



Studies on Antimicrobial Effect of Botanicals on Leaf Blight of Indian mustard Caused By *Alternaria brassicae*

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Authors' contributions

This work was carried out in collaboration among all authors. All authors read and approved the final manuscript.

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ABSTRACT

The present study was conducted at ANDU&T Kumarganj Ayodhya at student instructional form (SIF). As in the investigation it was observed that foliar spray with Carbendazim (0.1%), Neem oil (5%), followed by Neem leaf extract (5%) found to be more effective on growth parameters like Number of branches/plants, number of leaves/ plants, plant height (cm), number of pods/plants,) and increased the yield (1000-seed weight, per plant yield (g), per hectare yield) and also significantly reduced the *Alternaria* blight in Indian mustard. Carbendazim (0.1%), *Trichoderma harzianum* (2%) followed by garlic bulb extract (5%) was found most effective in reducing *Alternaria* blight, recorded maximum disease incidence *i.e.* percent Disease intensity, percent Leaf area disease (LAD), percent leaf infection, number of spots per pods, seed infection percent respectively.

Keywords: *Alternaria brassicae*; leaf blight; Indian mustard and botanicals.

1. INTRODUCTION

India is one of the major producers in the global oilseeds/ vegetable oil economy. India has the

largest area in oilseed crops in the world. However, the productivity is low as it is just 50-60 percent of the world average [1]. *Alternaria* blight is a most dangerous disease of rapeseed

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mustard crop and this appears all winter session. Crops throughout the crop growing areas of the world. It occurs in various countries like Canada, England, France, Holland, Poland, Spain, Sweden, Australia, USA, and Asian countries. *A. brassicae* causal organism of Alternaria blight disease of mustard was reported from whole world. It was infected cruciferous crops and its causing yield loses with no proven main diseases of mustard source of movable fight in several of the crops [2]. This disease is a major limiting factor in reducing the yield of Rapeseed-mustard in India. Which is range from 15-71% due to this disease. The disease cause quantitative loss as well as, seed quality in term of seed size seed colour and oil content are reduced due to loss of chlorophyll in infected plant which also reduce the growth and development of plant [3]. *A. brassicae* is a pathogen necrotrophic and can cause serious loss to the crop. The major symptoms are appears as the form of spots on leaves, stem and pods mustard plant [4,5,6].

2. MATERIALS AND METHODS

2.1 Collection of Botanicals and Preparation of Plant Extract

Botanicals such as leaf of Neem leaf (*Azadirachita indica*), and *Ocimum sanctum* collected from ANDU&T field and Onion (*Allium cepa*), Ginger, Neem oil, and clove of Garlic (*Allium sativum*), *Trichoderma harzianum* and Carbendazim were collected from local market. For preparation of extract, collected plant materials were weighed in an electric balance and then washed in water. Plant material are chopped in required quantity of water (1:1. w/v), boiled for 30 min. and then strain through cheese cloth to obtained standard plant extract solution (100%). The extract is centrifuge at 5000 rpm for 5 min. and the clear supernatant was used as stock solution. All the treatments were used as foliar spray as given in Table 1.

2.2 Application of Spray Solution

The Botanicals and fungicidal solutions were prepared by mixing with required amount of Botanicals and fungicide with water. seven botanicals and one fungicidal solution, (concentration @ 1:10) and plain water were sprayed with compressed hand sprayer as described in Table 1. Sprays were done at 30, 40, 50, 60 days after sowing. Every time the botanicals and fungicide were freshly prepared prior to application and the spray tank was thoroughly cleaned before filling with new spray solution. Special attention was given to complete coverage of the growing plants with the fungicides. Adequate precaution was taken to avoid drifting of spray materials from one plot to the neighbouring ones.

3. RESULTS AND DISCUSSION

3.1 Plant growth Parameters

The effect of treatments on the germination was recorded after the maximum number of seeds were germinated. As displayed in Table 2 the maximum germination was recorded in T7 (95.75%) and T5 (95.12%) over the control T9 (92.94%) respectively followed by T3 (95.04%), T4 (95.0%), T6 (94.8%), T8 (93.88%), T2 (93.63%), T1 (93.60) as all were significantly effective among the botanical studies that *Azadirachita indica* is more effective against *Alternaria brassicae* of Indian mustard [7]. Many researchers used Neem leaf, Onion extract found more effective in germination [3]. The data indicates that all treatments were significantly showing the effect as they were increasing the number of leaf/plant. The Table 2 is the revealing that T8 (25.00) and T2 (21.13)] were showing the best effect of treatment over the control i.e.T9 (14.93) respectively followed by T7 (20.13) T1 (18.93), T6 (18.20), T3, T4 (17.27), T5 (16.33).

Table 1. Details of different treatments (Used as foliar spray)

Treatments	Name	Dose
T ¹	<i>Trichoderma harzianum</i>	2%
T ²	Neem oil	5%
T ³	<i>Allium cepa</i>	5%
T ⁴	Ginger rhizome extract	5%
T ⁵	Garlic bulb extract	5%
T ⁶	<i>Ocimum sanctum</i> extract	5%
T ⁷	Neem leaf extract	5%
T ⁸	Carbendazim	0.1%
T ⁹	Control	Water Spray

Table 2. Effect of different treatments of growth parameters of crop

Treatments	Germination % Mean±SD	Leaves Per Plants Mean±SD	Branches Per Plants Mean±SD	Plant height (cm) Mean±SD	Pods Per Plants Mean±SD	1000 seed weight Mean±SD	Yield Per Plant In(g) Mcan±SD	Yield Per hectare in (q) Mean±SD
T ¹ <i>Trichoderma harzianum</i>	93.60±0.96	18.93±1.33	6.57±0.12	75.73±1.70	198.47±11.23	4.17±0.76	4.33±0.76	6.83±1.26
T ² <i>Neem oil</i>	93.63±2.69	21.13±0.70	7.03±0.42	77.87±1.33	216.27±18.83	4.33±1.53	4.83±1.26	8.17±1.04
T ³ <i>Alium cepa</i>	95.04±1.80	17.73±2.10	6.30±0.20	71.67±1.53	177.07±3.31	3.80±0.82	4.13±0.81	6.64±1.30
T ⁴ <i>Ginger rhizome extract</i>	95.00±0.33	17.27±2.00	6.03±0.50	68.27±1.03	163.20±8.32	3.67±1.53	3.80±1.06	5.50±0.87
T ⁵ <i>Garlic bulb extract</i>	95.12±4.00	16.33±2.08	5.77±0.61	65.60±1.74	159.20±10.25	3.17±0.76	3.50±0.50	5.10±1.15
T ⁶ <i>Ocimum sanctum extract</i>	94.08±1.46	18.20±2.23	6.37±0.31	74.67±2.14	190.80±7.79	4.00±1.32	4.17±0.76	6.80±0.75
T ⁷ <i>Neem leaf extract</i>	95.75±1.69	20.13±1.33	6.77±0.12	77.60±1.44	205.93±8.90	4.17±1.76	4.63±1.31	7.30±0.82
T ⁸ <i>Carbendazim</i>	93.88±3.96	25.00±0.53	7.17±0.46	79.53±1.63	247.20±9.10	4.50±1.32	5.60±0.53	8.97±1.05
T ⁹ Control	92.94±1.12	14.93±2.05	5.17±0.50	61.40±2.75	156.33±9.19	2.77±0.93	3.07±1.01	4.70±0.82
SE(in)	1.28	0.47	0.12	1.05	6.15	0.56	0.54	0.60
CD	3.71	1.37	0.35	3.05	17.88	1.64	1.56	1.75

Table 3. Effect of different treatments of disease parameters of crop

Treatments	Percent disease intensity Mean±SD	Percent leaf infection Mean±SD	Percent leaf Area Disease (LAD) Mean±SD	Percent Pod infection Mean±SD	Number of spots per pods Mean±SD	Percent seed infection Mean±SD
T ¹ <i>Trichoderma harzianum</i>	41.93±0.12	38.47±2.34	8.00±1.00	25.50±1.32	1.17±0.76	13.67±1.26
T ² <i>Neem oil</i>	43.00±0.72	41.67±3.21	13.00±3.61	26.50±2.78	1.67±1.15	14.83±2.25
T ³ <i>Alium cepa</i>	42.73±2.77	40.33±3.79	11.67±1.53	26.17±1.04	1.27±0.64	14.33±1.53
T ⁴ <i>Ginger rhizome extract</i>	42.93±0.76	41.33±3.21	12.67±1.53	26.33±3.79	1.33±0.76	14.50±2.21
T ⁵ <i>Garlic bulb extract</i>	42.40±2.46	39.33±3.06	10.00±1.00	25.87±2.20	1.17±0.76	14.00±2.00
T ⁶ <i>Ocimum sacntum extract</i>	43.00±1.04	41.67±4.04	13.67±2.08	26.80±1.59	1.60±0.53	14.53±3.32
T ⁷ <i>Neem leaf extract</i>	43.53±1.29	42.77±2.54	14.33±1.53	31.17±1.04	1.67±0.58	16.07±2.50
T ⁸ <i>Carbendazim</i>	41.93±1.14	32.07±2.10	5.67±2.08	25.17±1.44	0.97±0.06	13.37±1.70
T ⁹ Control	48.07±0.81	58.83±1.76	21.33±1.53	41.83±1.26	2.17±0.76	19.17±1.04
SE (m)	0.81	1.51	1.14	1.21	0.37	1.14
CD	2.35	4.40	3.31	3.52	1.06	3.31

All the treatments were significantly showing the effect as they were increasing the number of branches/plant. The Table 2 is the showing that T8 (7.17) and T2 (7.03) were effective over the control i.e.T9 (5.17) respectively followed by T7 (6.77), T1 (6.57), T6 (6.37), T3 (6.30), T4 (6.03), T5 (5.77). Researchers [8] used Neem leaf extract and garlic bulb extract that were significantly effective and reduced disease severity and increased yield. The data indicate that all the treatments were significantly best over the T9 as they were increasing the plant height. It may be seen from the data (Table 2) that best result found in T8 (79.53 cm), T2 (77.87 cm) and T7 (77.60 cm) followed by T3 (71.67 cm), T4 (68.27 cm), T5 (65.60 cm) [9] also used several fungicides and botanicals to manage the alternaria blight which also were increasing the plant growth.

All treatments were significantly showing the effect as they were increasing the number of pods/plant. Table 2 is displaying that T8 (247.20), T2 (216.27) and T7 (205.93) were showing the best effect of treatment over the control i.e.T9 (156.33) followed by T3 (177.07), T4 (163.20), T5 (159.20). Maximum height found plant from T8 (Carbendazim) plot among the other all treatments. Among the other all treatments best result found from T2 (Neem oil) followed by all botanicals and bio-agent. Similar observation was recorded by [7] and [10] as he used botanicals' including Garlic bulb extract which were effective among the botanicals. 1000-seed weight was found to be significant in all the treatments as there were having positive effect. Spraying with T8 (4.50 g) T2 (4.33 g) and T7 (4.17g) were showing the best effect of treatment over the control i.e., T9 (2.77g) followed by T3 (3.80 g), T4 (3.67 g), T5 (3.17 g) respectively the data indicate by (Table 2). Many researchers studied the same aspect and the study revealed similarity of present investigation [11].

Significant variation of different treatments was found on yield per plant (g) and yield quintal per hectare. Maximum yield per plant (5.60 g) and per hectare (8.97 q) was obtained from T8 (Carbendazim) treated plot followed by T2 (neem oil), and T7 (Neem leaf extract) in both the cases. The minimum yield per plant (3.07 g) and per hectare (4.70 q) was recorded from T9 (Control) (Table-1). Carbendazim T8 (Carbendazim) was more effective than other treatment respectively and T2 (Neem oil) was more effective among the botanicals [8,12] use Neem leaf extract and

garlic bulb extract were significantly and reduce disease severity and increase yield.

3.2 Disease Incidence Parameters

All the treatments were significantly showing the effect as they were increasing the disease intensity percent (%). The Table 3 is the showing that T8 (41.93%) T1 (41.93 %) and T5 (42.40 %) were showing the best effect of treatment over the control i.e.T9 (48.07) respectively followed by T2 (43.00 %), T6 (43.00 %), T7 (43.53 %) [13,14]. They also used Garlic bulb extract *T. harzianum* and Neem leaf extract botanicals which were significantly effective in reducing disease incidence. Also [7, 15, 16] revealed that *Trichoderma harzianum* which was best with the botanicals [6, 17] used garlic bulb extract, Tulsi and Neem extract at concentration 5%, 10% is more effective on disease intensity [18, 19, 20] supported the present investigation by their study on Carbendazim and *Trichoderma harzianum* reducing the disease severity and increasing the grain yield. [8, 12] use Neem leaf extract and garlic bulb extract which were significantly effective which reduced disease severity and increased yield.

The data indicate that all the treatments were significantly best over the T9 (control) (58.83). It may be seen from the data (Table 3) that best result found in T8 (32.07), T1 (38.47), T5 (39.33) followed by T2 (41.67), T6 (41.67), T7 (42.77) [21,22] also confirm reduced disease intensity the present investigations finding were also supported by [23, 24, 25]. The Percent leaf area disease (LAD) in data it is indicated that all the treatments were significantly best over the T9 (21.33 %). It may be seen from the data (Table 3) that best result found in T8 (5.67 %), T1 (8.00 %), T5 (10.0 %) over the control [T9 (21.33 %)] respectively. followed by T2 (13.00 %), T6 (13.67 %), T7 (14.33 %). Percent pod infection. A perusal of the data indicates that all the treatments were significantly superior over the T9 [control (41.83 %)] in Percent pod infection. It may be seen from the data (Table 3) that minimum percent pod infection was found in T8 (25.17 %), T1 (25.50 %), T5 (25.87 %) followed by T2 (26.50 %), T6 (26.80 %), T7 (31.17 %). Similar observation was reported by [1] he was also observed effect of botanicals in reduce disease severity. [14, 19] They were also used Garlic bulb extract *T. harzianum* and Neem leaf extract botanicals which significant effective reduce disease incidence [7]. A perusal of the data indicates that all the treatments were

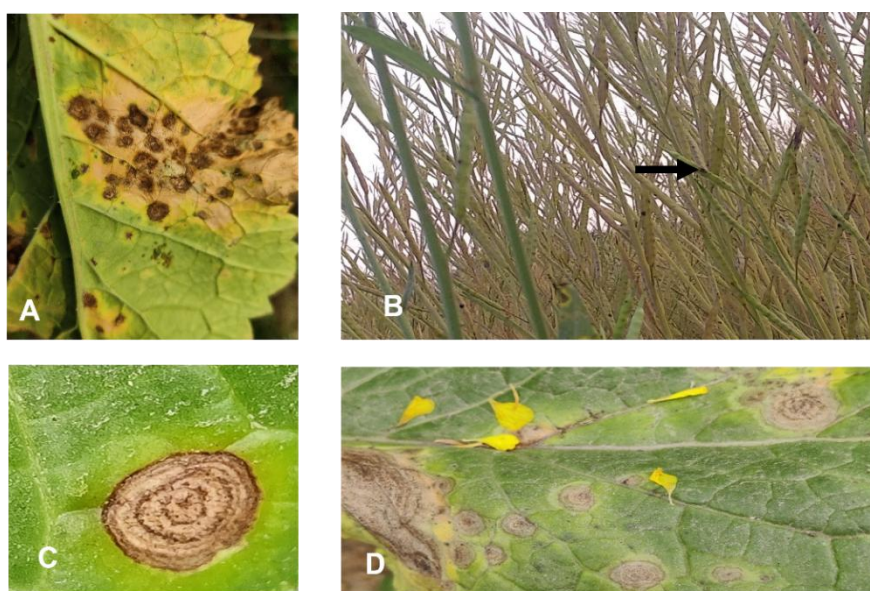


Plate 1. Symptoms of Alternaria blight on mustard leaves (A and D. blighted spots on leaf, B. Symptoms on pods, C. concentric rings)

significantly superior over the T9 [control (2.17)] Number of spot per pods. It may be seen from the data (Table 3) that minimum percent pod infection was found in T8 (0.97), T1 (1.17), T5 (1.17) followed by T2 (1.67), T6 (1.60), T7 (1.67). They were used botanicals which significant effective reduce disease incidence.

After harvest percent seed infection was examined. Percent seed infection by *Alternaria brassicae* and *Alternaria brassicicola* of harvested seed received from treated plot with different botanicals, bio-agent and fungicide was found to be significant. Seed obtained from control treatment showed the highest percent seed infection (19.17%) while seed obtained from carbendazim (T8) treated plot showed the lowest seed infection (13.37%) preceded by T1 (13.67%), T5 (14 %) respectively and followed by T2 (14.83)], T6 (14.53)], T7 (16.07). T8 [Carbendazim] was found more effective for controlling seed borne *Alternaria brassicae* of harvested mustard seeds. Similar result was recorded by [19] he used nine botanicals' Garlic bulb extract and found more effective as similar as [6, 14, 23]. Many researchers also used Garlic bulb extract which was significantly effective in reducing disease incidence. *T. harzianum* and Neem leaf extract as botanicals [24, 25].

4. CONCLUSION

As the chemicals have the hazardous effect on environment, mammals and also economical

consideration. Researchers are trying to find eco-friendly bio compounds for plant diseases management which should be beneficial, cheaper and easily available too. To generate awareness of harmful effects of fungicides integrated use of bioagents *Trichoderma harzianum* and botanicals will be the perfect solution as foliar spray against Alternaria blight. In this investigation among the botanicals and bio agent Neem oil, Neem leaf extract, *Trichoderma harzianum* and Garlic bulb extract is effective for management Alternaria blight of mustard cause by *Alternaria brassicae*. So with this investigation it can be said that many of the botanicals can be used as alternatives of the chemicals which can be so cheap and good for human and environment too.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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