

Original Research Article

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## Effect of Selected Botanicals and their Commercial Products against *Alternaria* Blight of Cabbage (*Alternaria brassicae*)

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### ABSTRACT

#### Keywords

*Alternaria brassicae*, Botanical extracts, Botanical fungicides, Essential oil, cabbage

#### Article Info

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An experiment was conducted to evaluate the effect of three botanical extracts, two botanical fungicides and one essential oil *in vitro* and *in vivo* against *Alternaria brassicae* causing *Alternaria* blight of cabbage. Among the treatments basil essential oil was found most effective in the inhibition of mycelial growth of *Alternaria brassicae* followed by Oenanthol (castor based botanical fungicide), bloom buddy (neem based botanical fungicide), neem leaf extract, basil leaf extract and castor leaf extract at all the three different concentrations tested in laboratory condition as compared to untreated control. The botanical extracts and their commercial products were tested under field condition during *rabi* 2019-2020 for their efficacy against the disease. Among the treatments minimum percent disease intensity was recorded in Bloom buddy (neem based botanical fungicide) @ 0.5% (23.35%) followed by Oenanthol (castor based botanical fungicide) @ 0.1% (25.15%), basil essential oil @ 2% (26.20%), neem leaf extract @ 25% (28.31%), *basil leaf extract* @ 5% (30.12%) and castor leaf extract @ 30% (31.50%) as compared to untreated control (34.43%).

### Introduction

Cabbage is one of the most popular and widely grown vegetable in the world. Botanical name is *Brassica oleracea* var *capitata* L. It belongs to family Cruciferae. *Alternaria* blight, disease caused by *Alternaria brassicae* and *Alternaria brassicicola* is the most devastating disease of cabbage. *Alternaria brassicae* and *Alternaria brassicicola*, they can survive saprophytically outside of the host and diseased crop debris (Yadav *et al.*, 2014).

The genus is characterized by the formation of polymorphous conidia either singly or in short or longer chains and provided with cross, longitudinal as well as oblique septa and having longer or short beaks (Nayyar *et al.*, 2014).

The disease occurs in all parts of the world where cabbage is grown. The disease caused by this fungus is characterized by yellow-brown spots with target-like concentric rings which appear on leaves, as well as dark brown sunken spots on heads. The causal organism

is air borne and soil inhabiting. It affects every part of infected plant.

A temperature range of 25 to 30°C and 15 to 35°C was found optimum for mycelial growth and sporulation of *A. brassicae*, respectively. Mycelial growth was most favoured by 100% relative humidity with a gradual reduction in growth and sporulation till 70% RH and a decrease in growth and sporulation at 60 and 50% RH (Meena *et al.*, 2012).

Regular use of chemical fungicide is hazardous for the soil and for humans as well. Thus, utilization of botanical extracts, botanical fungicides and essential oils in disease management is considered as eco-friendly, without any environmental pollution. Botanical extracts have been used in disease management for long time as foliar spray is rarely followed approach and needs screening in different crops and under different environmental conditions. The present study was carried out to explore the efficiency of some botanical extracts and their commercial products, under *in vitro* and in field condition at Sam Higginbottom University of Agriculture, Technology and Sciences, Prayagraj, (U. P), India.

## Materials and Methods

### *In vitro* Experiment

botanical extracts of castor (20%, 30% and 40%), basil (5%, 10% and 15%) and neem (15%, 25% and 35%) and botanical fungicides namely, oenanthol (castor based botanical fungicide 0.1%, 0.2% and 0.3%), bloom buddy (neem based botanical fungicide 0.3%, 0.5% and 0.7%) and basil essential oil (1.0%, 2.0% and 3.0%) were tested for their efficacy against *Alternaria brassicae* under *in vitro* by using poison food technique on Potato dextrose agar medium.

The selected fresh leaves of healthy plants were collected and washed thoroughly with clean water and dried to drain the water. About 10 g of plant leaves were grounded using pestle and mortar by adding same proportion (10 ml) of sterilised distilled water in weight by volume method. The botanical extract thus obtained by grounding was filtered through muslin cloth and the extract was diluted by adding sterilised distilled water to get required concentration. Calculated concentration of botanical extracts, botanical fungicides and essential oil were thoroughly mixed in the medium. Twenty ml of amended medium was poured in 90 mm sterilized Petri-plates and allowed to solidify. Mycelial disc of 5 mm from seven day old actively growing culture was inoculated at the centre of the plate and then incubated at 28 ± 2°C for 4 days.

Control was maintained without any treatment. Three replications were maintained for each treatment with three different concentrations and data was recorded. Control was maintained where in only test fungus was grown. The plates were incubated at 28 ± 2°C for four days. The experiment was conducted in completely randomized block design (CRD) with three replications in each treatment. Percent inhibition was calculated by using the formula given by Vincent (1947).

$$\text{Per cent inhibition of colony} = \frac{C-T}{C} \times 100$$

Where

C = Colony diameter in control

T = Colony diameter in treatment

### *In vivo* experiment

Field experiment was laid-out in Randomized block design with three replications. Two sprays were given at an interval of 15 days. Treatments were imposed after appearance of

the first disease symptoms. Observations on percent disease intensity was recorded by using 1-9 disease rating scale at 15 days interval and yield data were obtained after the harvest based on physiological maturity.

## Results and Discussion

### Per cent inhibition of mycelial growth and mean colony diameter of *Alternaria brassicae* as affected by treatments at different concentrations

The data presented in table 1, 2 and 3 for evaluation of per cent inhibition of mycelial growth over control as affected by treatments against *Alternaria brassicae* reveals that basil essential oil was found most effective followed by oenanthol (castor based botanical fungicide), bloom buddy (neem based botanical fungicide), neem leaf extract, basil leaf extract and castor leaf extract at all the three different concentrations tested in laboratory condition as compared to untreated control.

Basil essential oil recorded maximum per cent inhibition in the mycelial growth of the pathogen. Similar findings have been reported by Mona *et al.*, (2016), Momoh *et al.*, (2012), Chandhan *et al.*, (2013) and Sasode *et al.*, (2012). The probable reason for such findings may be due the fungitoxic properties exhibited by essential oil (Fig. 1–3).

### Field evaluation of selected botanicals and their commercial products against the *Alternaria* blight of cabbage caused by the *Alternaria brassicae*

A field study was carried out to assess the efficacy of botanical extracts, botanical fungicides and essential oil against *Alternaria* blight (*Alternaria brassicae*) of cabbage with

two sprays taken up at 45 DAT and 60 DAT during *rabi* 2019-2020. Two sprays were given at 45 DAT and 60 DAT. Results revealed that bloom buddy (neem based botanical fungicide) [23.35%] was found most effective in minimizing the per cent disease incidence and getting higher yields. Amongst all the treatments after which was {delete this sentence marked in red color upto was} followed by oenanthol (castor based botanical fungicide) [25.15%], basil essential oil (26.20%), neem leaf extract (28.31%), basil leaf extract (30.12%) and castor leaf extract (31.50%) as compared with untreated control (34.43%). Thus, the study indicated that suitable integration of more efficient eco-friendly treatments like botanical extracts and their commercial products with minimum usage of chemical fungicides may provide a better and effective management of the disease

In the field condition, bloom buddy (neem based botanical fungicide) was found most effective amongst all the treatments for the management of *Alternaria* blight caused *Alternaria brassicae*. Minimum per cent disease intensity (23.35%) was recorded with the same. Similar findings regarding the antifungal property of neem have been reported by Mohiddin *et al.*, (2008), Ranaware *et al.*, (2010) and Utkarsh *et al.*, (2018).

Basil essential oil which recorded maximum inhibition of the mycelial growth of the pathogen under *in vitro* conditions was not able to manage disease in the field conditions as efficiently as botanical fungicides when used as foliar spray. The probable reason for such findings may be due to fungal growth inhibition by neem-based botanical fungicide which works in various ways, involves prevention of hyphal growth and sporulation.

**Table.1** Per cent inhibition of mycelial growth and mean colony diameter of *Alternaria brassicae* as affected by treatments at low concentration

Treatments (T)	Mean Colony diameter				Percent inhibition			
	Concentrations(C)				Concentrations(C)			
	C <sub>1</sub>	C <sub>2</sub>	C <sub>3</sub>	Mean (T)	C <sub>1</sub>	C <sub>2</sub>	C <sub>3</sub>	Mean (T)
T <sub>0</sub>	90.00	90.00	90.00	90.00	0.00	0.00	0.00	0.00
T <sub>1</sub>	62.33	43.33	40.33	48.67	30.70	51.83	58.47	47.00
T <sub>2</sub>	22.33	0.00	0.00	7.44	74.90	100.00	100.00	91.63
T <sub>3</sub>	55.00	43.00	37.00	45.00	38.86	52.20	58.20	49.75
T <sub>4</sub>	0.00	0.00	0.00	0.00	100.00	100.00	100.00	100.00
T <sub>5</sub>	52.33	41.67	39.33	44.44	41.80	53.67	56.27	50.58
T <sub>6</sub>	24.67	23.33	20.33	22.78	72.33	74.33	76.67	74.44
Mean (C)	<b>43.81</b>	<b>34.48</b>	<b>32.43</b>		<b>51.23</b>	<b>61.72</b>	<b>64.23</b>	
	<b>F-test</b>	<b>S. Em. (±)</b>	<b>C.D. at 5%</b>		<b>F-test</b>	<b>S. Em. (±)</b>	<b>C.D. at 5%</b>	
Treatments	S	1.025	2.093		S	1.404	2.866	
Concentration	S	0.725	1.480		S	0.993	2.027	
Int. (T x C)	S	1.776	3.626		S	2.431	4.965	

Where, C<sub>1</sub> - low concentration; C<sub>2</sub> - Medium concentration; C<sub>3</sub> - High concentration

**Table.2** Per cent inhibition of mycelial growth and mean colony diameter of *Alternaria brassicae* as affected by treatments at medium concentration

Sr.no.	Treatment	Concentration (percent)	Mean colony diameter (mm)	Percent inhibition
T0	Control	-	90	0
T1	Castor leaf extract	30%	43.33	51.83
T2	Oenanthal (castor based botanical fungicide)	0.2%	0	100
T3	Basil leaf extract	10%	43	52.2
T4	Basil essential oil	2%	0	100
T5	Neem leaf extract	25%	41.66	53.66
T6	Bloom buddy (neem based botanical fungicide)	0.5%	23.33	74.33
Sem±			0.816	0.830
CD@5%			2.501	2.540
CV (%)			4.102	2.328

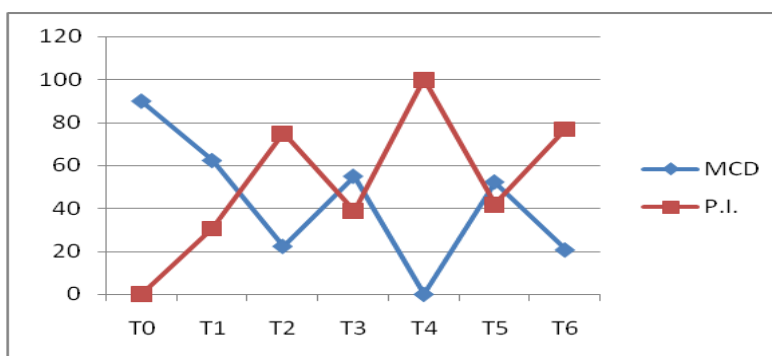
**Table.3** Per cent inhibition of mycelial growth and mean colony diameter of *Alternaria brassicae* as affected by treatments at high concentration

Sr.no.	Treatment	Concentration (percent)	Mean colony diameter (mm)	Percent inhibition
T0	Control	-	90	0
T1	Castor leaf extract	40%	40.33	55.13
T2	Oenanthol (castor based botanical fungicide)	0.3%	0	100
T3	Basil leaf extract	15%	37	58.86
T4	Basil essential oil	3%	0	100
T5	Neem leaf extract	35%	39.33	56.26
T6	Bloom buddy (neem based botanical fungicide)	0.7%	20.33	76.66
Sem±			1.113	2.050
CD@5%			3.408	6.279
CV (%)			4.102	5.529

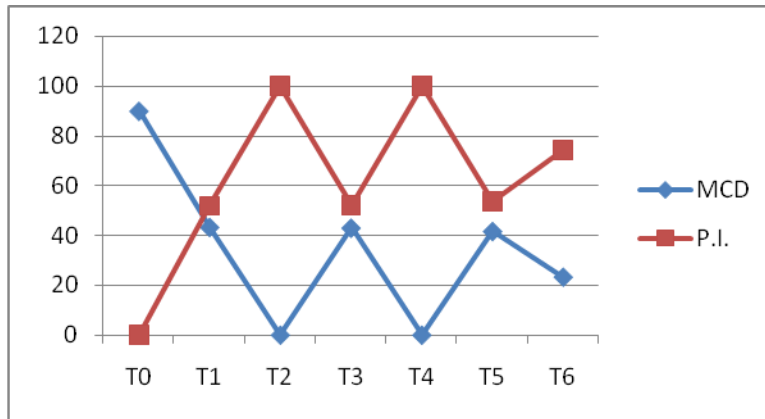
**Table.4** Percent disease intensity at 30DAT, 45 DAT and 60 DAT as affected by treatments

Sl.no	Treatments	Dosage	PDI			Mean
			30 DAT Before spray	45 DAT after 1 <sup>st</sup> spray	60 DAT after 2 <sup>nd</sup> spray	
T <sub>0</sub>	Control(untreated)	-	23.33	35.07	45.94	34.43
T <sub>1</sub>	Castor leaf extract	30%	22.29	32.16	39.02	31.50
T <sub>2</sub>	Oenanthol (castor based botanical fungicide)	0.1%	20.05	26.06	29.35	25.15
T <sub>3</sub>	Basil leaf extract	5%	22.21	31.67	36.42	30.1
T <sub>4</sub>	Basil essential oil	2%	19.71	27.23	31.68	26.20
T <sub>5</sub>	Neem leaf extract	25%	22.64	29.36	32.95	28.31
T <sub>6</sub>	Bloom buddy (neem based botanical fungicide)	0.5%	20.48	23.28	26.29	23.35
SEd± C			0.63	0.61	1.57	
CD@5%			1.95	1.88	4.84	
CV (%)			5.1	3.6	7.9	

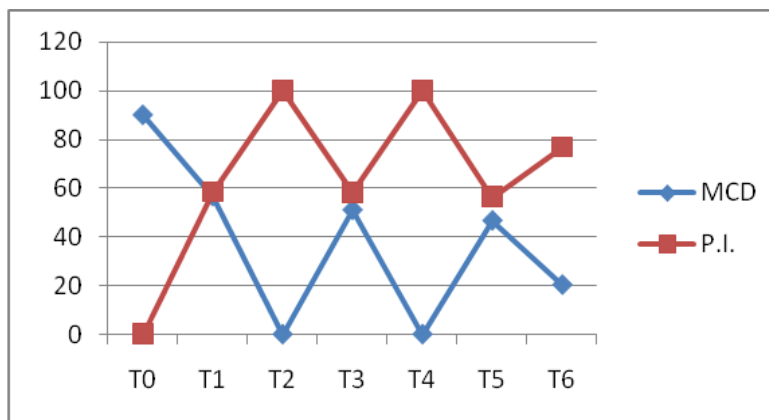
**Fig.1** Per cent inhibition of mycelial growth and mean colony diameter of *Alternaria brassicae* as affected by treatments at low concentration



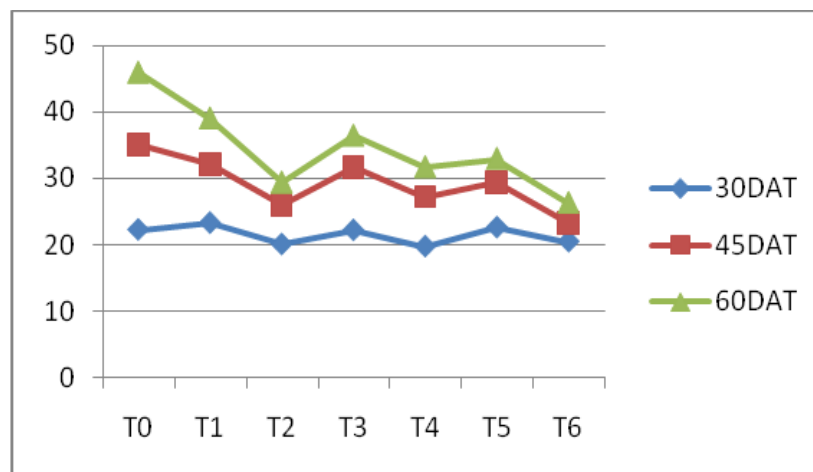
**Fig.2** Per cent inhibition of mycelial growth and mean colony diameter of *Alternaria brassicae* as affected by treatments at medium concentration



**Fig.3** Per cent inhibition of mycelial growth and mean colony diameter of *Alternaria brassicae* as affected by treatments at high concentration



**Fig.4** Per cent disease intensity at 30 DAT, 45 DAT and 60 DAT as affected by treatments



In concluding the present study, it was found that basil essential oil was most effective against *Alternaria brassicae*, causing Alternaria blight disease of cabbage under *in-vitro* condition. The treatment recorded maximum per cent inhibition of mycelia growth of the pathogen. Under field condition, bloom buddy (neem based botanical fungicide) @ 0.5% was found most effective against *A. brassicae*, which recorded minimum disease intensity (23.35%). Therefore, it may be recommended for the better management of Alternaria blight disease of cabbage. The results of the present experiment are limited to one crop season (Nov. 2019- Jan. 2020) under Prayagraj agro-climatic conditions, as such to validate the present findings more such trials should be taken up in future.

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