alternaria alternata* and *Cercospora capsici* were the very common biotic factors in almost all chilli growing areas around India. As an air-borne or seed born nature of pathogen they will cause less to moderate damage to foliage, yield and quality of the produce.

In order to regulate this damage from early stage of the cropping season usage of fungicide is one of the method. So the present investigation was carried out in *in-vitro* condition.

Materials and Methods

The laboratory experiment was carried out in the Department of Horticultural Plant Pathology, K.R.C.

College of Horticulture, Arabhavi, University of Horticultural Sciences, Bagalkot. The efficacy of non-systemic fungicides and systemic fungicides against *Alternaria alternata* and *Cercospora capsici* were assessed by poisoned food technique (Sharvelle, 1961). Required quantities of individual fungicides based on active ingredients (a.i.) were added separately into molten and cooled potato dextrose agar so as to get the desired concentration of the fungicides. Later 25 ml of the poisoned medium was poured into sterile Petri plates. Mycelial discs of five mm size from actively growing culture of the fungus were cut out by a sterile cork borer and one such disc was placed at the centre of each PDA plate. Control was maintained without adding any fungicides to the medium. Each treatment was replicated thrice. Then such plates were incubated at $26 \pm 1^{\circ}\text{C}$ for nine days (*A. alternata*) and 20 days (*C. capsici*), then radial colony growth was measured. The efficacy of a fungicide was

expressed as per cent inhibition of mycelia growth over control that was calculated by using the formula given by Vincent (1947). The per cent values were converted to arc sin transformations, the data were analysed statistically.

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

Where,

I= Per cent inhibition.

C= Radial growth in control (mm).

T= Radial growth in treatment.

Results

Ten fungicides (including one combination product) were evaluated at three concentrations viz., 500, 1000 and 2000 parts per million (ppm) for their efficacy against *A. alternata* and *C. capsici* by poisoned food technique as described in “Material and Methods”.

The results of *in-vitro* evaluation of fungicides against *A. alternata* were presented in the Table 1. The results revealed that, effect of fungicides on the fungal growth was significant. Irrespective of the concentration at the end of ninth day maximum inhibition of mycelial growth over control was recorded in propiconazole 25% EC (100.00%) which was significantly superior over other treatments. Difenconazole 25% EC (91.16%) was second best followed by mancozeb 75% WP (88.20%) but the growth was on par with each other. Myclobutanil 10% WP (86.16%), copper hydroxide 77% WP (73.03%), mancozeb 63%+ carbendazim 12% WP (65.12%), copper oxychloride 50% WP (51.79%), benomyl 50% WP (39.22%) and carbendazim 50% WP (15.51%) were the next best chemicals in that order. Least inhibition was observed in thiophanate methyl 70% WP (13.45%).

Table 1. *In-vitro* evaluation of different fungicides against *Alternaria alternata*

Sl. No.	Treatment	Per cent inhibition of mycelium over control (mm)			Mean
		Concentration (ppm)			
		500	1000	2000	
1	Mancozeb 75% WP	64.60 (53.49)*	100.00 (89.99)	100.00 (89.99)	88.20 (77.82)
2	Difenconazole 25% EC	83.86 (66.31)	89.63 (71.21)	100.00 (89.99)	91.16 (75.84)
3	Propiconazole 25% EC	100.00 (89.99)	100.00 (89.99)	100.00 (89.99)	100.00 (89.99)
4	Myclobutanil 10% WP	83.08 (65.71)	87.33 (69.18)	88.08 (69.79)	86.16 (68.23)
5	Carbendazim 50% WP	8.46 (16.90)	13.85 (21.84)	24.23 (29.39)	15.51 (22.71)
6	Mancozeb 63% WP + Carbendazim 12% WP	58.83 (50.10)	65.37 (53.95)	71.16 (57.51)	65.12 (53.85)
7	Thiophanate methyl 70% WP	6.12 (13.89)	14.20 (22.04)	20.03 (26.55)	13.45 (20.83)
8	Copper oxychloride 50% WP	36.12 (36.93)	56.55 (48.76)	62.70 (52.35)	51.79 (46.01)
9	Copper hydroxide 77% WP	57.19 (49.20)	77.69 (61.81)	84.22 (66.59)	73.03 (59.20)
10	Benomyl 50% WP	26.14 (30.74)	36.92 (37.41)	54.59 (47.63)	39.22 (38.59)
		S.Em±			CD @ 1%
	Treatment	0.64			2.40
	Concentration	0.35			1.31
	Treatment X Concentration	1.10			4.15

*Data in parenthesis are Arc sin transformed values.

With respect to concentration maximum (100.00%) inhibition of test fungus was observed in propiconazole 25% EC at 500 ppm which was on par with 1000 and 2000 ppm of propiconazole, mancozeb 75% WP at 1000 and 2000 ppm and difenconazole 25% EC at 2000 ppm. The least inhibition was observed in thiophanate methyl 70% WP at 500 ppm (6.12%).

The results of *in-vitro* evaluation of fungicides against *C. capsici* were presented in the Table 2. The results revealed that, effect of fungicides on the fungal growth

was significant. Irrespective of the concentration at the end of twenty day maximum inhibition of mycelial growth over control was recorded in propiconazole 25% EC (100.00%) which was on par with difenconazole 25% EC (100.00%), benomyl 50% WP (100.00%) and mancozeb 63%+ carbendazim 12% WP (100.00%). Next best fungicides are in order, carbendazim 50% WP (93.87%), mancozeb 75% WP (87.98%), thiophanate methyl 70% WP (78.67%), myclobutanil 10% WP (77.32%) and copper oxychloride 50% WP (75.04%). Least inhibition was observed in copper hydroxide 77% WP (72.10%).

Table 2. *In-vitro* evaluation of fungicides against *Cercospora capsici*

Sl. No.	Treatment	Per cent inhibition of mycelium over control (mm)			Mean
		Concentration (ppm)			
		500	1000	2000	
1	Mancozeb 75% WP	80.96 (64.12)*	82.97 (65.64)	100.00 (89.99)	87.98 (73.25)
2	Difenconazole 25% EC	100.00 (89.99)	100.00 (89.99)	100.00 (89.99)	100.00 (89.99)
3	Propiconazole 25% EC	100.00 (89.99)	100.00 (89.99)	100.00 (89.99)	100.00 (89.99)
4	Myclobutanil 10% WP	74.14 (59.43)	77.56 (61.73)	80.25 (63.62)	77.32 (61.59)
5	Carbendazim 50% WP	81.60 (64.62)	100.00 (89.99)	100.00 (89.99)	93.87 (81.53)
6	Mancozeb 63% WP + Carbendazim 12% WP	100.00 (89.99)	100.00 (89.99)	100.00 (89.99)	100.00 (89.99)
7	Thiophanate methyl 70% WP	74.14 (59.43)	78.89 (62.65)	82.97 (65.64)	78.67 (62.57)
8	Copper oxychloride 50% WP	69.35 (56.39)	75.50 (60.33)	80.25 (63.62)	75.04 (60.11)
9	Copper hydroxide 77% WP	63.96 (53.14)	72.77 (58.54)	79.57 (63.14)	72.10 (58.28)
10	Benomyl 50% WP	100.00 (89.99)	100.00 (89.99)	100.00 (89.99)	100.00 (89.99)
		S.Em±			CD @ 1%
	Treatment	0.35			1.31
	Concentration	0.19			0.72
	Treatment X Concentration	0.6			2.26

* - Data in parenthesis are Arc sin transformed values

With respect to concentration maximum (100.00%) inhibition of test fungus was observed in propiconazole 25% EC at 500 ppm which was on par with difenconazole 25% EC at 500 ppm (100.00%), benomyl 50% WP at 500 ppm (100.00%) and saaf at 500 ppm (mancozeb 63%+ carbendazim 12% WP) (100.00%) followed by 1000 and 2000 ppm concentration of same fungicides. Least inhibition was observed in copper hydroxide 77% WP (63.96%).

Discussion

In-vitro evaluation of fungicides provides useful preliminary information regarding its efficacy against a pathogen within the shortest period of time and therefore, serve as guide for further field testing. In the present study 10 fungicides including both systemic and non systemic fungicides were tested at three concentrations viz., 500, 1000 and 2000 ppm.

Of the 10 fungicides used propiconazole was found effective irrespective of concentrations against *A. alternata*, where complete inhibition of mycelium was observed. Next in order were difenconazole, mancozeb, myclobutanil, copper hydroxide and a combination product mancozeb + carbendazim, copper oxychloride and benomyl. Carbendazim and thiophanate methyl showed least inhibition. With respect to concentration, propiconazole at very low concentration (500 ppm) showed its effectiveness, none of the others showed the effectiveness at 500 ppm. However, similar findings were also reported by Singh and Majumdar (2002) reported that propiconazole was the most effective fungicide in controlling *A. alternata* by 100% in 8 day after inoculation. Gorawar *et al.* (2006 b) reported that propiconazole, penconazole and hexaconazole at all three concentrations (0.025%, 0.05% and 0.1%) showed complete inhibition of growth of the *A. alternata*. Phapale *et al.* (2010) reported propiconazole showed cent per cent reduction of *A. alternata* at 250, 500 and 1000 ppm concentrations. Propiconazole 0.05 per cent completely inhibited the growth of the *A. alternata* (Thaware *et al.*, 2010).

Out of 10 fungicides used against *C. capsici* in all three of concentrations *viz.*, 500, 1000 and 2000 ppm cent per cent inhibition of mycelial growth over control was recorded in propiconazole, difenconazole, benomyl and a combination product of mancozeb+ carbendazim. The next best fungicides in order were carbendazim, mancozeb, thiophanate methyl, myclobutanil and copper oxychloride. Least inhibition was observed in copper hydroxide. Similar findings of Pairashi (2007) supported the present finding that

benomyl and propiconazole found 100 per cent inhibition of *C. nicotianae*.

The present investigation established that propiconazole at 500 ppm was effective against both *A. alternata* and *C. capsici*. Hence, the same fungicide was included for the management of leaf spot disease on chilli under field conditions.

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