

Original Research Article

Evaluation of phyto-extracts for the management of alternaria leaf blight of cluster bean (*Cyamopsis tetragonoloba* L.) caused by *Alternaria cucumerina*

ABSTRACT

The present study was carried out to evaluate the effect of selected phyto-extracts for the management of alternaria leaf blight of cluster bean (*Cyamopsis tetragonoloba* L.) caused by *Alternaria cucumerina* under field conditions. Three replications of cluster bean were planted in a randomized block design at the research plot of the Central Research Field, Department of Plant Pathology, SHUATS, Prayagraj during Zaid season of 2023. Ginger rhizome extract, onion bulb extract, eucalyptus leaf extract, neem leaf extract, garlic clove extract and mancozeb were applied as foliar spray. All the treatments were found significantly reduced the disease severity and increased the yield. Among all the treatments garlic clove extract @ 10% was recorded minimum disease intensity (29.63) and maximum yield (2.50 t/ha). Neem leaf extract @ 10% was recorded maximum cost benefit ratio (1: 1.80), as compared to treated mancozeb @ 0.2%(treated) and untreated control.

1. INTRODUCTION

Cluster bean (*Cyamopsis tetragonoloba* L. Taub.) belongs to the family Fabaceae and it is commonly known as guar, has come to be recognized as one of the most important commercial crop of arid and semi-arid region. It is a drought hardy leguminous crop because of its deep tap rooting system and has high capacity to recover from water stress. The seed of cluster bean contains about 30-33% gum in the endosperm. The discovery of the galactomannan gum in the endosperm during 1948, led to this hitherto insignificant plant gaining importance as an industrial crop (<http://www.cazri.res.in/>).

India accounts for more than three-fourth (about 80 per cents) of the global production of cluster bean. The area under the crop is reported about 5345.9 Hectares with production is about 3286 tones and productivity are 615 (kg/Hectares) during the year 2014-15. Rajasthan is the largest cluster bean producing state in India followed by Haryana, Gujarat, UP, MP and Punjab. Rajasthan has an area of 46.30 lakh hectare, production of 27.47 M tonnes with a productivity of 593 kg/ha during the agricultural year 2014-15. The state contributes about 85 percent of the total area under crop in the country. The district of Bikaner, Jaislmer, Barmer, Churu and Hunumangarh contributes to higher average about 29.1%, 13.9%,13.8%,10.6% and 9.6% respectively (Bhupender *et al.*, 2020).

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Alternaria blight of cluster bean is also severe which was reported from Pusa (Bihar) and Madras. It suffers from several diseases that cause quantitative and qualitative losses, among them *Alternaria* spp. is an economically important pathogen widely distributed throughout the world and cause devastating disease on field crops (Ambesh *et al.*, 2014).

Alternaria spp. in early stages of infection, the water-soaked spots appear on leaf blade which later turn greyish to dark brown with concentric zonations, demarcated with light brown lines inside the spot on the under surface. The lesions are light to grayish brown. Higher yield losses (43-78 %) were recorded when leaves were infected at seedling stage than at old stage. During favourable weather conditions for disease development very meager work has been carried out on weather parameters, which are responsible for disease development. There is a positive correlation between weather parameters favourable for progressive development of disease in the crop (Sharma *et al.*, 2020).

It is a routine practice for farmers to spray fungicides starting from one month crop age to maturity, particularly for alternaria leaf blight control. Fungicidal applications are also mandatory for alternaria leaf blight management after its initiation. The pesticides residues present in seed are main concern for human health at national and international level. To overcome these problems, we have to find out some eco-friendly alternatives for the management of disease. Hence looking to importance of this disease and need of present era, efficacy of various phyto-extracts like ginger rhizome extract, onion bulb extract, eucalyptus leaf extract, neem leaf extract, garlic clove extract tested in the field condition against alternaria pathogens.

2. MATERIALS AND METHODS

The experiment was carried out at the Central Research Field, Department of Plant Pathology, SHUATS, Prayagraj during Zaid season 2023. The study was laid-out with Randomized Block Design (RBD) with three replications. Three sprays of all treatments were given at an interval of 15 days. Treatments were imposed after appearance of the first disease symptoms. Observations on disease intensity (%) of alternaria leaf blight of cluster bean were recorded at 15 days interval, yield (t/ha) and C:B ratio data were obtained after the harvest on physiological maturity. The treatments comprised of application of selected phyto-extracts *viz.*, ginger, onion, eucalyptus, neem, garlic @ 10% and mancozeb @ 0.2% (treated check) and control (untreated). The crop was sprayed three times at 45, 60, and 75 DAS of interval. The disease intensity of alternaria leaf blight was recorded after ten days of spray.

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The disease severity of alternaria leaf blight was recorded before spray, seven days after first spray and seven days after second spray using 0-5 rating scale (table 1) is given by **Rajkumar and Mukhopadhyay (1986)**.

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Per cent disease index (PDI) was calculated using the formula given by **Wheeler (1969)**.

$$\text{PDI} = \frac{\text{Sum of all disease ratings}}{\text{Total number of leaves observed} \times \text{Maximum disease rating}} \times 100$$

Table 1. Disease rating scale

Serial Number	Score / Grade	Description
1	0	No infection
2	1	1-5% leaf area covered
3	2	6-10% leaf areas covered
4	3	11-25% leaf areas covered
5	4	26-50% leaf areas covered
6	5	>50% leaf areas covered

2.1 Preparation of Phyto-extracts

Phyto-extract was prepared from rhizome of ginger (*Zingiber officinale*), bulb of onion (*Allium cepa*), leaves of eucalyptus (*Eucalyptus globulus*), leaves of neem (*Azadirachta indica*) and bulb of garlic (*Allium sativum*) washing with running tap water followed by sterile distilled water, air dry at 27°C and ground to obtained extracts of each plant species the extraction was done by means of pestle and mortar. Water extract was obtained by adding one gm of tissue in one ml of water (1:1w/v) and filtered through double layers of muslin cloth. This forms the standard solution (100%). The phyto-extracts was sprayed at the rate of 10% prepared from standard solution. All the treatments were given as foliar sprays. Phyto-extracts was sprayed @ 10 ml/liter of water, mancozeb @ 2 ml/liter of water.

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2.2 Economics

Cost benefit ratio is the ratio of gross returns to cost of cultivation, which can also be expressed as return per rupees invested. This index provides an estimate of the benefit a farmer derives from the expenditure he incurs in adopting a particular cropping system any value above 2.0 is considered safe as the farmer gets Rs. 2 for every rupee invested. The cost benefit ratio was calculated using the following formula by **Reddy and Reddi (1995)**.

C: B Ratio = Gross returns (Rs/ha) / Total cost of cultivation (Rs/ha).

2.3 Statistical analysis

The data obtained from the field experiment were statistically analysed by following the standard procedures (**Panse and Sukhantme, 1989**). In the experiment Randomized Block Design (RBD) was adopted. The analysis of variance (ANOVA) technique was applied for drawing conclusion from data. The calculated values were compared the tabulated values at 5% level of probability for the appropriate degree of freedom.

3. RESULTS

A field study was carried out to assess on various aspects of alternaria leaf blight of cluster bean (*Cyamopsis tetragonoloba* L.) caused by *Alternaria cucumerina* var. *cyamopsidis* with reference to evaluation of disease intensity (%), yield (q/ha) and cost benefit ratio among the treatments.

The results of the field experiment presented in **Table no.2** two clearly indicate that the disease intensity was significantly low in all the treated plots compared to the unsprayed control plot after two sprays. Disease intensity was recorded three times before spray, fifteen days after first spray and fifteen days after second spray of phyto-extracts along with fungicide, respectively. The first spray of treatment was applied at 45 days after sowing and the second was given at 60 days after sowing an interval of 15 days.

3.1 Disease intensity (%) of alternaria leaf blight on cluster bean

Among the treatments the significant reduction in the disease intensity (%) at 45, 60 and 75 DAS was recorded in the treatments. The minimum disease intensity (%) of cluster bean was recorded in T₅Garlic

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clove extract @10% (12.7, 23.47, 33.31) followed by T₄- Neem leaf extract @ 10% (14.2, 23.76, 34.43) as compared to other treatments including control.

3.2 Yield (t/ha) in cluster bean

The significant increase in yield was obtained in the treatments, T₅- Garlic clove extract @ 10 % (2.50 t/ha) followed by T₄- Neem leaf extract @10% (2.46 t/ha) as compared to other treatments including control.

3.3 Cost benefit ratio of the treatments

Highest cost benefit ratio was obtained in the treatments, T₄- Neem leaf extract @10% (1: 1.80) followed by T₅- Garlic clove extract @ 10 % (1: 1.70) as compared to other treatments including control.

Table 2. Effect of treatment on disease intensity, yield and cost benefit ratio

Treatments	Per cent disease intensity				Yield (t/ha)	C:B ratio
	45 DAS (Before spray)	60 DAS (After 1 st spray)	75 DAS (After 2 nd spray)	Mean		
T ₀ - Control	14.27	30.3	40.53	28.37	1.29	1: 1.48
T ₁ - Ginger rhizome extract @ 10 %	13.97	25	36.07	25.01	1.95	1: 1.15
T ₂ - Onion bulb extract @ 10 %	14.37	26.1	36.49	25.65	1.90	1: 1.16
T ₃ - Eucalyptus leaf extract @ 10 %	13.9	27.43	38.39	26.57	1.41	1: 1.61
T ₄ - Neem leaf extract @ 10 %	14.2	23.76	34.43	24.13	2.46	1: 1.80
T ₅ - Garlic clove extract @ 10 %	12.7	23.47	33.31	23.16	2.50	1: 1.70
T ₆ - Mancozeb (Dithane M-45) @ 0.2 %	14.63	25	29.63	23.09	2.67	1: 1.88
SED(+/-)	0.71	0.39	0.59		0.56	
C.D (5%)	2.10	1.16	1.73		3.10	

4. DISCUSSION

The probable reasons for such findings may be due to the antimicrobial properties of garlic extract and neem leaf extract due to the presence of volatile oil which contains diallyl disulphides, diallyl

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trisulphides and sulphur dioxides derived from allicin or ajoene which disrupts the cell membrane of the pathogen and restricts the performance of some enzymes that are important to proliferate fungi in nature and inhibits enzyme formation leading to cell death and loss of vigour, ultimately killing the pathogen by this garlic may directly reduce the disease intensity. But among all the treatments chemical fungicide (Treated check) has shown the minimum disease control has shown with strong fungicidal effect against pathogen. In order to reduce the pathogen, it may produce some toxic chemical residues, they may have potential harmful effects to non-targeted organism. The research outcomes align with the similar findings was reported by Singh and Verma (2010); Chethana *et al.* (2012); Kantwa *et al.* (2014); Rakholia *et al.* (2016); Choudhary *et al.* (2020) and Pun *et al.* (2020).

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Plant extracts possess antimicrobial properties and contain a spectrum of secondary metabolites such as alkaloids, quinones, flavonoids, glycosides, saponins, tannins and terpenoids enable their use in combating fungi that cause plant diseases. Usage of botanicals is reported to be safe due to its easy decomposition, non-residual activity, non-phytotoxic properties and also economical. Similar findings are consistent with the research conducted by Trivedi *et al.* (2014) and Khursheed *et al.* (2021).

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4. CONCLUSIONS

The present investigation concluded that garlic clove extract @ 10% as foliar spray recorded minimum disease intensity (%) of alternaria leaf blight (*Alternaria cucumerina*) of cluster bean (*Cyamopsisidis tetragonoloba* L.) and increased yield (q/ha) of cluster bean. Neem leaf extract @ 10% as foliar spray recorded maximum cost benefit ratio. The present investigation was limited to one crop season (April, 2023 – July, 2023) under Prayagraj agro-climatic conditions, therefore to substantiate the present results more trials are required for future recommendations.

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DISCLAIMER (ARTIFICIAL INTELLIGENCE)

Author(s) hereby declares that NO generative AI technologies such as Large Language Models (ChatGPT, COPILOT, etc) and text-to-image generators have been used during writing or editing of manuscripts.

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