Evaluation of phyto-extracts for the management of alternaria leaf spot of blackgram (*Vigna mungo*L.) caused by *Alternaria alternata*(Fr.)Keissler

ABSTRACT

The present study was investigated to evaluate the effect of selected phyto-extracts for the management of alternaria leaf spot on black gram caused by *Alternaria alternata* (Fr.) Keissler, under field conditions. Three replications of black gram were planted in a randomized block design. At the research plot of the Central Research Field, Department of Plant Pathology, Sam Higginbottom University of Agriculture, Technology and Sciences, Prayagraj during *Zaid* season of 2023. Neem leaf extract, onion bulb extract, ginger rhizome extract, garlic clove extract, ashoka leaf extract and Mancozeb were applied as foliar spray.All the treatments were found significantly reducedthe disease severityand increasedtheyield. Among all the treatments garlic bulb extract @ 10%was recorded minimum disease intensity (25.62) and maximumyield (7.45 q/ha) and costbenefitratio (1: 2.54),as compared to treated check mancozeb @ 0.2%and untreated check control.

INTRODUCTION

Black gram [*Vigna mungo* (L.) Hepper] or Urad bean is one of the most important pulse crops in India. This legume originated in India, where it has been cultivated from ancient times and is one of the most highly priced legumes has inevitably marked itself as the most popular legume and can be most appropriately referred to as the "King of legumes"**(Rajni *et al.*, 2019)**. Black gram locally known as urid bean, mash kalai, minapa pappu originated in India **(Anusree and Kanzaria, 2022).**

One of the most important pulse crops having global economic importance as a dietary ingredient of the staple food in tropical and subtropical region. It is the appropriate mixture of all the nutrients which consist of proteins (25-26%), carbohydrates (60%), fat (1.5%), minerals, amino acids and vitamins**(Reddy*et al.*, 2021).**The estimated production of black gram in India during *Kharif* and *Rabi* season in 2021-22 is 513 kg/ha, 866 kg/ha and the total yield of black gram is 586 kg/ha **(DA & FW, 2023).**

Black gram suffers from many diseases caused by biotic (fungi, bacteria, viruses) and also abiotic stresses. Out of which fungal diseases cause up to 50% or more yield losses in black gram. Alternaria

leaf spot and blight in black gram has become endemic and is appearing in severe form. Alternaria being a low sugar fungus, most prominent symptoms are produced at flowering stage on older leaves **(Prathyusha *et al.*, 2021)**.

Botanicals produced by plant having antimicrobial and antifungal activity as onion contains compound called Allicin as it belongs to class sulfoxide helps in control of fungi and bacteria and Garlic contains a compound called Allicin belongs to class sulfoxide helps in control of fungi, bacteria. Ginger extract contains gingerol contains antifungal and antimicrobial properties helps in control of various fungal plant diseases.Thousands of phyto-chemicals which have inhibitory effects on all types of microorganisms *in-vitro* should be subjected *in-vivo* testing to evaluate the efficacy in controlling the plant diseases. In most of the reported works, underground parts (root, tuber, rhizome, bulb etc.) of plants were extensively compared with other above ground parts in search for bioactive compounds possessing antimicrobial properties **(Sharma *et al.*, 2017)**.

It is a routine practice for farmers to spray fungicides starting from one month crop age to maturity, particularly for powdery mildew control. Fungicidal applications are also mandatory for powdery mildew 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 neem leaf extract, ginger rhizome extract, garlic clove extract, onion bulb extract, ashoka leaf 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, Sam Higginbottom University of Agriculture, Technology And Sciences, 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 plant height (cm) and disease intensity (%) of Alternaria leaf spot of mung bean were recorded at 15 days interval, pod length (cm) and B:C ratio data were obtained after the harvest on physiological maturity. The treatments comprised of application of selected phyto-extracts *viz.*, neem, garlic, ginger, onion, ashoka @ 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 spot was recorded after ten days of spray.

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

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

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

Table 1. Disease rating scale

Grade	Leaf area covered
0	No symptoms of disease on leaves (Immune)
1	Spots size covering 1-10% of leaf area (Resistant)
2	Spots size covering 11-25% of leaf area (Moderately resistant)
3	Spots size covering 26-50% of leaf area (Moderately susceptible)
4	Spots coalesce to form big patches covering 51-75 % of leaf area (Susceptible)
5	Big spots size covering >75 % of leaf area (Highly susceptible)

2.1 Preparation of Phyto-extracts

Phyto-extract was prepared from, leaves of neem (*Azadirachta indica*), bulb of garlic (*Allium sativum*), rhizome of ginger (*Zingiber officinale*), bulb of onion (*Allium cepa*), leaves of ashoka(*Polyalthia longifolia*) washing with running tap water followed by sterile distilled water, air dry at 270C 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.

2.2Economics

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 **(Reddy and Ram, 2004).**

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

2.3 Statical 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 spot of black gram caused by *Alternaria alternata* (Fr.) Keissler with reference to evaluation of disease intensity (%), number of pods, 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 spot on blaack gram

Among the treatments the significant reduction in the disease intensity (%) at 45, 60, 75 DAS was recorded in the treatments. The minimum disease intensity (%) of black gram was recorded in T2– Garlic clove extract @10% (9.22, 17.57, 25.62) followed by T1- Neem leaf extract @ 10% (8.08, 19.40, 28.69) as compared to other treatments including control.

3.2 Number of pods on black gram

The maximum number of pods observed in T2- Garlic clove extract @ 10% (16.27) followed by T1- Neem leaf extract @ 10% (14.0), as compared to other treatments including control.

3.3 Yield (q/ha) in black gram

The significant increase in yield was obtained in the treatments, T2- Garlic clove extract @ 10 % (7.45 q/ha) followed by T1- Neem leaf extract @10% (6.62 q/ha) as compared to other treatments including control.

3.4 Cost benefit ratio of the treatments

Highest cost benefit ratio was obtained in the treatments, T2- Garlic clove extract @ 10 % (1: 2.54) followed by T1- Neem leaf extract @10% (1: 2.38) 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				No. of pods	Yield (q/ha)	C:B ratio
	45 DAS (Before spray)	60 DAS (After 1st spary)	75 DAS (After 2nd spray)	Mean			
T0- Control	14.30	28.58	40.56	27.82	9.20	3.58	1: 1.29
T1- Neem leaf extract @ 10 %	8.08	19.40	28.69	18.72	14.00	6.62	1: 2.38
T2- Garlic clove extract @ 10 %	9.22	17.57	25.62	17.47	16.27	7.45	1: 2.54
T3- Ginger rhizome extract @ 10 %	12.23	23.77	37.20	24.40	11.87	5.57	1: 1.93
T4- Onion bulb extract @ 10 %	13.95	24.60	37.55	25.37	11.73	4.53	1: 1.62
T5- Ashoka leaf extract @ 10 %	12.97	24.10	37.26	24.78	11.00	5.40	1: 1.94
T6- Mancozeb (Dithane M-45) @ 0.2 %	9.39	14.46	21.55	15.13	18.40	8.62	1: 2.93
SEd(+/-)	0.53	0.26	0.26		0.56	0.25	
C.D (5%)	1.10	0.56	0.57		1.24	0.56	

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 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. So, considering the ecosystem, phytoextracts of garlic and neem significantly inhibits the pathogen could lead to better health of the plants which in turn helps in producing minimum disease intensity and increased the pod setting and yield. 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).**

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)**.

5. CONCLUSIONS

The present investigation concluded that garlic clove extract @ 10 % as foliar spray recorded minimum disease intensity (%) of alternaria leaf spot (*Alternaria alternata*) of black gram (*Vigna mungo* L.) and increased the maximum number of pods, yield (q/ha) and 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.

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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