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Original Research Article

Strategy on Management of Alternaria Leaf Spot of Broad Bean (*Vicia faba* L.)

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A B S T R A C T

In this study we evaluated the three bio-control agents and nine alone and combined treatment of three disease controlling agents *viz.*, Chemical (Cabendazim 50 WP), Botanical agent (neem seed kernel extract) and bio-control agents (*Pseudomonas flourescens* and *Trichoderm harzianum*) against Alternatria leaf spot of broad bean *in vitro* and *in vivo* respectively. Among three bio-control agents the maximum Inhibitory effects on mycelial growth of *Aliternaria alternata* was inhibited by *B. subtilis* (54.28 %) followed by *T. viride* (48.57 %) and *T. harzianum* (42.85 %) *in vitro.* Among the nine treatments minimum percent disease severity and per cent disease control was found in T_2 followed by T_1, T_8, T_7, T_4, T_3, T_6, T_5 as compared to T_9 (untreated),The maximum plant height and yield was recorded in T_2 followed by T_1, T_8, T_7, T_4, T_3, T_6, T_5 as compared to T_9 (untreated) plots *in vivo.*

Keywords

Broad Bean, Alternaria Leaf Spot, Botanicals, Bio-control Agents, Fungicide

Introduction

Broad bean (*Vicia faba* L.) belongs to family Fabaceae, popularly known as bakala (in India), broad bean, field bean, tick bean etc. Broad bean is grown mainly by poor farmers and this crop is vital for both food security and income generation. The cultivation of broad bean improve soil fertility and reduce the incidence of weeds, diseases and pests, when grown in rotation with other field crops (Mwanamwenge *et al.*, 1998). Most of the people in the urban areas take stewed broad bean for breakfast, supper as well as sandwiches to be taken at any time of the day. Broad bean is cultivated for use as a green or dried, fresh vegetable or for green manure in many parts of the world. It is also

widely grown as a minor garden crop. Broad bean ranks fourth in the world as an important food legume after garden pea, chickpea and lentil (Torres *et al.,* 2006). It is one of the earliest domesticated food legumes in the world and provides protein requirement of human diet, especially for poorer sections of the population and also a chief source of calcium, iron and vitamins, and ranks high among the vegetable. Sprouted seed is a reach source of vitamin A and C. Nutritive value of broad bean is high with about 30% protein, carbohydrate 56%, fat 0.8 %, crude fiber 6.6-8.54%, ash 3.45% and lipid 1.63% (Crepona *et al*., 2010). The protein of broad bean is very reach in essential amino-acid and lysine contain comparatively higher than other legumes.

In India broad bean is usually grown in localized pockets of eastern Uttar Pradesh, Bihar, Haryana, Himachal Pradesh, Madhya Pradesh, Ladakh and Kashmir. This crop is susceptible to many diseases which considerably reduce yield. A number of diseases *viz*. Alternatria leaf spot caused by *Alternaria alternata*, Chocolate leaf spot caused by *Botrytis fabae*, Brown spot caused by *Ascochyta fabae*, Zonate spot caused by *Cercospora fabae*, Rust caused by *Uromyces fabae*, Powdery mildew caused by *Erysiph epolygoni*, Root rot or Soft root rot by *Pythium debryanum* and *Pythium altimum*, Downy mildew caused by *Peronospora vicieae* and Verticillium wilt by *Verticillium albo-atrum* have been reported in this crop. Among them, Alternatria leaf spot is important and is responsible for major yield losses in our countries. Alternatria leaf spot disease of broad bean caused by *Alternaria alternate* (Fries) Keissler is one of the most serious in many areas of Bihar and Jharkhand. Under severe conditions of infection yield loss up to 40 per cent has been reported (Kumar *et al.,* 2005). Much effort has been not done this line. However, most of the work conducted is confined to chemical control of the diseases. Since no systematic research has been conducted in relation to this important disease on broad bean in India, it is therefore, thought worthwhile to take on this important disease.

Materials and Methods

These experiments were carried out in Plant Pathological laboratory, Department of Plant Pathology and Students Instructional Farm of N.D. University of Agriculture and Technology, Kumarganj, Ayodhya (U.P.) India during *Rabi season* in 2018-2019.

Isolation of Pathogen

The pathogen *A. alternata* was isolated from infected plants leaves of the broad bean on PDA (Potato Dextrose Agar) medium for further studies.

Effect of bio-control agents on radial growth of *A. alternata*

For this studies three bio-control agents as presented in (Table-1) were collected from the Department of Plant Pathology, N. D. University of Agriculture and Technology, Kumarganj, Ayodhya (U.P.) India and using dual plate technique (Kayim *et al.,* 2018), the per cent inhibition of *A. alternate* was calculated by adopting the following formula.

$$\text{Per cent inhibition} = \frac{\text{Radial growth in control (C)} - \text{Radial growth in treatment (T)}}{\text{Radial growth in control (C)}} \times 100$$

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Foliar spray and Seed treated with fungicide (Carbendazim 50 WP), botanical (neem seed

kerenal extract) and biological control agents (*Pseudomonas flourescens* and *Trichoderm harzianum*) in alone and combination. The experiment was laid out in randomized block design (RBD) with nine treatments as presented in (Table 2 and 3) and three replications. A susceptible germplasm HFB-1was used in this experiment. Artificial inoculation (10^6conidia/ml) was done at 45 days after sowing.

The fungicide, botanical and bio-control agents treatment were applied as spray to run off at fifteen days intervals with first and second spray were given at 95 and 110 DAS, respectively. Seven days after last spraying, PDS was recorded in all the treatments and calculated the disease reduction in each treatment plot over control and increased the yield in the each treatment.

Statistical Analysis

In this investigation, field experiment was conducted in randomized block design. The data obtained from all the experiments were statistically analyzed following the standard procedures (Gomez and Gomez, 1984).

Results and Discussion

Efficacy of different bio-agents against *A. alternate in vitro*

Maximum mycelial growth was inhibited by *B. subtilis* (54.28 %) followed by *T. viride* (48.57 %) and *T. harzianum* (42.85 %) were found least effective in the inhibition of mycelial growth in dual plate technique see (Table-1 and Plate-1). Anjum *et al.,* (2019) evaluated the efficacy of different fungicides and biological agents. Among them fungicide Carbendazim 50% WP were found statistically significant in reducing 72.7%, mycelial growth of *A. alternate* and in case of bio-agents *Trichoderma harzianum* was found most effective. Kayim *et al.,* (2018) tested five *Trichoderma harzianum* isolates (T_1, T_2, T_3, T_4 and T_5) among them *Trichoderma* isolates (T_2 and T_3) were found the most effective against *A. alternata* causing Alternaria leaf spot disease of broad bean.

The similar findings were also reported by Vijayalakshmi *et al.,* (2018); El-Mougy *et al.,* (2016); Behairy *et al.,* (2014) and Kumar *et al.,* (2005).

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Among nine treatments the least percent disease severity (31.8) was found in T_2 followed by T_1 (32.26), T_8 (36.66), T_7 (38.53), T_4(38.8), T_3 (40.40), T_6(41.66), T_5 (42.73) as compared to T_9 (untreated) plots (62.33).

The highest per cent disease control (48.98%) was recorded in T_2followed by T_1 (48.24%), T_8 (41.18%), T_7 (38.18%), T_4 (37.75%), T_3(35.18%), T_6 (33.16%), T_5 (31.44%) as compared to T_9 (untreated) plots. Disease severity was recorded maximum at 90 days after sowing as compared to 30 and 60 days after sowing see (Table-2 and Plate-2).

The maximum plant height and yield (123.60 cm.), (538.89kg/ha) was recorded in T_2 respectively followed by T_1 (118.06 cm.), (527.03 kg/ha); T_8(115.86 cm.), (493.33 kg/ha); T_7(114.93cm.), (492.26 kg/ha); T_4(114.80 cm.), (491.22 kg/ha); T_3(113.40 cm.), (473.33 kg/ha); T_6 (111.06cm.), (454.22 kg/ha); T_5 (106.46cm.), (452.51 kg/ha) as compared toT_9 (untreated) plots (107.40), (414.66 kg/ha.) (Table-3 and Plate-2).

Table.1 Efficacy of bio-control agents against *A. alternata* on radial growth and growth inhibition using dual culture technique after 7 days incubation

Bio-agents	Per cent Inhibition
B. subtilis	54.28
T. viride	48.57
T. harzianum	42.85
Control	00.00
SEm±	0.577
CD at % 1	2.733

Table.2 Effect of fungicide, botanical and bio-control agents against *A. alternata* in field condition.

Treatments	Disease Severity 95 DAS	Per cent Disease control 95 DAS	Disease Severity 110 DAS	Per cent disease control 110 DAS
T_1 - FS Carbendazim @ 0.1%	22.86 (28.49)	56.25	32.26 (34.55)	48.24
T_2 - ST + FS Carbendazim @ 0.1%	21.26 (27.45)	59.31	31.8 (34.32)	48.98
T_3-FS *T. harzianum* @ 0.4%	30.4 (33.45)	41.82	40.4 (39.46)	35.18
T_4 - ST + FS *T. harzianum*@ 0.4%	28.86 (32.48)	44.77	38.8 (38.52)	37.75
T_5 - FS neem seed kernel extract @ 5%	32.11 (34.51)	38.55	42.73 (40.82)	31.44
T_6 - ST + FS N S K E @ 5%	31.86 (34.36)	39.03	41.66 (40.20)	33.16
T_7 - FS *P. fluorescens*@ 0.5%	28.43 (32.21)	45.59	38.53 (38.36)	38.18
T_8 - ST + FS *P. fluorescens*@ 0.5%	26.33 (30.87)	49.61	36.66 (37.22)	41.18
T_9-Control	52.26 (46.30)	00.00	62.33 (52.15)	00.00
SEm±	1.60		1.57	
CD at 5 %	4.80		4.71	

Table.3 Effect of fungicide, botanical and bio-control agents on plant height and yield of broad bean

Treatments	Plant height (cm.) 110 DAP	Yield (Kg/ha)
T_1 - FS Carbendazim @ 0.1%	118.06	527.03
T_2 - ST + FS Carbendazim @ 0.1%	123.60	538.89
T_3 – FS *T. harzianum* @ 0.4%	113.40	473.33
T_4 - ST + FS *T. harzianum* @ 0.4%	114.80	491.22
T_5 - FS neem seed kernel extract @ 5%	106.46	452.51
T_6 - ST + FS N S K E @ 5%	111.06	454.22
T_7 - FS *P. fluorescens* @ 0.5%	114.93	492.26
T_8 - ST + FS *P. fluorescens* @ 0.5%	115.86	493.33
T_9-Control	107.40	414.66
SEm±	3.45	3.74
CD at 5 %	10.33	11.21

Plate.1 Efficacy of bio-control agents against *A. alternata* on radial growth and growth inhibition using dual culture technique after 7 days incubation (A) *B. subtilis vis. A. aternata*, (B) *T. viride vis. A. alternata*, (C) *T. harzianum vis. A. alternata* and (D)Control culture plate of *A. alternata*

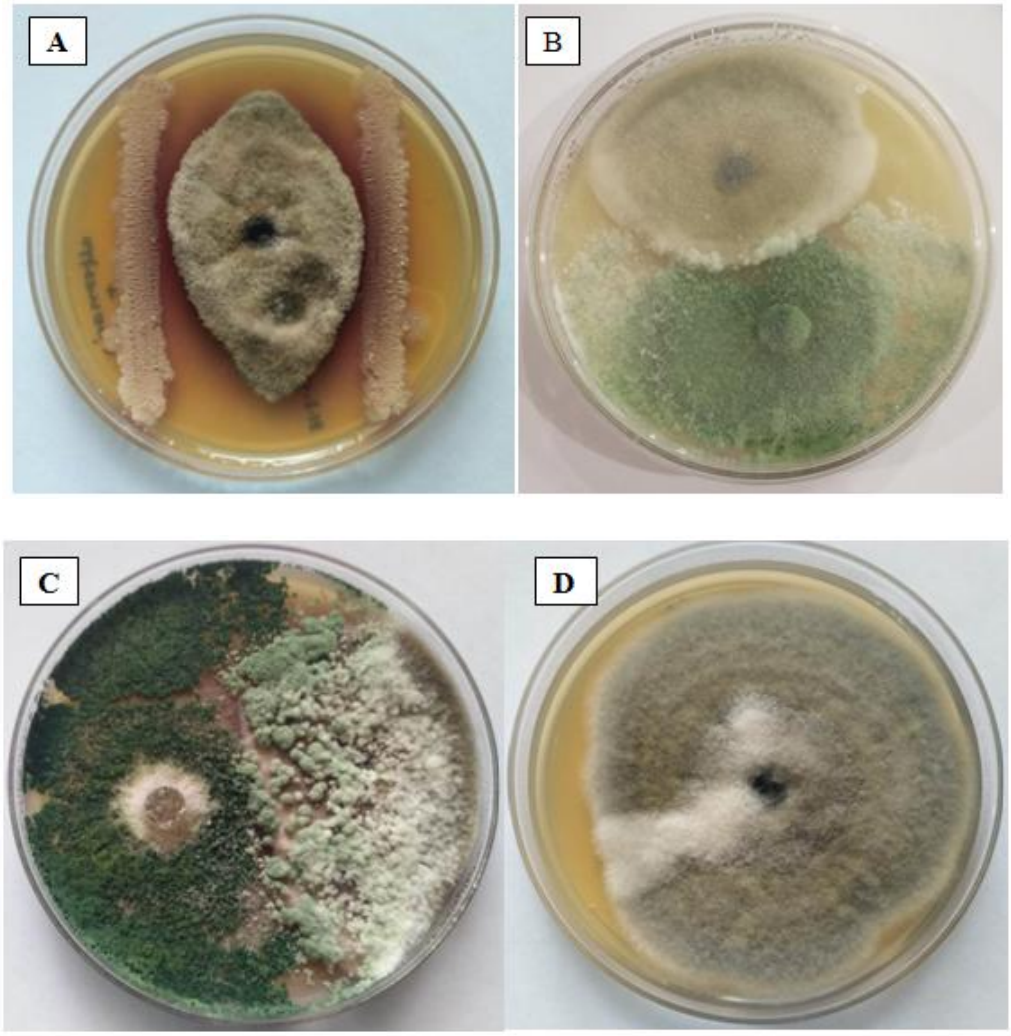
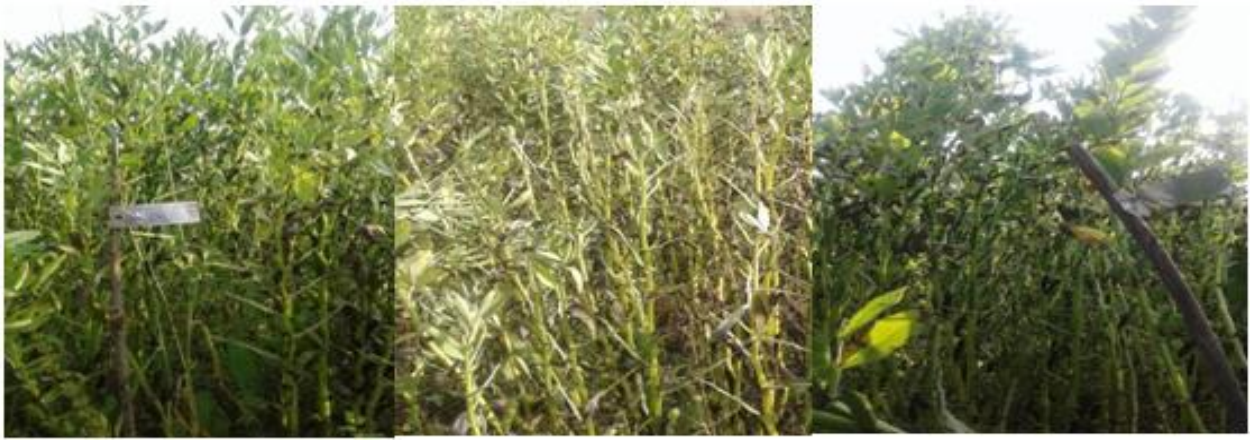


Plate.2 Experiment on management of broad bean

T_1- ST Carbendazim T_2- ST+FS Carbendazim T_3-ST*P. fluorescence*

T_4- ST+FS *P. fluorescence* T_5- ST *T. hargianum,* T_6-ST+FS *T. hargianum*



T_7- FS NSKE T_8- ST+FS NSKE T_9- Control

Pandey *et al.,* (2019)found *Trichoderma viride* most effective followed by *Trichoderma harzianum,* Bavistin and Thiram in controlling the seed borne infection of *Alternaria alternata*. Vijayalakshmi *et al.,* (2018) recorded maximum inhibition of mycelia growth of *A. helianthi* (89.75%) by Iprodione + Carbendazim. Thakur *et al.,* (2017) also found the foliar spray of *Trichoderma harzianum* 2% (fs) significantly reduced Alternaria blight and increased yield followed by foliar spray of *Trichoderma viride* (fs) 2% and neem leaf extract. El Mougy *et al.,* 2016); Regmi *et al.,* (2014) Chidambaram *et al.,* (2004); Lal and Upadhyay (2002) All above mentioned scientist also repotted the present findings.

Inhibitory effects of bio-control agents were tested against *A. alternata in vitro* condition and the maximum mycelial growth was inhibited by *B. subtilis* (54.28) followed by *T. viride* (48.57) and *T. harzianum* (42.85) were found least effective in inhibition of mycelial growth (42.85) in dual plate culture technique. Efficacy of fungicide, botanical and bio-control agents were tested alone and in combinations to see their individual as well as combined effect on Alternaria leaf spot disease of broad bean in field conditions. Nine treatments were under taken in this study, among them minimum disease severity (31.8) was found in T_2 followed by (32.26), T_8 (36.66), T_7 (38.53), T4 (38.8), T_3 (40.40), T_6 (41.66), T_5 (42.73) as compared to T_9 (untreated) plots (62.33).The highest per cent disease control (48.98%) was recorded in T_2 followed by T_1 (48.24%), T_8 (41.18%), T_7 (38.18%), T_4 (37.75%), T_3 (35.18%), T_6 (33.16%), T_5 (31.44%) as compared to T_9(untreated) plots.

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