

## Original Research Article

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## Evaluation of Selected Bio Agents, Plant Extracts and Fungicides for the Management of *Alternaria* Leaf Blight of Indian Mustard

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### ABSTRACT

#### Keywords

*Alternaria* blight, Bio agents, Fungicides, Garlic bulb extract, Indian mustard, Plant height, Test weight.

#### Article Info

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A field experiment was conducted at the research plot of the Department of Plant Pathology, SHIATS, Allahabad, U.P. during the Rabi season of 2013-14 to evaluate selected bioagents, plant extracts and fungicides for the management of *Alternaria* blight of Indian mustard (*Brassica juncea* L.) by applying foliar sprays of certain fungicides plant extract and bio-agents. Per cent disease intensity on leaves at 75 DAS, per cent *Alternaria* pod blight at 90 DAS, test weight (g/1000 seeds) and yield (q/ha) were recorded. Results revealed that foliar spray of mancozeb at 75 DAS recorded lowest per cent disease intensity on leaves (36.76) and pods (20.53) as compared to control (61.03 and 37.9, respectively). The same treated recorded maximum plant height at 60 DAS and 90 DAS (106.66 cm and 162.6 cm, respectively). Maximum test weight of 1000 seeds and yield q/ha were also in the same treatment (5.04g and 13.38q/ha., respectively) as compared to the control (4.11g and 9.04 q/ha., respectively). Results showed that the foliar spray of mancozeb @ 2.5g/l significantly reduced *Alternaria* blight, increased yield and was the most effective treatment, followed by garlic bulb extract @ 15% (w/v), neem leaf extract @

### Introduction

Mustard (*Brassica juncea* L.) is one of the major oil seed crop in India during Rabi season. It occupies a prominent place being next in importance to ground nut, both in area and production. *Alternaria* blight is a common disease in mustard. This is caused by *Alternaria brassicae* (Berk.) Sacc. and *A. brassicicola* (Schw.). This disease is reported from all continents of the world, and is reported to cause losses upto 70% depending on the crop species Kolte *et al.*, (1987) and Chattopadhyay (2008). It is soil, air and seed borne disease. In the present day scenario when the concern regarding environmental pollution is at its peak a need to evaluate eco-

friendly alternatives for the management of *Alternaria* blight was felt and an experiment was planned with botanicals, bio-agents and fungicides Mukhopadhyay (1994); Meena *et al.*, (2004). Currently pertaining to the use of botanicals in management of pathogens and related diseases are highly focused (Koche, 2013; Toppo, 2013; Mathad *et al.*, 2013; Mahapatra, 2013; Bisht, 2013). The paper deals with the evaluation of selected bio-agents and plant extracts along with the conventional fungicides against this important disease of mustard which causes losses. The approach was aimed to come up with alternative as the indiscriminate use of

fungicides is hazardous to the environment and affect human health. So, the present study was conducted to with a motive to come up with an eco-friendly management strategy which could be at par with the conventional fungicides used.

## Materials and Methods

The experiment was carried out in the research plot of the Department of Plant Pathology, SHIATS, during 2013-2014 under natural conditions. The crop was sown in randomized block design with three replications, seven treatments including control. Two botanicals [neem leaf extract (15%), garlic bulb extract (15%), two bio agents (*Trichoderma harzianum* 1%, *Pseudomonas fluorescens* 1%) and two fungicides [mancozeb 75% WP (0.25%), carbendazim @ 50WP (0.2%)] were selected and these were sprayed separately after 50 days of sowing (Meena *et al.*, 2011; Singh and Singh, 2007; Chaudhary *et al.*, 2013 and Mahapatra and Das 2013). The foliar spray was repeated after 15 days of first spray. Observations on per cent disease intensity on leaf at 75 DAS and pod at 90 DAS, plant height (60, 90 DAS), test weight (g/1000 seeds) and yield (q/ha) were recorded. Aqueous extracts of two botanicals (15 %) were prepared individually Mahapatra and Das (2013). Per cent disease intensity was recorded on leaves and pods at 15 days interval following 0-9 disease rating scale Singh (2009), per cent disease intensity was calculated using Mc Kinney's (1923) formula (Per cent disease intensity = Sum of all individual rating x 100/ Total number of leaves observed x maximum rating).

## Results and Discussion

### Disease parameters

The results revealed that spraying of botanicals (neem leaf extract 15%, and garlic

bulb extract 15%), bio agents (*Trichoderma harzianum* 1% and *Pseudomonas fluorescens* 1%), fungicides [mancozeb 75% WP (0.25%), carbendazim @ 50WP (0.2%)] in their respective doses reduced the leaf blight severity and subsequently increased the yield and cost benefit ratio in comparison to untreated control (check).

The results showed botanicals, bio agents and fungicides reduced the per cent leaf/pod infection significantly in comparison to control. Minimum per cent disease intensity (36.76 %) at 75 DAS was recorded in mancozeb 75% WP sprayed plots. This was followed by garlic bulb extract @ 15 % (38.47 %), neem leaf extract @ 15 % (40.76 %), *T. harzianum* @1 % (42.66 %), carbendazim @ 0.2 % (47.61 %) and *P. fluorescens* @ 1 % (51.25 %) as compared to control (61.03 %). The minimum disease intensity on pods (20.53 %) at 90 DAS was recorded in mancozeb treated plots. This was followed by garlic bulb extract @15% (23.2 %), neem leaf extract @ 15 % (25.55 %), *T. harzianum* @1 % (27.0 %), carbendazim @ 0.2 % (32.68 %) and *P. fluorescens* @ 1 % (37.9 %) as compared to control (44.59) as given in table 1. Thus, mancozeb @ 0.25 % provided superior results in all the treated plots. Similar findings have been reported by Jagana *et al.*, (2013). They have reported that Dithane M-45 was the most effective fungicide for *Alternaria* leaf blight in mustard crop.

In the present study among the plant extracts tested garlic bulb extract @ 15 % was found to be better in decreasing the disease intensity. Similar findings have been reported by Meena and Sharma (2012). The probable reason for such finding may be that ajoene, a compound derived from garlic may have inhibited spore germination of *Alternaria* sp. It is reported that the compound has effectively checked spore germination at a concentration of 25 µg/ml and recorded 100

% inhibition. It is quite likely that compound may be useful in controlling disease under field conditions. Similar findings have been reported by Singh *et al.*, (1990).

### Growth parameters

The growth parameters e.g. maximum plant height was recorded in plants sprayed with garlic bulb extract @ 15 % (167.01 cm) at 90 DAS which was at par with mancozeb (162.6 cm) and neem leaf extract @ 15% (158.03 cm) and followed by *T. harzianum* @ 1 % (150.97 cm), carbendazim @0.2 % (144.38 cm) and *P. fluorescens* @ 1 % (137.26 cm) as compared to control (135.73 cm) as given in table 1. Similar results have been observed by Perello *et al.*, (2013). They reported that garlic bulb extract was found to be the most effective treatment for improving the seedling health and plant height on wheat. While, Yadav *et al.*, (2002) have reported that mancozeb was the most effective fungicide

for plant height (cm). Amongst the bio-agents tested maximum plant height of mustard was recorded in *T. harzianum* (150.97 cm). Similar findings have been reported by Muhammad *et al.*, (2003) and Islam *et al.*, (2008).

### Yield parameters

The maximum test weight were recorded in mancozeb treated plots(5.04 g) which was at par with garlic bulb extract @ 15 % (4.91 g) and neem leaf extract @ 15 % (4.89 g) and followed by carbendazim (4.72 g), *P. fluorescens* (4.68 g) and *T. harzianum* (4.49 g) as compared to control (4.11 g) as given in table 1. Similar results were recorded by Patni and Kolte (2006). They reported that the maximum test weight (g/1000 seeds) was observed in mancozeb sprayed plants (4.22 g).

**Table.1** *Alternaria* blight of Indian mustard as affected by selected bio agents, plant extracts and fungicides

Treatments and Concentration	PDI on leaf at 75 DAS	PDI on pod at 90 DAS	Plant height (cm)		Test weight g/1000 seeds	Yield q/ha
			60 DAS	90 DAS		
Control	61.03	37.9	87.53	135.73	4.11	9.04
<i>Trichoderma harzianum</i> (1%)	42.66	27.0	95.98	150.97	4.49	11.95
<i>Pseudomonas fluorescens</i> (1%)	51.25	35.04	85.86	137.26	4.68	10.12
Neem leaf extract (15 %)	40.76	25.55	102	158.03	4.89	12.68
Garlic bulb extract (15 %)	38.47	23.2	104.14	167.01	4.91	12.91
Mancozeb 75 % WP (0.25 %)	36.76	20.53	106.66	162.6	5.04	13.38
Carbendazim 50 % WP (0.2 %)	47.61	32.68	92.88	144.38	4.72	10.57
S. Ed. (±)	0.704	0.905	3.129	4.863	0.130	0.835
C. D. (P = 0.05)	1.534	1.972	6.818	10.598	0.283	1.820

**Table.2** Economics of treatments against *Alternaria* leaf blight of Indian mustard

Treatments	Doses	Cost of treat. ₹/kg	Yield (q/ha)	Additional yield over control (q/ha)	Additional income (₹ /ha)	Cost of Protection (₹ /ha)	Net return (₹ /ha)	Benefit cost ratio
<i>Trichoderma harzianum</i>	1 %	75	11.95	2.91	8148	1125	7023	7.24
<i>Pseudomonas fluorescens</i>	1 %	70	10.12	1.08	3024	1050	1974	2.88
Neem leaf extract	15 %	10	12.68	3.64	10192	2250	7942	4.52
Garlic bulb extract	15 %	60	12.91	3.87	10836	1350	9486	8.02
Mancozeb	0.25 %	350	13.38	4.34	12152	1311	10841	9.26
Carbendazim	0.2 %	560	10.57	1.53	4284	1680	2604	2.55
Control	-----	-----	9.04	-----	-----	-----	-----	-----

In the present study, the highest yield was recorded in mancozeb treatment (13.38 q/ha) which was at par with garlic bulb extract @ 15 % (12.91 q/ha), neem leaf extract @ 15 % (12.68 q/ha) and *T. harzianum* @ 1 % (11.95 q/ha) and followed by carbendazim (10.57) and *P. fluorescens* @ 1 % (10.12 %) as given in table 1. Patni and Kolte (2006) reported that the maximum number of pods on main raceme was observed in mancozeb treatment. Similar results were recorded by Jagana *et al.*, (2013). They reported that mancozeb recorded the highest yield in mustard and was the most effective fungicide. Similar results were also recorded by Girish *et al.*, (2007). Amongst the bio-agents maximum yield q/ha was recorded in *T. harzianum*. The probable reason may be that *Trichoderma* spp. may have enhanced the plant growth as such the yield (q/ha) in the present study was found to be statistically superior over control. Similar findings have been reported by (Gupta and Srivastav, 1976; Kamlesh and Gurjar, 2001; John *et al.*, 2010; Shabir and Rubina, 2010).

### Cost benefit ratio

In the present study the maximum cost benefit ratio was recorded in mancozeb @ 2.5 g/l

(9.26) followed by foliar spray of garlic bulb extract @ 15 % (w/v) (8.02), *T. harzianum* @ 10 g/l (7.24), neem leaf extract(w/v) @ 15 % (4.52), *Pseudomonas fluorescens* @ 10 g/l (2.88) and carbendazim @ 2 g/l (2.55) as given in table 2. Similar results were recorded by Chattopadhyay and Bhunia (2003). They reported that highest seed yield and significant increase of 1000-seed weight were recorded from single spray of iprodione at post-flowering stage. But maximum economic return was obtained from two spray of mancozeb at 45 DAS and 60 DAS.

The results proved that application of botanicals could be bio-pesticidal and eco-friendly substitute for chemical fungicides in management of *Alternaria* leaf blight of Indian mustard. The success of garlic bulb extract and neem leaf extract in minimizing the disease intensity on both leaves and pods which are similar with earlier reports of Meena *et al.*, (2008), the results also are in conformity with the ones reported by Chatopadhyay *et al.*, (2005) in which they revealed that both garlic bulb extract and neem leaf extract were the better choice than the conventional chemical fungicides which are fast in action but there indiscriminate use

can be hazardous. So, the results proved that two foliar sprays at 50 and 65 DAS of garlic bulb extract and neem leaf extract could be bio-pesticidal, eco-friendly, equally effective as mancozeb and may become the substitute for chemical fungicides in management of *Alternaria* leaf blight of mustard. This experiment therefore, suggest that water extractable plant extract may in future be recommended as biologically based management strategy and can be made available in user friendly formulations for the management of *Alternaria* leaf blight disease of Indian mustard.

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