Assessment of okra powdery mildew (*ErysipheCichoracearum* DC) by using bio-agents and chemical fungicides

ABSTRACT:

The present study aimed to assess okra powdery mildew (Erysiphe Cichoracearum DC) by using bio-agents and chemical fungicides. Okra (*Abelmoschus esculentus* (L.) Moench occupies a prominent place in the horticultural wealth and economy of the country. Powdery mildew disease on okra (*Abelmoschus esculentus* (L.) Moench incited by fungus, *Erysiphe cichoracearum* is a limiting factor in the successful cultivation in Bundelkhand region of Uttar Pradesh. Studies were carried out to find out disease management strategies against okra powdery mildew using bioagents and chemical fungicides. Disease incidence declined after first, second and third sprays.The fungicide Hexaconazole (Contaf 5% EC) @0.1%, showed significantly lowest disease incidence (19.53 %) with maximum (68.40 %) disease control. On the basis of effectiveness in controlling the powdery mildew disease of okra the most effective fungicidesrecorded in the order of merit wereCarbendazim (Bavistin 50WP) @0.1%, Propiconazole (Tilt 25EC) @0.1%, *Trichoderma viride*(3 %), Sulphur(Sulfex 80% WP) @ 0.3%, *Pseudomonas flouresens*(4 %) and *Trichoderma harizum*(4 %).

Key words: Powdery mildew, *Erysiphe cichoracearum* DC, and okra.

INTRODUCTION

"Okra commonly known as lady's finger or 'bhendi' is most delicious vegetable relished world over. It belongs to the family Malvaceae. Okra is important in improving the health of the digestive system and is widespread in the world. Therefore, treating diseases that affect this plant is an important step in improving the quality and quantity of production of this type. It has many benefits, as it is an anti-diabetic, strengthens the immune system, and strengthens bones. India occupies an area of 547.7 thousand hectares with a production of 6889.4 thousand tones and productivity of 12.6 mt/ha". (Anonymous, 2022a). "In Maharashtra, it was cultivated on an area of 24.92 thousand hectares with annual production of 338.84 thousand tones and productivity of 13.60 mt /ha" (Anonymous, 2022b). "A number of fungal, bacterial, viral diseases have been reported in India" [26]. "Amongst the fungal diseases, powdery mildewcaused by *Erysiphe cichoracearum* DC. is one of the important and of common occurrence wherever this crop is grown. The occurrence of the disease has been reported from Mexico" (Diaz-Franco, 1999). "In

India, the disease has been reported to occur in Delhi" (Prabhu et al., 1971), Karnataka (Sohi and Sokhi, 1974), Himachal Pradesh (Raj et al., 1992) and Maharashtra (Jambhale and Nerkar, 1983). "Disease initiates as white minute patches, first on the upper surface of lower leaves or older leaves and then spread to younger ones. While grayish powdery coating is visible on severely affected leaves. Leaves finally show necrosisresulting in withering, drying and defoliation. The powderymildew affects all growth stages and responsible for yieldto the tune of 17 to 86.6 per cent" (Sridhar et al.,1989).Considering the economic importance of the diseasethe present study was undertaken with the objectives tomanage the disease with the help of bioagents and chemical fungicides.

MATERIAL AND METHODS

A field experiment was carried out at the field of Rainfed Organic Agriculture Research Farm Narayan Bagh, Institute of Agricultural Sciences, Department of plant pathology, Bundelkhand University, Jhansi (Utter Pradesh) during *kharif Season* of 2023. to study the efficacy of different fungicides, bioagents and plant extracts against powdery mildew of okra (*Erysiphe cichoracearum* DC) with ninetreatments Sulphur (Sulfex 80% WP) @ 0.3%, Hexaconazole (Contaf 5% EC) @0.1%, Propiconazole (Tilt 25EC) @0.1%, Carbendazim (Bavistin 50WP) @0.1%, Neem oil (Azadiractin EC 1 %), *Trichoderma Viride*@ 4 g/ lit of water, *Trichoderma harizium*4 g/ lit of water, *Psedumonasfluresence*4 g/ lit of water, Control (Untreated). In Randomized Block Design, plotsize: 2.40 X 2 m., Spacing (R×P): 60 cm x 45 cm.Three sprayings of fungicides were given at ten days interval. First spraying was doneimmediately after first appearance of powdery mildew disease symptoms and subsequent secondand third sprayings were given at an interval of 10 days.

The observations on disease incidence were recorded at first appearance of the diseaseand subsequent three observations were taken after each spraying and per cent incidence was calculated, applying following formula.

$$\text{Per cent disease incidence} = \frac{\text{No. of plant affected}}{\text{Total number of plants observed}} \times 100$$

$$\text{Per cent disease control} = \frac{\text{Control plot} - \text{Treatment plot}}{\text{Control plot}} \times 100$$

Observations on powdery mildew disease severity were recorded on five randomlyselected plants. The first observation was taken at first appearance of the disease and subsequentthree observations were taken after each spraying. The powdery mildew disease was graded onthe basis of disease severity observed on leaves by applying 0-5 disease rating scale developedby Mckineey (1923).

RESULTS AND DISCUSSION

Efficacy of fungicides against okra powdery mildew

Total nine fungicides were evaluated under field condition against powdery mildew ofokra using susceptible variety "Aprana" during *Kharif*, 2023. Results obtained inrespect of disease incidence, per cent disease control are presented here in following paragraphs.

Effect on powdery mildew incidence

To study the effect of fungicides on powdery mildew incidence an experiment wascarried out and results obtained are presented in (Table:1) and graphically depicted in28 (Fig: 1). Results revealed that, all the fungicides were found effective and reduced the powdery mildew incidence over control.

The powdery mildew disease incidence at first appearance was ranged from 9.66% to12.30%. The disease incidence was found to be increased steadly up to second spraying (20.90to 38.31%). There after in different treatements it was reduced after third spraying which rangedfrom 19.53 to 31.07 per cent, as against highest incidence (68.40%) in untreated control.

The results revealed that, after second and third sprayings, plot sprayed withhexaconazole recorded disease incidence of 20.90 and 19.53%, respectively, and it was at parwith propiconazole, which recorded disease incidence of 26.39% and 24.34% after second andthird sprayings, respectively. Rest of the treatments exhibited comparatively maximum diseaseincidence in the range of 20.90 to 38.31 per cent and 19.53 to 31.07 per cent, respectively, aftersecond and third sprayings.

Thus, data indicated that all the treatments significantly and gradually reduced thepowdery mildew incidence after second and third sprayings over control. Mean diseaseincidence was ranged from 19.53 to 37.07%. However, it was least in hexaconazole (19.53%)followed by propiconazole (24.34%), carbendazim (22.34%), *Tricodermaviride*(25.21%) andSulphur (27.34).

Table:1 Effect of fungicides on powdery mildew incidence in okra.

S. No.	Treatment	Conc. (%)	PDI at first appearance	Per cent disease incidence after spraying			Mean PDI
				First	Second	Third	
T_1	Sulphur	0.3%	11.49 (3.46)	16.69 (4.15)	29.43 (5.43)	27.34 (5.28)	27.34 (4.96)
T_2	Hexaconazole	0.1%	12.27 (3.57)	15.41 (3.99)	20.90 (4.64)	19.53 (4.48)	19.53 (4.36)
T_3	Propiconazole	0.1 %	11.52 (3.47)	16.85 (4.17)	26.39 (5.19)	24.34 (4.98)	24.34 (4.78)
T_4	Carbendazim	0.1 %	12.57 (3.62)	14.21 (3.84)	23.27 (4.88)	22.34 (4.78)	22.34 (4.5)
T_5	Neem oil	4 %	9.66 (3.19)	23.37 (4.89)	38.31 (6.23)	31.07 (5.62)	31.07 (5.58)
T_6	*Tricodermaviride*	3 %	13.41 (3.73)	15.35 (3.98)	27.42 (5.28)	25.21 (5.07)	25.21 (4.78)
T_7	*Trichoderma harizum*	4 %	11.59 (3.48)	17.22 (4.21)	31.52 (5.66)	28.27 (5.36)	28.27 (5.08)
T_8	*Psedumonasflouresens*	4 %	12.3 (3.58)	14.14 (3.83)	28.59 (5.39)	27.71 (5.31)	27.71 (4.84)
T_9	Control (water spray)	-	11.56 (3.47)	29.93 (5.52)	42.41 (6.55)	68.40 (8.30)	68.4 (6.79)
	S.Em. ±	-	**0.04**	**0.03**	**0.02**	**0.02**	-
	C.D	-	**0.11**	**0.08**	**0.05**	**0.05**	-

*****Mean of three replications; PI- Per cent Incidence.

******Figures in parentheses are arcsine transformed values.

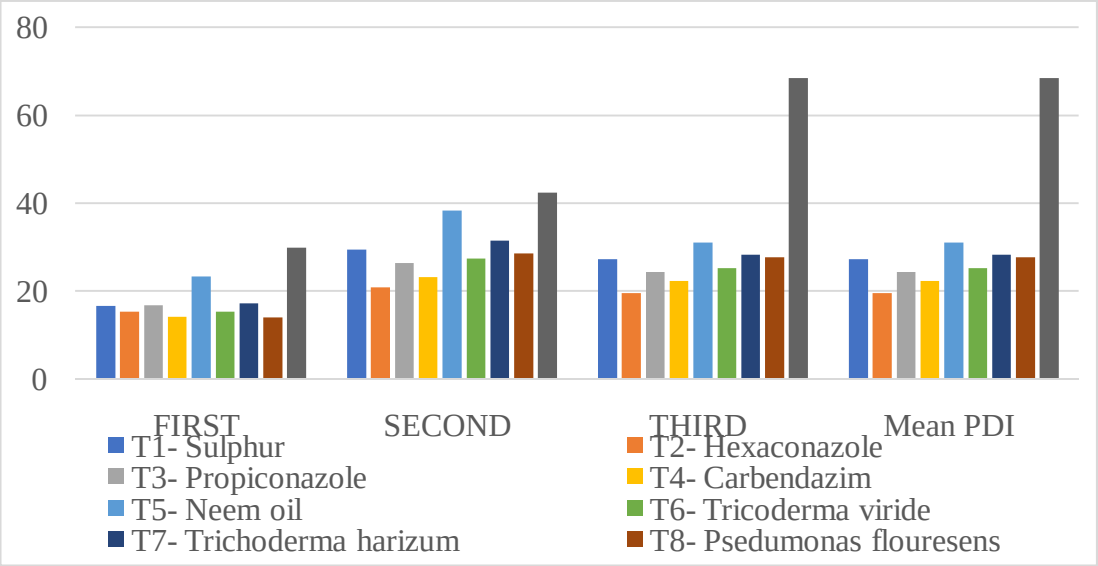

Fig. 1 Effect of fungicides on powdery mildew incidence in okra.

Similar results regarding effectiveness of hexaconazole were reported in pea by Khunti*et al.* (2002), Banniyal and Rana (2003), Singh (2007), Surwase*et al.* (2009) and Kacchot*et al.* (2011). Effectiveness of propiconazole was reported by Nargund*et al.* (2012) in green gram, Basandrai*et al.* (2013) in black gram and Hiremath*et al.* (2013) in pea. Effectiveness of difenconazole, sulphur, carbendazim, mancozeb was reported by Vijaya (2004), Shivanna*et al.* (2006) and Bachihal*et al.* (2014) in okra crop. Singh *etal.* (1998), Naik and Nagaraja (2000), Khodke and Kakde (2004) in mustard. Similar results in pea were reported by Patel *et al.* (2008), Nargund*et al.* (2012), Hiremath*et al.* (2013) in pea and by Chavan *et al.* (2013) in cowpea.

Effect on reduction of powdery mildew severity of okra.

Results (Table. 2, Fig.2). indicated that, all the treatments reduced the powdery mildew disease severity, over untreated control, after first, second and third spray treatements. After first spraying, the per cent reduction in disease severity over control was ranged from 52.76% to 21.92%, which after second spraying ranged from 50.72% to 9.67% and after third spraying, ranged from 88.71.45% to 58.67%.

Mean per cent disease reduction over untreated control was ranged from 71.45% (hexaconazole) to 60.03 (water spray). However, it was highest in Hexaconazole (71.45%), followed by carbendazim (67.34%), propiconazole (64.42), *Tricodermaviride* (63.14%), *Psedumonasflouresens* (59.49%), sulphur (60.03%),*Tricodermaviride*(63.14%) and neem oil (54.58%). The mean reduction in disease over control was observed in water spray (60.03%).

Table:.2 Effect on reduction of powdery mildew severity of okra.

S.No.	Treatment	Conc. (%)	Per cent disease control after spraying			Mean PDC
			First	Second	Third	
T_1	Sulphur	0.3%	44.24	30.61	60.03	60.03
T_2	Hexaconazole	0.1%	48.51	50.72	71.45	71.45
T_3	Propiconazole	0.1 %	43.70	37.77	64.42	64.42
T_4	Carbendazim	0.1 %	52.52	45.13	67.34	67.34
T_5	Neem oil	4 %	21.92	9.67	54.58	54.58
T_6	*Tricodermaviride*	3 %	48.71	35.35	63.14	63.14
T_7	*Trichoderma harizum*	4 %	42.47	25.68	58.67	58.67
T_8	*Psedumonasflouresens*	4 %	52.76	32.59	59.49	59.49
T_9	Control (water spray)	-	44.24	30.61	60.03	60.03

*PDC- Per cent disease control.

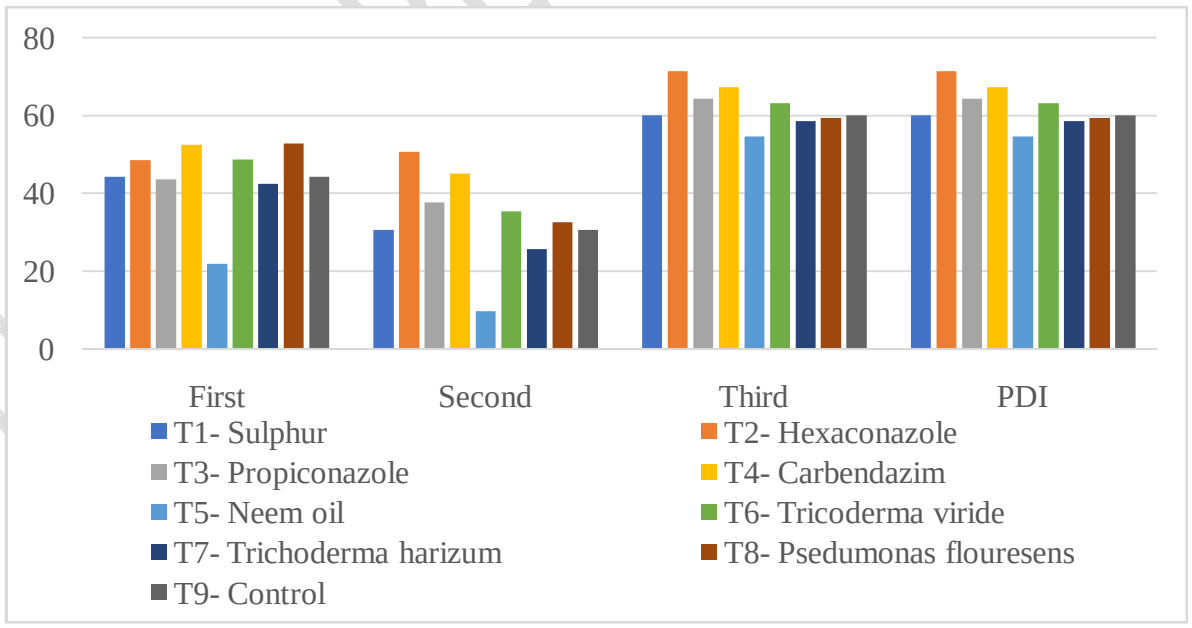

Fig: 2 Effect on reduction of powdery mildew severity of okra.

Conclusion

The present study highlightsabout the disease with the help of bioagents and chemical fungicides.Amongst the fungal diseases, powdery mildew caused by *Erysiphe cichoracearum* DC. is one of the important and of common occurrence wherever this crop is grown.

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1.

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