

Original Research Article

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Evaluation of Different Fungicides against *Alternaria alternata* Leaf Spot of Ber (*Zizyphus mauritiana* Lamk.) under *in vitro* Condition

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ABSTRACT

To study the effect of different fungicides against *Alternaria* leaf spot of ber, fungus was isolated from the infected leaves of ber plant and cultural and morphological study was done through Poison Food Technique to find that the fungus was *Alternaria alternata* having branched and septate mycelium with light brown to blackish conidiophores in acropetal chain and the conidia having olive green to dark brown colour with transverse and longitudinal septa. The evaluation of the fungal growth was done with chemical fungicides. A total of nine fungicides were tested at 100, 250, 500, 1000, 1500, 2000 and 2500 ppm concentrations, out of which Hexaconazole 5% EC (97.95%) showed maximum mycelium growth inhibition followed by Tebuconazole 25% EC (96.57%) and Tebuconazole 25% + Trifloxystrobin 25% WG (95.27%) while minimum inhibition was by Propineb 70% WP (78.41%) followed by Carbendazim 50% WP (79.17%). The fungicides tested in present study have also shown potential in controlling *A. alternata* leaf spot disease of Ber.

Keywords

Fruits, Green fodder, Green manure, Irregular brown spots

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Introduction

Indian jujube or ber (*Zizyphus mauritiana* Lamk.) is one of the most common fruit trees grown in tropical and sub-tropical regions, indigenous to an area stretching from India to South West China and Malaysia. It belongs to family *Rhamnaceae*. It is commonly called as Poor man's fruit. Ber is mostly grown in arid and semi-arid regions. The area occupied by

Ber in India is over more than 50,000 ha of land with a production of 513,000 MT (Anonymous, 2018; Kaur *et al.*, 2020). It is grown for different purposes *viz.*, fruits, green fodder, green manure. The production of ber in terms of fruits and fodder is limited mostly due to the *Alternaria* leaf spot disease caused by *Alternaria alternata*. The fruit are widely acknowledged as a rich and cheap source of minerals such as iron, calcium and

phosphorus, ascorbic acid, carbohydrates and essential minerals (Pareek, 1983; Abbas *et al.*, 1988; Pareek *et al.*, 2002). Leaf spot disease caused by *Alternaria alternata* is an important disease in the major crop growing areas of the state. The disease appears with formation of irregular brown spots on the upper surface of leaves followed by dark brown to black spots on the lower surface. Later, on the spots coalesce and leaves drop off. *Alternaria* leaf spot was a minor disease, but due to climatic changes, it emerged moderately to severe in form. So, keeping in view the importance of the disease the present study was conducted to evaluate *in vitro* efficacy of some fungicides against *Alternaria alternata*.

Materials and Methods

The experiment was conducted during 2018-2020 at Main Experimental Station, Horticulture, and Department of Plant Pathology Laboratory, A.N.D.U.A.T., Kumarganj, Ayodhya, U.P., India. Laboratory experiment was carried out to find out the fungitoxicity of following nine fungicides (Table 1) with four replications under *in vitro* conditions by using Poison Food Technique to study the inhibitory effect of these botanicals against the mycelial growth against *Alternaria alternata* in completely randomized design (CRD). The following nine fungicides (Table 1) were evaluated with seven concentrations (100, 250, 500, 1000, 1500, 2000 and 2500 ppm) against *A. alternata* under laboratory conditions to find out per cent inhibition on growth of the pathogen by poisoned food technique (Schmitz, 1930). Requisite quantity of each fungicide was incorporated in sterilized PDA medium, thoroughly mixed by shaking prior to pouring in sterilized Petri-plates and were allowed to solidify.

These Petri-plates were inoculated with 5 mm diameter disc of seven day old culture of the pathogen in the center of the plate and

incubated at 25±1°C. Each treatment was replicated four times with suitable control. The efficacy of fungicides in each treatment and average of four replications were calculated. The fungicides and the linear growth of test fungus were recorded and per cent mycelial growth inhibition was calculated by using formula (Vincent, 1947) given below:

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

Where,

I = Percent inhibition of fungal growth

C = Radial growth of colony

T = Radial growth in treated petri plates

Results and Discussion

The efficacy of nine fungicides was evaluated *in vitro* against *Alternaria alternata* (Table 2) at seven concentrations viz. 100, 250, 500, 1000, 1500, 2000 and 2500ppm on a PDA media by Poison Food Technique. Among the nine fungicides, the significantly highest average mycelial growth inhibition was shown by Hexaconazole (97.95%) which was significantly superior over Tebuconazole (96.57%), Tebuconazole + Trifloxystrobin (95.27%), Azoxystrobin + Difenoconazole (94.72%), Propiconazole (85.3%). Propineb (78.41%) was least effective followed by Carbendazim (79.17%), Mancozeb (80.42%) and Carbendazim + Mancozeb (83.08%) in inhibiting the growth of *Alternaria alternata*. Among the different concentrations highest inhibition was recorded at 2500 ppm (83.92%) followed by 2000 ppm (82.75%), 1500 ppm (81.32%) and 1000 ppm (80.12%) concentration and lowest inhibition at 100 ppm (69.34%) concentration followed by 250 ppm (73.44%) and 500 ppm (76.74%) of

fungicides. The present findings are in agreement with Kumar and Singh (2017), who found that Hexaconazole 5% EC at 250 ppm and Tebuconazole 50% + Trifloxystrobin 25% WG at 500 ppm was found most effective against inhibiting mycelial growth of *Alternaria solani*.

The result was also similar with that of Hariprasad *et al.*, (2017), showed that combination fungicides Hexaconazole + Zineb (86.29%) was comparable to Tebuconazole + Trifloxystrobin (84.44%) gave maximum mycelium inhibition at 0.10%, 0.15% and 0.20% concentration against *Alternaria tenuissima*. Similar findings were showed by Singh and Singh (2006), who evaluated bio efficacy of seven different fungicides viz., Azoxystrobin, Chlorothalonil, Propineb, Mancozeb, Copper oxychloride and Copper hydroxide at 250, 500, 1000, 2000 and 2500 ppm and Hexaconazole at 50, 100, 200, 500 and 1000ppm against *Alternaria alternata*

causing early blight of tomato. Every fungicide was found effective in inhibiting the mycelial growth of the fungus but Hexaconazole was found most effective with 100 per cent inhibition rate.

Mesta *et al.*, (2009), also tested five different fungicides viz., chlorothalonil and captan (0.1, 0.2 and 0.3% conc.), difenoconazole and Hexaconazole (0.05, 0.1, and 0.15% conc.) against *Alternaria helianthi* and it was found that maximum inhibition of fungal growth was observed in Hexaconazole (72.87%).

The fungicides tested in present study have shown potential in controlling *A. alternata*. The Hexaconazole followed by Tebuconazole and Tebuconazole + Trifloxystrobin were found most effective against *A. alternata* infection under *in vitro* condition while Propineb was found least effective against *A. alternata* infection in Ber (Fig. 1).

Table.1 List of fungicides used under *in vitro* study against *Alternaria* leaf spot of ber

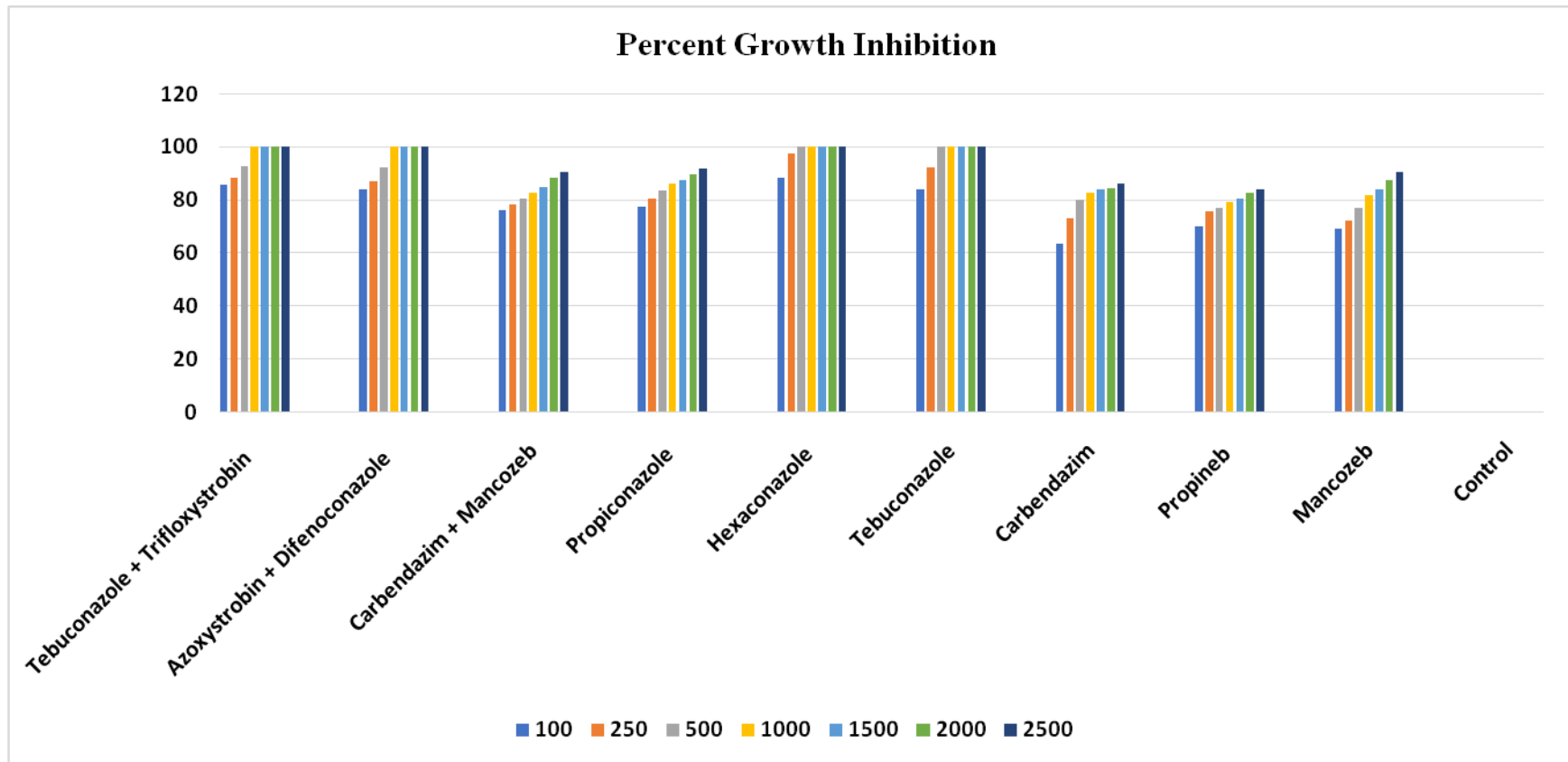
S.No.	Common name	Trade name	Concentrations
T1	Tebuconazole 25% + Trifloxystrobin 25% WG	Nativo	0.05
T2	Azoxystrobin 18.2% + Difenconazole 11.4SC	Quadris Top	0.10
T3	Carbendazim 12% + Mancozeb 63% WP	SAAF	0.20
T4	Propiconazole 25% EC	Tilt	0.10
T5	Hexaconazole 5% EC	Contaf	0.10
T6	Tebuconazole 25% EC	Folicure	0.20
T7	Carbendazim 50% WP	Bavistin	0.10
T8	Propineb 70% WP	Antracol	0.25
T9	Mancozeb 75% WP	Dithane M-45	0.20
T10	Control		Untreated

Table.2 Efficacy of fungicides on percent growth inhibition of *Alternaria alternata* on solid media

S.No.	Treatments	Percent Growth Inhibition							Avg. Per cent Inhibition (%)
		*Fungicide conc. (ppm)							
		100	250	500	1000	1500	2000	2500	
1	Tebuconazole 25% + Trifloxystrobin 25% WG	85.86 (67.94)	88.38 (70.11)	92.66 (74.35)	100 (90.00)	100 (90.00)	100 (90.00)	100 (90.00)	95.27 (81.77)
2	Azoxystrobin 18.2% + Difenoconazole 11.4% SC	83.88 (66.33)	86.9 (68.77)	92.32 (73.95)	100 (90.00)	100 (90.00)	100 (90.00)	100 (90.00)	94.72 (81.29)
3	Carbendazim 12% + Mancozeb 63% WP	76.14 (60.76)	78.55 (62.40)	80.57 (63.86)	82.52 (65.27)	84.73 (67.04)	88.5 (70.28)	90.55 (72.19)	83.08 (65.97)
4	Propiconazole 25% EC	77.54 (61.73)	80.62 (63.90)	83.62 (66.16)	86.16 (68.18)	87.51 (69.34)	89.73 (71.38)	91.94 (73.56)	85.3 (67.75)
5	Hexaconazole 5% EC	88.23 (69.96)	97.42 (80.89)	100 (90.00)	100 (90.00)	100 (90.00)	100 (90.00)	100 (90.00)	97.95 (85.83)
6	Tebuconazole 25% EC	83.97 (66.57)	92.08 (72.03)	100 (90.00)	100 (90.00)	100 (90.00)	100 (90.00)	100 (90.00)	96.57 (84.08)
7	Carbendazim 50% WP	63.6 (52.88)	73 (58.70)	80.05 (63.51)	82.91 (65.58)	84.18 (66.56)	84.46 (66.80)	86.05 (68.08)	79.17 (63.15)
8	Propineb 70% WP	70 (56.80)	75.6 (60.41)	77.09 (61.43)	79.2 (62.87)	80.51 (63.81)	82.55 (65.29)	83.97 (66.40)	78.41 (62.43)
9	Mancozeb 75% WP	69.36 (56.40)	72.33 (58.26)	77.2 (61.49)	81.93 (65.02)	84.22 (66.62)	87.36 (69.23)	90.56 (72.21)	80.42 (64.17)
10	Control	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
	SEm±	1.22							
	CD at 5%	3.43							
	Fungicides (F)	0.34							
	Concentration (C)	0.11							
	F × C	37.4							

Note: Average of four replications; Figures in parentheses are angular transformed values

Fig.1 Efficacy of fungicides against mycelium growth of *Alternaria alternata* on 7th day of incubation at 25 ± 1 °C



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