



Efficacy of fungicides and phytoextracts against *Alternaria* spp. causing leaf spot on cotton *in vitro*

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Abstract : Of the eight fungicides tested *in vitro*, mancozeb and hexaconazole were found most effective to inhibit the mycelial growth of *Alternaria* spp. at 0.2% concentration. Phytoextract, azadiractien was superior over karanz oil and mustard oil to inhibit the mycelial growth. In potted plants, minimum disease severity were obtained in mancozeb and hexaconazole followed by copper oxychloride and tilt. All treatments as foliar sprays were able to reduce disease severity over untreated control at 0.2% followed by 0.1% concentration. Mancozeb and hexaconazole were found effective in management of *Alternaria* leaf spot of cotton.

Key Words : Fungicides, Plant extract, *Alternaria alternata*, *Alternaria macrospora*, *Alternaria gossypina*, Leaf spot, Bt cotton, Non Bt cotton

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INTRODUCTION

The symptoms of *Alternaria alternata* and *Alternaria macrospora* on leaves a small necrotic spot with a purplish halo, expands to about 1 cm diameter the center becoming grey and cracked. The zonation is more clearly defined on the upper surface. Defoliation can be severe especially where the peduncle becomes infected. Stem lesions begin as a small sunken spot which develops into a canker. Flowers and bolls may be shed, the latter become mummified and the fibre is attacked. Boll rots can also be caused by *Alternaria gossypina*.

Conidia of *Alternaria alternata* are dark Brown, ovoid, ellipsoidal, cylindrical beak, transversely septate septa. Size 20-63 x 9-18 μm in size mature conidia typically 10-30 x 5-12 μm . conidiophores are pale brown to olive brown 25-60 x 3-3.5 μm straight. The fungus is black grey with fluffy cottony growth on PDA medium plates. Mycelium was dark brown on slides.

Conidia of *Alternaria macrospora* are solitary, straight or curved obclavate. They are reddish brown in colour, usually

minutely verruculose, with four to nine transverse septa and several longitudinal septa. The body of the mature conidium is 15-22 μm thick at the broadest part. Conidiophores are erect and simple straight almost cylindrical or tapering towards the apex and septate. They are pale brown in colour and 4-9 μm thick and up to 80 μm in length. Colony colours are brown to grayish brown.

Conidia of *Alternaria gossypina* are dark brown with one or two longitudinal septa. They are 30-35 x 12-15 μm in size, excluding the beak, which is 9-52 μm long. Conidiophores are erect, simple, they are dark brown, relatively long and 3-5 celled and bear conidium terminally. Colony colours are black on PDA medium plates.

MATERIAL AND METHODS

Eight fungicides and four phytoextracts *i.e.* copper oxychloride 50 WP, mancozeb 75 WP, captafol 80 WP, saaf (carbendazim 12% + mancozeb 63%) 75 WP, tebuconazole (folicur) 250 EC, carbendazim (bavistin) 50 WP, tilt (propiconazole) 25 EC, hexaconazole 5 EC, azadiractin,

karanz oil, mustard oil and garlic extract were tested under laboratory and potted plants.

The effect of eight fungicides (systemic and non systemic) at two concentrations (0.1% and 0.2%) and four phytoextracts at two concentrations (1% and 2%) were evaluated *in vitro* against the pathogen using poisoned food technique.

In poisoned food technique desired quantities of fungicides and phytoextracts were weighed and mixed with sterilized PDA and poured aseptically in sterilized Plates. Medium without any fungicides and phytoextracts served as control. Two millimeter disc was cut out from one week old culture of three *Alternaria* spp. and were placed in the center of each Petri plates. The inoculated plates were incubated at $25 \pm 2^\circ\text{C}$ for 7 days. Each treatment was replicated thrice. When the control plates were fully covered with mycelial growth of the fungus, colony diameter was measured in each treatment and per cent inhibition of growth was calculated, by using Completely Randomized Design. Per cent inhibition of growth was calculated by using the following formula (Bliss, 1934).

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

where, I = Inhibition per cent, C = Colony diameter in control (mm), T = Colony diameter in control (mm).

RESULTS AND DISCUSSION

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

Effect of different concentration of fungicides (*In vitro*):

Results revealed that all eight fungicides inhibited

mycelial growth at both the concentrations of 0.1 and 0.2 per cent as compared to control (Table 1).

In case of *Alternaria alternata* maximum mycelial growth inhibition recorded with both the concentrations (0.1 and 0.2%) in mancozeb (100%) and hexaconazole (97.64 and 100%), followed by copper oxychloride (93.24 and 97.67%). Further, tilt (75.40 and 83.22%), tebuconazole (70.77 and 81.91%), captafol (66.50 and 73.01%) and Saaf (61.95 and 70.94%) gave per cent inhibition, respectively. Moreover, least inhibition noticed in carbendazim (55.09 and 66.61%) (Fig. 1).

In case of *Alternaria macrospora* complete inhibition of mycelial growth was noticed at both the concentrations (0.1 and 0.2%) in mancozeb (100%) and hexaconazole (97.16 and 100%), followed by copper oxychloride (95.48 and 97.77%) were also best at both concentration in comparison to tilt (77.58 and 85.55%), captafol (71.96 and 79.96%), tebuconazole (69.89 and 78.90%) and saaf (66.55 and 75.50%). Furthermore comparatively least inhibition was noticed in carbendazim (58.59 and 68.88%) (Fig. 2).

In case of *Alternaria gossypina* complete inhibition of mycelial growth was noticed at both the concentrations (0.1 and 0.2%) in mancozeb (100%) and hexaconazole (97.78 and 100%). Followed by copper oxychloride (95.45 and 98.78%) and tilt (92.07 and 97.65%) were also best at both concentration in comparison to captafol (71.98 and 79.74%), tebuconazole (69.64 and 77.37%) and saaf (64.08 and 72.24%). Furthermore comparatively least inhibition noticed in carbendazim (56.39 and 68.84%) (Fig. 3). Thus, it can be concluded that mancozeb and hexaconazole were found highly effective in checking the mycelial growth of all the three species of *Alternaria alternata*, *Alternaria macrospora* and *Alternaria gossypina*.

Table 1 : Effect of different fungicides on mycelial growth of *Alternaria* spp.

Fungicides	Mycelial growth of <i>A. alternata</i> (mm)		Inhibition over control (%)		Mycelial growth of <i>A. macrospora</i> (mm)		Inhibition over control (%)		Mycelial growth of <i>A. gossypina</i> (mm)		Inhibition over control (%)	
	0.1%	0.2%	0.1%	0.2%	0.1%	0.2%	0.1%	0.2%	0.1%	0.2%	0.1%	0.2%
Copper oxychloride	6.08	2.10	93.24	97.67	4.05	2.00	95.48	97.77	4.08	1.10	95.45	98.78
Mancozeb	-	-	100.00	100.00	-	-	100.00	100.00	-	-	100.00	100.00
Captafol	30.12	24.30	66.50	73.01	25.17	18.00	71.96	79.96	25.20	18.20	71.98	79.74
Saff	34.24	26.14	61.95	70.94	30.10	22.00	66.55	75.50	32.24	25.00	64.08	72.24
Tebuconazole	26.24	16.28	70.77	81.91	27.09	19.00	69.89	78.90	27.36	20.35	69.64	77.37
Carbendazim	40.35	30.00	55.09	66.61	37.15	28.00	58.59	68.88	39.23	28.01	56.39	68.84
Tilt	22.14	15.07	75.40	83.22	20.08	13.00	77.58	85.55	7.12	2.12	92.07	97.65
Hexaconazole	2.12	-	97.64	100.00	2.54	-	97.16	100.00	2.00	-	97.78	100.00
Control	90.00	90.00	-	-	90.00	90.00	-	-	90.00	90.00	-	-
S.E.±	1.267	0.886	1.390	0.932	1.238	0.844	1.008	0.763	0.984	0.811	0.926	0.792
C.D. (P=0.05)	3.765	2.633	4.129	2.769	3.677	2.508	2.996	2.266	2.924	2.408	2.751	2.354
C.D. (P=0.05)	5.158	3.608	5.657	3.794	5.038	3.437	4.105	3.104	4.006	3.299	3.769	3.225

* Average of three replications

Effect of different concentration of phytoextracts (*In vitro*) :

Effect of four phytoextracts viz., azadirachtin, karanz oil, mustard oil and garlic extract were evaluated at 1 and 2 per cent concentrations with poisoned food technique against three *Alternaria* spp (Table 2 and Fig. 4).

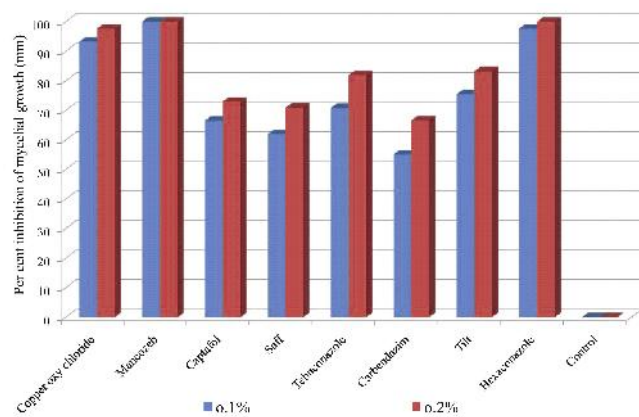


Fig. 1 : Effect of different fungicides on mycelial growth of *Alternaria alternata*

In case of *A. alternata* the maximum inhibition recorded at both concentration in azadirachtin (49.78 and 77.64%) followed by karanz oil (46.22 and 60.93%) and mustard oil (41.94 and 57.32%) and least inhibition was observed in Garlic extract (32.52 and 55.53%).

Further, in case of *A. macrospora* the maximum

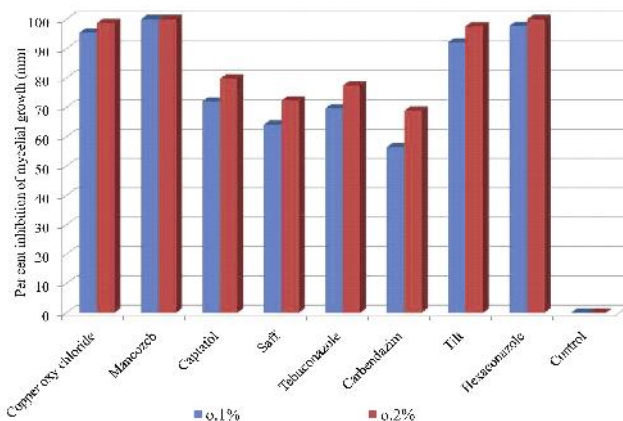


Fig. 3 : Effect of different fungicides on mycelial growth of *Alternaria gossypina*

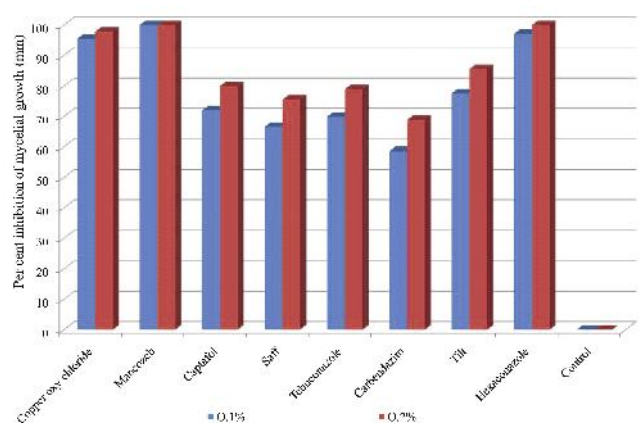


Fig. 2 : Effect of different fungicides on mycelial growth of *Alternaria macrospora*

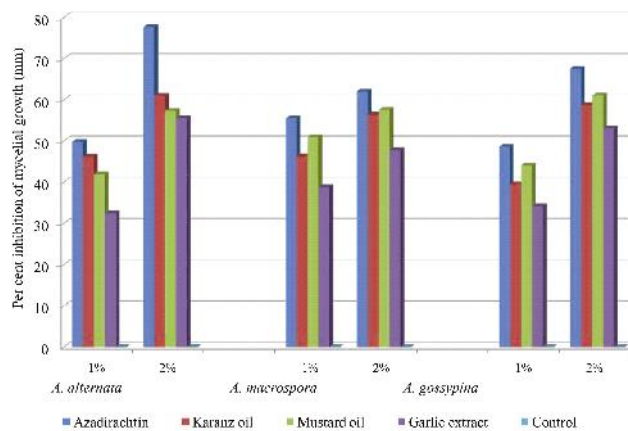


Fig. 4 : Effect of different phytoextracts on mycelial growth of *Alternaria* spp.

Table 2 : Effect of different Phytoextracts on mycelial growth of *Alternaria* spp.

Phytoextracts	Mycelial growth of <i>A. alternata</i> (mm)		Inhibition over control (%)		Mycelial growth of <i>A. macrospora</i> (mm)		Inhibition over control (%)		Mycelial growth of <i>A. gossypina</i> (mm)		Inhibition over control (%)	
	1%	2%	1%	2%	1%	2%	1%	2%	1%	2%	1%	2%
Azadirachtin	45.20	20.12	49.78	77.64	40.08	34.14	55.47	62.06	46.21	29.20	48.56	67.56
Karanz oil	48.40	35.17	46.22	60.93	48.34	39.26	46.29	56.37	54.37	37.15	39.48	58.72
Mustard oil	52.25	38.40	41.94	57.32	44.14	38.22	50.94	57.53	50.20	35.08	44.08	61.02
Garlic extract	60.73	40.00	32.52	55.53	55.10	47.00	38.80	47.78	59.21	42.22	34.11	53.09
Control	90.00	90.00	-	-	90.00	90.00	-	-	90.00	90.00	-	-
S.E.±	1.493	1.066	1.659	1.232	1.384	1.178	1.454	1.297	1.506	0.742	1.913	0.825
C.D. (P=0.05)	4.706	3.361	5.229	3.882	4.360	3.711	4.582	4.088	4.746	2.339	6.029	2.599
C.D. (P=0.01)	6.694	4.780	7.438	5.521	6.202	5.279	6.517	5.815	6.751	3.328	8.575	3.698

* Average of three replications

inhibition was recorded at both concentration in azadirachtin (55.47 and 62.06%) followed by mustard oil (50.94 and 57.53%) and karanz oil (46.29 and 56.37%) and least inhibition was seen in garlic extract (38.80 and 47.78%).

Moreover, in case of *A. gossypina* the maximum inhibition was recorded at both concentration in azadirachtin (48.56 and 67.56%) followed by mustard oil (44.08 and 61.02%) and karanz oil (39.48 and 58.72%) and least inhibition was observed in garlic extract (34.11 and 53.09%).

Many workers evaluated different types of fungicides and phytoextracts in laboratory against *Alternaria* spp. causing diseases in various crops like cotton, brinjal, tomato, potato, sesame, chilli and gerbera etc. In present studies mancozeb and hexaconazole were best fungicides and azadirachtin was best phytoextract for control to *Alternaria* spp., these findings are in accordance with those of Chattopadhyay (1999); Ghosh *et al.* (2002); Singh and Singh (2006); Naik *et al.* (2007) and Bochalya (2010).

Thus, it can be concluded that 0.2 per cent concentration of fungicides and 2 per cent concentration of phytoextracts were more effective than 0.1 per cent concentration of fungicides and 1 per cent concentration of phytoextracts used. The maximum inhibition of mycelial growth was recorded in mancozeb and hexaconazole in comparison to

other eight fungicides and Azadirachtin was best in comparison to karanz oil, mustard oil and garlic extract in all the three *Alternaria* spp. tested.

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