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Management of *Cercospora* Leaf Spot Disease of Mungbean (*Vigna radiata*)

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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

This study aimed to investigate the effects of different fungicides on managing *Cercospora* leaf spot in Urdbean (*Vigna radiata*). The investigation was carried out at the experiment, Rainfed Organic Agriculture Research Farm Narayan Bagh, Institute of Agricultural Sciences, Department of Plant Pathology, Bundelkhand University, Jhansi (Utter Pradesh), during the *Kharif* season of 2023. The experiment was laid out in a randomized block design (RBD) with three replications. Fungicides were foliar applied after the initiation of the disease. Roko (thiophanate methyl) @ 0.05% (80.48%), followed by Kavach (Chlorothalonil) @ 0.01% (67.35%), *Trichoderma harzianum* @ 10 g/L (67.35%), *Pseudomonas fluorescens* @ 10 g/L (57.40%), *Trichoderma* + *Pseudomonas* @ 10 g/L (56.08%), M Guard 45 (Mancozeb) @ 0.2% (52.51%), Bavistin (Carbendazim) @ 0.10% (42.22%),

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Bavistin (Carbendazim) @ 0.05% (39.71%) and Control (67.35%). All the bioagents and fungicides tested against *Cercospora* leaf spot on per cent disease index and disease reduction in field conditions. The efficacy of bio-agents and fungicides as foliar spray were evaluated in field condition to find out the effectiveness of all treatments at 30 and 45 days of sowing.

Keywords: Cercospora leaf spot; bioagents and fungicides; Urdbean and management.

1. INTRODUCTION

The Mungbean sometimes called the green gram or mudga in Sanskrit, is a plant species in the legume family. Its scientific name is *Vigna radiata* L., R. Wilczek. One species that was recently removed from the genus Phaseolus to Vigna is the Mungbean. East Asia, Southeast Asia, and the Indian Subcontinent are where the Mungbean is primarily grown. Both savory and sweet meals can be used as ingredients (Dubey and Singh 2010; Khan et al., 2005, Uddin et al., 2013; Abbas et al., 2020, Tan et al., 2023).

The world's greatest producer of Mungbean, India, accounts for more than half of global production but consumes almost all of it. Mungbean production is concentrated in Asia (90%); India is the region's top producer. Mungbean accounts for 19% of China's total production of legumes, and the country produces a lot of them. Mungbean cultivation spanned 43.0 lakh ha in Uttar Pradesh, producing 28.2 million tons at a yield of 671 kg/ha (Anonymous 2022).

Due to its high nutritional value, simple digestion, and adaptability to various farming methods, Mungbean is widely used. In addition to Asia (India, South East Asia, and East Asia), southern Europe and the Southern United States all use this important edible legume seed. It also contains 26% protein, 51% carbohydrate, 4% minerals and 3% vitamins. (Khan,1981).

Some sources are resistant to the Mungbean disease *Cercospora* leaf spot; however, they are unstable. Currently, *Cercospora* leaf spot is controlled by treating the soil and seeds with fungicide. Fungicides, however, are more effective (Prasad et al., 2024; Basavarajappa et al., 2023; Kapadiya, 1999). Numerous biocontrol agents have been shown to have antifungal properties (Raghuvanshi et al., 2024; Narzary et al., 2024, Tiwari et al., 2021).

Cercospora leaf spot was first known to occur in Delhi, India (Munjal et al., 1960) and is prevalent in all parts of the humid tropical areas of India, Bangladesh, Indonesia, Malaysia, Philippines, Taiwan as well as Thailand. It becomes severe in the wet season causing 0.0 % to 100.0 per cent yield loss (Amin and Singh, 1987; Iqbal *et al*., 1995). The present study was conducted to evaluate the efficacy of fungicides against *Cercospora* leaf spot disease for effective management.

2. MATERIALS AND METHODS

A field experiment was conducted to evaluate the efficacy of different bioagents and fungicides against the *Cercospora* leaf spot disease of Mungbean under field conditions at Rainfed Organic Agriculture Research Farm Narayan Bagh, Institute of Agricultural Science, Bundelkhand University, Jhansi (UP). Urdbean variety HD1382was sown and trials were laid out in a randomized block design with 9 treatments and 3 replications. Recommended agronomic practices were followed for raising the crop. The total number of plants was recorded at the time of thinning i.e., fifteen days after sowing, while the number of green leaf spot-infected plants was recorded at 30 and 45 days after sowing and then the green leaf spot incidence per cent was calculated with the help of the following formula:

$$\text{Per cent disease incidence} = \frac{\text{Number of infected plants}}{\text{Total number of plants}} \times 100$$

$$\text{Per cent disease control} = \frac{C-T}{C} \times 100$$

Where,

I = Per cent inhibition of fungal growth.
C = Per cent disease incidence of control plots
T = Per cent disease incidence in treated plots

3. RESULTS AND DISCUSSION

All the bioagents and fungicides tested against *Cercospora* leaf spot on per cent disease index and disease reduction in field conditions. The efficacy of bio-agents and fungicides as foliar spray were evaluated in field condition to find out the effectiveness of all treatments at 30 and 45 days of sowing.

Table 1. Effects of bioagent and fungicides against *Cercospora* leaf spot on per cent disease index and disease reduction under field condition at 30 and 45 days after sowing

Symbol	Treatment	Dose	30 Days		45 Days	
			PDI	PDC	PDI	PDC
T_1	*Trichoderma harzianum*1 % WP	10 g/L	23.10	66.86	25.60	67.35
T_2	*Pseudomonas fluorescens* 1 % WP	10 g/L	28.25	59.47	33.40	57.4
T_3	*Trichoderma + Pseudomonas*	10 g/L	30.40	56.38	34.43	56.08
T_4	Mancozeb 75 % WP (M Guard 45)	0.20%	31.20	55.24	37.23	52.51
T_5	Carbendazim 50 % WP (Bavistin)	0.10%	41.10	41.03	45.30	42.22
T_6	Carbendazim 50 % WP (Bavistin)	0.05%	43.30	37.88	47.27	39.71
T_7	Thiophanate methyl (Roko)	0.05%	12.70	81.78	15.30	80.48
T_8	Chlorothalonil 75 % WP (Kavach)	0.01%	14.40	79.34	19.00	67.35
T_9	Control	-	69.70	-	78.40	-
	S. Em±		**0.02**		**0.05**	
	CD		**0.07**		**0.15**	

Figure given in parenthesis are transformed value
**PDI= Percent disease incidence, *PDC= Percent disease control*

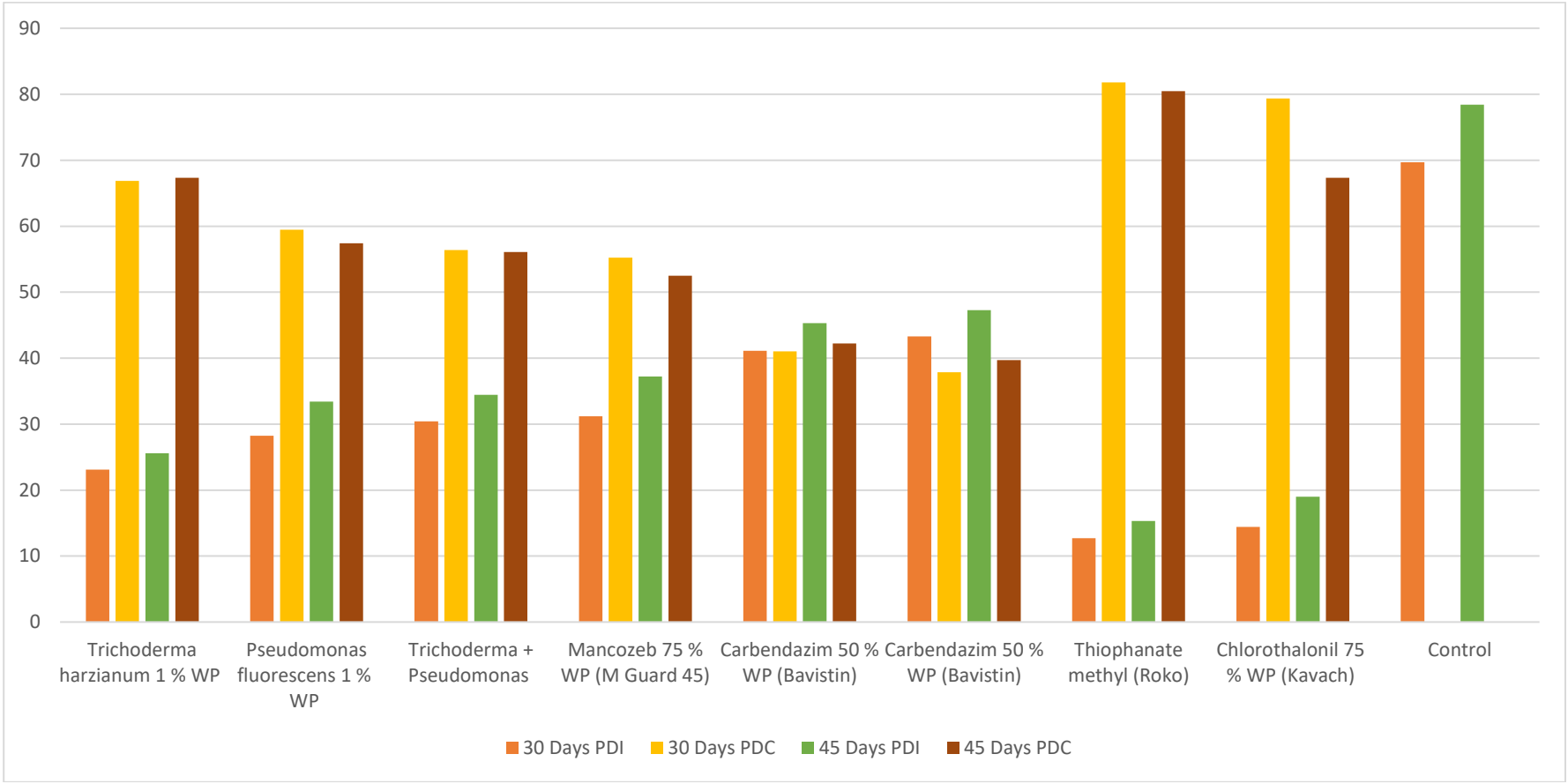

Fig. 1. Effects of bioagent and fungicides against *Cercospora* leaf spot on per cent disease index and disease reduction under field condition at 30 and 45 days after sowing

3.1 At 30 Days after Sowing

Per cent Disease index: The result indicated that the minimum disease index was found in Roko (Thiophanate methyl) @ 0.05% (12.70%), followed by Kavach (Chlorothalonil) @ 0.01% (14.40%), *Trichoderma harzianum* @ 10 g/L (23.10%), *Pseudomonas fluorescens* @ 10 g/L(28.25%), *Trichoderma* + *Pseudomonas* @ 10 g/L (30.40%), M Guard 45 (Mancozeb) @0.2% (31.20%), Bavistin (Carbendazim) @ 0.10% (41.10%), Bavistin (Carbendazim) @ 0.05% (43.30%) and Control (69.70%). Roko (thiophanate methyl) @ 0.05%, Kavach (chlorothalonil) @ 0.01%, *Trichoderma harzianum* @ 10 g/L, *Pseudomonas fluorescens* @ 10 g/L, *Trichoderma* + *Pseudomonas* @ 10 g/L, M Guard 45 (Mancozeb) @ 0.2%, Bavistin (Carbendazim) @ 0.10%, and Bavistin (Carbendazim) @ 0.05% were found at par with each other (Table 1).

3.2 Disease Reduction

The results indicated that maximum disease control was found in Roko (Thiophanate methyl) @ 0.05% (81.78%), followed by Kavach (Chlorothalonil) @ 0.01% (79.34%), *Trichoderma harzianum* @ 10 g/L (66.86%), *Pseudomonas fluorescens* @ 10 g/L(59.47%), *Trichoderma* + *Pseudomonas* @ 10 g/L (56.38%), M Guard 45 (Mancozeb) @ 0.2% (55.24%), Bavistin (Carbendazim) @ 0.10% (41.03%), Bavistin (Carbendazim) @ 0.05% (37.88%) and Control (69.70%). Roko (thiophanate methyl) @ 0.05%, Kavach (chlorothalonil) @ 0.01%, *Trichoderma harzianum* @ 10 g/L, *Pseudomonas fluorescens* @ 10 g/L, *Trichoderma* + *Pseudomonas* @ 10 g/L, M Guard 45 (Mancozeb) @ 0.2%, Bavistin (Carbendazim) @ 0.10%, and Bavistin (Carbendazim) @ 0.05% were found at par with each other (Table 1).

3.3 At 45 Days after Sowing

Disease incidence: The result indicated that the minimum disease index was found in Roko (Thiophanate methyl) @ 0.05% (15.30%), followed by Kavach (Chlorothalonil) @ 0.01% (19.00%), *Trichoderma harzianum* @ 10 g/L (25.6%), *Pseudomonas fluorescens* @ 10 g/L (33.60%), *Trichoderma* + *Pseudomonas* @ 10 g/L (34.43%), M Guard 45 (Mancozeb) @ 0.2% (37.23%), Bavistin (Carbendazim) @ 0.10% (45.30%), Bavistin (Carbendazim) @ 0.05% (47.27%) and Control (78.40%). Roko (thiophanate methyl) @ 0.05%, Kavach (chlorothalonil) @ 0.01%, *Trichoderma harzianum* @ 10 g/L, *Pseudomonas fluorescens* @ 10 g/L, *Trichoderma* + *Pseudomonas* @ 10 g/L, M Guard 45 (Mancozeb) @ 0.2%, Bavistin (Carbendazim) @ 0.10%, and Bavistin (Carbendazim) @ 0.05% were found at par with each other (Table 1).

3.4 Disease Reduction

The results indicated that maximum disease control was found in Roko (thiophanate methyl) @ 0.05% (80.48%), followed by Kavach (Chlorothalonil) @ 0.01% (67.35%), *Trichoderma harzianum* @ 10 g/L (67.35%), *Pseudomonas fluorescens* @ 10 g/L (57.40%), *Trichoderma* + *Pseudomonas* @ 10 g/L (56.08%), M Guard 45 (Mancozeb) @ 0.2% (52.51%), Bavistin (Carbendazim) @ 0.10% (42.22%), Bavistin (Carbendazim) @ 0.05% (39.71%) and Control (67.35%). Roko (thiophanate methyl) @ 0.05%, Kavach (chlorothalonil) @ 0.01%, *Trichoderma harzianum* @ 10 g/L, *Pseudomonas fluorescens* @ 10 g/L, *Trichoderma* + *Pseudomonas* @ 10 g/L, M Guard 45 (Mancozeb) @ 0.2%, Bavistin (Carbendazim) @ 0.10%, and Bavistin (Carbendazim) @ 0.05% were found at par with each other (Table 1).

Several researchers reported the effectiveness of compounds against *Cercospora* leaf spot disease in black gram and green gram (Khunti et al., 2005; Kavyashree et al., 2017; Tiawri Smita et al., 2021). Kavyashree et al. (2017) evaluated the efficacy of different fungicides against *Cercospora* leaf spot infecting Mungbean.

4. CONCLUSION

Some sources are resistant to the Mungbean disease *Cercospora* leaf spot; however, they are unstable. Currently, *Cercospora* leaf spot is controlled by treating the soil and seeds with fungicide. Fungicides, however, are more effective. Numerous biocontrol agents have been shown to have antifungal properties.

DISCLAIMER (ARTIFICIAL INTELLIGENCE)

Author(s) hereby declare 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 this manuscript.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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