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Efficacy of fungicides against *Drechslera setariae* causing leaf spot disease of pearl millet *Pennisetum glaucum* (L.) *In vitro*

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Abstract

The present investigations were carried out to study the effects of selected fungicides viz. Dithane M-45, Tilt, Score, Kavach, Contaf, Companion and Folicur on mycelial growth of *Drechslera setariae* *in vitro*. The result revealed that all the fungicides viz., Dithane M-45, Tilt, Score, Kavach, Contaf, Companion and Folicur, significantly inhibited the mycelial growth of *D. setariae* at 1, 10, 50, 100 and 200 ppm. Tilt was most inhibitory proved followed Folicur and Tilt to mycelial growth of *D. setariae* *in vitro*.

Keywords: Leaf spot, *Drechslera setariae*, Severity, Fungicides, Management

Introduction

Pearl millet [*Pennisetum glaucum* (L.) R. Br.] $2n = 14$ locally known as bajra, bari, sajja, combo, ganti or kambam, is an allogamous crop having protogynous nature. It belongs to the family *Poaceae*. It is an important food and forage crop in Africa and Asia and important forage in America. It has great potential because of its suitability to the extreme limits of agriculture. The pearl millet grains are very nutritious and form the staple diet of approximately 10 per cent of the population in India. It has high protein with slightly superior amino acid profile. It is a good source of protein (11.5%), fat (4.1-6.4%), carbohydrate (59.8-78.2%) and also rich good amount of minerals particularly phosphorus and iron (2.8%). India is the largest producer of pearl millet with an annual production of 9.25 million tonnes from an area of 7.0 million hectares with productivity being 1250 kg/ha (Anonymous, 2014-15a) ^[1, 2]. In Rajasthan occupies first position in area and production of pearl millet in India. In Rajasthan, it is cultivated on 40.76 lac hectares area with the production 44.56 lac tonne and productivity of 1093 kg/ha (Anonymous, 2014-15b) ^[1, 2].

Leaf spot of pearl millet caused by *Drechslera setariae* is a common foliar disease. *Drechslera setariae* was isolated from the, rotted seeds and infected parts of seedlings. The seed used was obtained from Mysore, India and was found to be infected with *D. setariae*, which has been reported from the United States to be seed-borne in pearl millet, causing seed rot, blight and leaf spotting (Wells & Winstead, 1965 and Wells & Burton, 1967) ^[13, 12]. The disease has also been noticed in India by Bhowmik (1972) ^[4] and Balasubramanian (1980) ^[3].

Materials and Methods

Evaluation of fungicides against of *Drechslera setariae* *in vitro*

Different fungicides were tested at five different concentrations viz., 1, 10, 50, 100 and 200 ppm in Petri plates. Poisoned food technique (Grover and Moore, 1961) ^[6] was adopted for management of plant pathogen *in vitro*.

Technical formulation	Trade name	Dose (ppm)
Mancozeb 75 WP	Dithane M-45	1, 10, 50, 100, 200
Chlorothalonil 75WP	Kavach	1, 10, 50, 100, 200
Hexaconazole 5 EC	Contaf	1, 10, 50, 100, 200
Propiconazole 25 EC	Tilt	1, 10, 50, 100, 200
Difencconazole 25EC	Score	1, 10, 50, 100, 200
Carbendazim 12 WP + Mancozeb 63 WP	Companion	1, 10, 50, 100, 200
Tebuconazole 25 EC	Folicur	1, 10, 50, 100, 200
Control*	-	-

*Without fungicide

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Poisoned food technique

In this experiment the antifungal activity of various fungicides were tested *in vitro*, against mycelial growth of the pathogen by poisoned food technique at five different concentrations viz., 1, 10, 50, 100 and 200 ppm.

Desired quantities of fungicides were incorporated in potato dextrose agar medium (PDA) aseptically, thoroughly mixed and 20 ml of medium was poured in each Petri plate. These Petri plates were seeded with 5 mm disc taken from periphery of seven-days old culture of the pathogen and incubated at 28 ± 1^o C. Experiment was replicated thrice. A control was also maintained where no components was added in potato dextrose agar medium (PDA).

Observations were recorded on radial growth of mycelium with two diagonals through the center of colony after seven days. Growth inhibition percentage was calculated by the following formula (Bliss, 1934) [5].

$$\text{Per cent inhibition (I)} = \frac{C - T}{C} \times 100$$

Where,

I = Per cent inhibition of mycelial growth (%).

C= Mycelial growth observed in control (mm).

T= Mycelial growth observed in treatment (mm).

Results and Discussion

Evaluation of fungicides against *Drechslera setariae* in vitro

The efficacy of fungicides viz., Dithane-45, Kavach, Contaf, Tilt, Score, Companion and Folicur on mycelial growth of *Drechslera setariae* was studied *in vitro* using potato dextrose agar medium with five concentrations viz., 1, 10, 50, 100 and 200 ppm. The results given in (Table- 1), revealed that the mycelial growth of *Drechslera setariae* was significantly less in potato dextrose agar medium amended with seven individual fungicides. The results also indicated that the inhibition of mycelial growth increased with the increase in concentration of fungicides (Table- 2), out of seven fungicides tested, Tilt was found most inhibitory to the mycelial growth of *Drechslera setariae* followed by Folicur. Companion also significantly checked the mycelial growth of the fungus, however, it was found less effective as compared to Tilt and Folicur. The inhibition of mycelial growth was relatively less in Companion, Score, Dithane M-45 and Contaf treatments. Kavach was least inhibitory to the mycelial growth of *D. setariae*.

Table 1: The efficacy of fungicides on mycelial growth of *Drechslera setariae*

Fungicides	mycelial growth (mm)					Mean
	1 ppm	10 ppm	50 ppm	100 ppm	200 ppm	
Dithane M-45	38.19	29.49	25.29	21.38	18.33	26.54
Kavach	42.37	33.33	27.29	24.19	20.51	29.54
Contaf	35.15	28.39	24.30	19.06	16.09	24.59
Tilt	10.07	0.00	0.00	0.00	0.00	2.01
Score	30.10	20.69	15.39	10.19	5.11	16.30
Companion	25.06	15.62	13.79	10.09	0.00	12.91
Folicur	15.13	5.07	0.00	0.00	0.00	4.04
Control	90.00	90.00	90.00	90.00	90.00	90.00
Mean	35.76	27.82	24.51	21.86	18.76	24.75
SEm±	0.21	0.19	0.18	0.17	0.15	0.16
CD at 5%	0.63	0.56	0.53	0.49	0.45	0.45

Table 2: The efficacy of fungicides on inhibition on mycelial growth of *Drechslera setariae*

Fungicides	Per cent inhibition of mycelial growth					Mean
	1 ppm	10 ppm	50 ppm	100 ppm	200 ppm	
Dithane M-45	57.57	63.23	71.90	76.24	79.63	69.71
	(49.35)*	(52.67)	(57.99)	(60.82)	(63.17)	(56.60)
Kavach	52.93	62.97	69.68	73.12	77.21	67.18
	(46.67)	(52.51)	(56.58)	(58.77)	(61.48)	(55.04)
Contaf	60.92	68.46	73.00	78.82	82.12	72.66
	(51.30)	(55.83)	(58.69)	(62.59)	(64.98)	(58.47)
Tilt	88.81	100.00	100.00	100.00	100.00	97.76
	(70.45)	(90.00)	(90.00)	(90.00)	(90.00)	(81.39)
Score	66.56	77.01	82.90	88.68	94.32	81.89
	(54.67)	(61.34)	(65.57)	(70.33)	(76.21)	(64.81)
Companion	72.16	82.64	84.68	88.79	100.00	85.65
	(58.15)	(65.37)	(66.95)	(70.43)	(90.00)	(67.73)
Folicur	83.19	94.37	100.00	100.00	100.00	95.51
	(65.79)	(76.27)	(90.00)	(90.00)	(90.00)	(77.76)
Mean	68.88	78.38	83.17	86.52	90.47	81.48
	(56.09)	(62.29)	(65.77)	(68.45)	(72.01)	(64.51)
	SEm±	CD at 5%				
Fungicide (F)	0.54	1.51				
Concentration (C)	0.40	1.12				
F x C	1.20	3.37				

* Figures given in parenthesis are angular transformed values

Evaluation of fungicides against of *Drechslera setariae*

In the present investigation fungicidal studies were done to find out their efficacy on inhibition of mycelial growth of *D. setariae*. The test fungicides viz., Dithane M-45, Kavach, Contaf, Tilt, Score, Companion and Folicur were significantly checked the mycelial growth of *D. setariae* under laboratory conditions. Where the fungicides concentrations were increased the toxicity towards *D. setariae* increased *in vitro*. Out of the seven fungicides tested, Tilt (200 ppm) followed by folicur (200 ppm) and companion (200 ppm), were most inhibitory to mycelial growth of *Drechslera setariae*. Similar results were also recorded by Gupta *et al.* (2013) [7] they evaluated the efficacy of several fungicides against brown leaf spot of rice. Out of seven fungicides viz., propiconazole, hexaconazole, tricyclazole, carbendazim, tridimefon, mancozeb and azoxystrobin at 50, 100, 150, 200 and 250 ppm against *Bipolaris oryzae* causing brown spot disease in rice. Propiconazole was most effective with maximum inhibition of 97 per cent at 250 ppm concentration followed by tricyclazole. Propiconazole at 0.1 per cent significantly reduced the disease severity under field conditions. Sunder *et al.* (2004) [11] they observed that hexaconazole and propiconazole were most inhibitory to mycelial growth of *Drechslera oryzae* followed by iprobenphos and edifenphos *in vitro*. Sharma and Basuchoudhary (1975) [10] also evaluated the fungicides thiram and difanotan showed complete inhibition of spore germination of *Drechslera rostrata* in pearl millet at 20 ppm. Hemayatullah and Mahapatra (2014) [8] evaluated different fungicides were evaluated conditioning by using poisoned food technique against the *C. miyabeanus*. Among the fungicides tested, propiconazole 25% EC gives the highest radial growth inhibition (89.16%) of the fungus. It was followed by carbendazim 12%+mancozeb 63% WP, hexaconazole 4%+zineb 68% WP, mancozeb 75% WP and difenoconazole 25% EC showing 88.33%, 87.49%, 87.49% and 83.89% growth inhibitions, respectively. Kumar *et al.* (2013) [9] they evaluated systemic fungicides viz., carbendazim, thiophanate methyl, difenconazole, carbendazim + mancozeb (Companion) and contact fungicides viz., mancozeb, copper oxychloride, captan, chlorothalonil against *Drechslera setariae* causing brown leaf spot of foxtail millet under *in vitro*. Among systemic fungicides, carbendazim + mancozeb found most effective followed by difenconazole and carbendazim were found least effective. Among contact fungicides, mancozeb found most effective followed by captan and least effective was chlorothalonil in inhibiting the mycelial growth of *Drechslera setariae*.

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