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Comparative efficacy of bio agents, botanicals and fungicides against alternaria leaf spot (*Alternaria brassicae*) of cauliflower (*Brassica oleracea* var. *botrytis*)

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Abstract

An experiment was conducted to evaluate the effect of two plant extracts, two bio-agents and two fungicide in *in-vivo* against *Alternaria brassicae* causing leaf spot of cauliflower. The minimum plant disease intensity (%) was observed in the treatment Propiconazole@0.2% (21.30%) followed by Mancozeb @ 0.2% (23.15%), Eucalyptus @5% (24.29%), *Lantana camara* @ 10% (25.19%), *Trichoderma harzianum* @ 2.0% (25.78%), *pseudomonas fluruscens* @ 2.0% (27.04%) as compared to untreated control (28.98%). Fresh weight of cauliflower head indicates that the maximum fresh weight with Propiconazole (1.29%) as compared to untreated control (0.67). The highest yield was given by the plants treated with propiconazole (70.06 t/ha) as compared to untreated control (31.58t/ha).

Keywords: *Alternaria brassicae*, bio-agents, botanicals plant extracts, fungicides, and cauliflower

Introduction

Cauliflower (*Brassica oleracea*) in the family Brassicaceae is an annual plant that reproduces by seed typically, only the head (the white curd) of aborted floral meristems is eaten, while the stalk and surrounding thick, green leaves are used in vegetable broth or discarded. Its name is from Latin caulis (cabbage) and flower, an acknowledgment of its unusual place among a family of food plants which normally produces only leafy greens for eating. *Brassica oleracea* also includes cabbage, Brussels sprouts, kale, broccoli, and collard greens, though they are of different cultivar groups. Cauliflower traces its ancestry back to the wild cabbage, a plant thought to have originated in ancient Asia Minor, which resembled kale or collards more than the vegetable. China, India, Italy, Mexico, France, Poland, USA, Pakistan, Germany, Egypt are the major producing countries in the world. The area production and productivity of cauliflower were 125 ha, 2284 MT and 18.2 MT (HA) respectively.

The major cauliflower producing states in India are Bihar, Uttar Pradesh, Orissa, West Bengal, Assam, Haryana and Maharashtra. The area production and productivity of cauliflower is 426 ha, 8090 MT and 19.8 MT/ha, respectively.

Black spot of different crucifers *viz.* oil seed rape, cabbage, cauliflower and mustard have been reported in many countries; Italy, USA, UK and several other European countries, Canada, Iran including India (Meena *et al.*, 2010)^[4]. Cauliflower (*Brassica oleracea* var. *botrytis*) and mustard (*Brassica juncea*) are the two important crucifer crops of India which are facing serious yield and quality loss in production due to *Alternaria brassicae* (Berk) Sacc. causing dark leaf spot disease (Sharma *et al.* 2013)^[7]. The effective management practices and resistant varieties, have urged the cultivators to resort to fungicides, botanicals and bio-control agents so as to achieve economic yield. Few of the managements mentioned, were reported against *Alternaria brassicae* (Bhatti *et al.*, 2002)^[3].

Materials and methods

The present investigation was carried out in the Central Research Field, the experiments were laid-out in Randomized block design with three replications at research plot of the Department of Plant Pathology, Sam Higginbottom University of Agriculture, Technology and Sciences (SHUATS), Allahabad.

Preparation of bio-agents spray

Amount of bio-agents formulation was calculated and weighed according to following formula for required concentration and then mixed in 5 litre of water. Freshly prepared suspension was used for spray.

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$$A = \frac{\text{required concentration (\%)} \times \text{required volume (ml)}}{\text{Active ingredient (\%)}}$$

Preparation of fungicidal spray solution

The fungicidal spray solution of desired concentration as per treatment was freshly prepared every time at the site of experimentation just before the start of spraying operations. The quantity of spray materials required for average of crop was gradually increased as the crop advanced in age.

The spray solution of desired concentration was prepared by adoption of the following formula (Singh *et al.* 2009) [1].

$$A = \frac{T \times P}{a. i.}$$

Percent disease incidence of Alternaria blight during survey

Observations on Alternaria leaf spot disease intensity were recorded on randomly selected plants from the bottom, middle and top leaves. The Alternaria leaf spot disease was graded on the basis of disease intensity observed on leaves by applying 0-9 disease rating scale developed by (Mayee and Datar, 1986) [2].

Preparation of plant extracts

The fresh leaves were ground in a pestle and mortar by using sterile distilled water. The extract was filtered through double layered muslin cloth and made to the required concentration by adding distilled water.

Results and discussion

Disease intensity at 30 DAT (Before spray) At 30 DAT, the

minimum percentage of disease intensity was recorded in treatment T₂. *Pseudomonas fluorescens* (15.80%), followed by T₁-*Trichoderma harzianum*, T₄-lantana leaf extract (15.67%) and T₃- eucalyptus leaf extract (15.54%), were found statistically at par with each other followed by T₅-mancozeb (15.17%) and least disease intensity were recorded in T₆. propiconazole (12.87%). Among the treatments (T₁, T₄, T₃ and T₅) were found non- significant and at par with each other.

Disease intensity at 45 DAT: At 45 DAT, treatment with T₀-Control (28.92%), T₆- propiconazole (22.14 %) recorded minimum percentage of disease intensity followed by treatment T₅-mancozeb (23.17%), T₃- eucalyptus leaf extract (24.01%). Treatments T₄-lantana leaf extract (25.65%) and T₁-*Trichoderma harzianum* (27.43%) are found statistically at par with each other, followed by T₂- *Pseudomonas fluorescens* (26.03%). All the treatments were found statistically significant from T₀ control. Among the treatments (T₆, T₅, T₃, T₂) were found non - significant and at par with each other.

Disease intensity at 60 DAT: At 60 DAT, treatment with T₆- Propiconazole (28.89 %) recorded minimum reduction percent of disease intensity followed by treatment T₅ - mancozeb (31.10%). Treatments T₃- eucalyptus leaf extract (33.33%) T₄-lantana leaf extract (34.25 %) were found statistically at par with each other, followed by T₁- *Trichoderma harzianum* (36.09%) and T₂- *Pseudomonas fluorescens* (35.50%), and maximum percentage of disease intensity was recorded in T₀-Control (40.12 %). All the treatments were found statistically significant from T₀ control. Among the treatments (T₅ and T₆) were found non - significant and at par with each other.

Table 1: Percent disease intensity at 30, 45 and 60DAT as affected by treatments.

Sl. no	Treatments	Dosage	PDI			
			30, DAT Before spray	45, DAT after, 1 st spray	60, DAT after, 2 nd spray	Mean
T ₀	Control	-	17.95	28.92	40.12	28.98
T ₁	<i>Trichoderma harzianum</i>	2.0%	15.80	26.03	35.50	25.78
T ₂	<i>Pseudomonas fluorescens</i>	2.0%	17.51	27.43	36.09	27.04
T ₃	Eucalyptus leaf extract	5%	15.54	24.01	33.33	24.29
T ₄	Lantana leaf extract	10%	15.67	25.65	34.25	25.19
T ₅	Mancozeb	0.2%	15.17	23.17	31.10	23.15
T ₆	Propiconazole	0.2%	12.87	22.14	28.89	21.30
SEd± C			0.98	0.36	0.53	
CD@5%			2.13	0.79	1.17	
CV (%)			7.59	1.76	1.92	

Effect of treatments on disease intensity with head weight of Cauliflower

Fresh weight of cauliflower head indicates that the maximum fresh weight with T₆-Propiconazole (1.29 kg), T₆- mancozeb (1.15 kg), T₁-*Trichoderma harzianum* (0.79kg), T₂- *Pseudomonas fluorescens* (0.73kg), T₃- eucalyptus leaf

extract (0.96kg), T₄. lantana leaf extract (0.94kg) and minimum percentage of disease intensity was recorded in T₀-Control (0.67kg)/. All the treatments were found statistically significant from T₀-Control. Among the treatments (T₄ and T₃), (T₂ and T₁) were found non- significant and at par with each other.

Table 2: Head weight (kg) of cauliflower as affected by treatments

Sl. No	Treatments	Dosage	Head weight (kg)
T ₀	Control	-	0.67
T ₁	<i>Trichoderma harzianum</i>	2.00%	0.79
T ₂	<i>Pseudomonas fluorescens</i>	2.00%	0.73
T ₃	Eucalyptus leaf extract	5%	0.96
T ₄	Lantana leaf extract	10%	0.94
T ₅	Mancozeb	0.2%	1.15
T ₆	Propiconazole	0.2%	1.29
SEd± C			2.89
CD@5%			0.09
CV (%)			2.12

Effect of treatments on the yield (tonnes) of Cauliflower.

The highest yield was given by the plants treated with T₆- Propiconazole (70.06 tonnes/ha) followed by T₅- Mancozeb (67.88 tonnes/ha) T₁-*Trichoderma harzianum* (42.08tonnes/ha), T₂-*Pseudomonas fluorescens* (39.05tonnes/ha), T₃- eucalyptus leaf extract (55.40tonnes/ha), T₄- Lantana camara (47.70tonnes/ha), the lowest yield were recorded in T₀-Control (31.58 tonnes/ha). All the treatments were found statistically significant from T₀-Control.

Table 3: cauliflower yield (tones) as affected by treatments

Sl. no	Treatments	Dosage	Yield (t/ha)
T ₁	<i>Trichoderma harzianum</i>	2.00%	42.08
T ₂	<i>Pseudomonas fluorescens</i>	2.00%	39.05
T ₃	Eucalyptus leaf extract	5%	55.40
T ₄	Lantana leaf extract	10%	47.70
T ₅	Mancozeb	0.2%	67.88
T ₆	Propiconazole	0.2%	70.06
T ₀	Control (untreated)	-	31.58
SEd± C			2.84
CD@5%			0.29
CV (%)			2.12

Conclusion

In the present study, propiconazole was found as best treatment to control of *Alternaria* leaf spot of cauliflower and also gave higher yield (70.06t/ha).The results of present experiment are limited to one crop season under Allahabad agro climatic conditions as such to validate the findings more such trials should be carried out in future.

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