

“An Assessment on the Efficacy of Different Fungicides against Powdery Mildew of *Vigna radiata* L. (Mung Bean) under Field Condition”

ABSTRACT

The present study was conducted during consecutive *Kharif* season 2024-25. Using selected fungicides against Powdery mildew caused by *Erysiphe polygoni* DC. To manage the disease an investigation was carried out in the department of Plant Pathology, College of Agriculture, Latur under Vasandrao Naik Marathwada Krishi Vidyapeeth. An experiment was conducted to evaluate the efficacy of eight fungicides (Azoxystrobin 11% + Tebuconazole 18.30% SC @ 0.1 %, Tebuconazole 50% + Trifloxystrobin 25% WG @ 0.05 %, Hexaconazole 5% SC @ 0.1 %, Tebuconazole 25.9% SC @ 0.1 %, Myclobutanil 10% WP @ 0.1 %, Azoxystrobin 23% SC @ 0.1 %, Wettable Sulphur 50% WP @ 0.3 % and Dinocap 48% EC @ 0.2 %) against powdery mildew of mung bean, using a Randomized Block Design (RBD) with three replications. In a field assay, the result showed that among the treatments Tebuconazole 50% + Trifloxystrobin 25% WG @ 0.05 % (PDI 19.61 & PDC 65.52) as foliar spray significantly to be most effective recorded with minimum percent disease intensity and maximum percent disease control on leaves followed by Azoxystrobin 11% + Tebuconazole 18.30% SC @ 0.1 % (PDI 22.10 & PDC 61.30), Azoxystrobin 23% SC @ 0.1 % (PDI 24.17 & PDC 57.56), Hexaconazole 5% SC @ 0.1 % (PDI 27.04 & PDC 52.54), Tebuconazole 25.9% SC @ 0.1 % (PDI 29.27 & PDC 48.47), Dinocap 48% EC @ 0.2 % (PDI 32.03 & PDC 43.80) and Wettable Sulphur 50% WP @ 0.3 % (PDI 34.90 & PDC 38.59), respectively. While Myclobutanil 10% WP @ 0.1 % (PDI 39.85 & PDC 30.39) as foliar spray significantly to be least effective recorded with maximum percent disease intensity and minimum percent disease control. The experiment revealed that, among the treatments Tebuconazole 50% + Trifloxystrobin 25% WG @ 0.05 % (14.45 qt/ha), significantly recorded maximum yield (qt/ha) followed by Azoxystrobin 11% + Tebuconazole 18.30% SC @ 0.1 % (13.59 qt/ha). While Myclobutanil 10% WP @ 0.1 % recorded minimum yield (7.86 qt/ha). Results documented in the (Table 3) showed that, all the treatments recorded overall benefits over control. Hexaconazole 5% SC gave highest net benefits with highest ICBR 1:10.88. The second-best treatment was found to be T1: Azoxystrobin 11% + Tebuconazole 18.30% SC with ICBR 1:7.33, followed by treatments T2, T7, T4, T8, T6 and T5 which recorded ICBR as, 1:6.27, 1:5.09, 1:3.50, 1:3.38, 1:2.81 and 1:0.88, respectively over the untreated control.

Keywords: [Mung bean, powdery mildew, *Erysiphe polygoni*, fungicides, yield, (ICBR) Incremental Cost Benefit Ratio]

1. INTRODUCTION

Mung bean (*Vigna radiata* (L.) Wilczek) belongs to the *Leguminosae* family is a vital pulse crop predominantly cultivated in Asia, especially in India. It is originated from India and Central Asia. Among the thirteen edible legumes grown in India, mung bean ranks as the third most important pulse crop after chickpea and pigeon pea. It is widely cultivated in tropical and subtropical regions as a short-duration food legume, making it a suitable cash crop between major cropping cycles.

Mung bean serves as a vital source of easily digestible protein in the cereal-based diet of people in India (Singh *et al.*, 2021). Pulses contain twice the amount of protein found in cereals and are a rich source of the essential amino acid lysine, which is deficient in most food grain crops. Mung bean is well known for its high protein content, pleasant flavour, and easy digestibility. It is primarily cultivated for its protein-rich seeds, which are widely used in various culinary applications such as soups, curries, bread, desserts, noodles, salads, and papad through processes like heating, fermenting, milling, or sprouting (Singh *et al.*, 1988). Nutritionally, mung bean seeds contain approximately 20% protein, 55-60% carbohydrates, 1% fat and 3.2% fiber. They are also rich in essential minerals and vitamins, including phosphorus (300-500 mg/100g), iron (7-10 mg/100g), vitamin C (10-15 mg/100g), calcium (69-75 mg/100g) and vitamin A (430-489 IU) (Singh *et al.*, 2015). In addition to their nutritional value, pulses play a crucial role in maintaining soil fertility by fixing nitrogen and contributing organic matter to the soil (Islam *et al.*, 2008). Additionally, mung bean farming is economically viable, as it requires lower investment, water and energy compared to many other crops (Shanmugasundaram *et al.*, 2004).

India contributes more than 70% world's mung bean production. Mung bean was cultivated over 35.58 lakh hectare in India during 2024-25. (Anonymous, 2024). Mung bean is susceptible to various diseases caused by fungi, bacteria, viruses, nematodes and abiotic stresses (Khaire *et al.*, 2018). Several fungal diseases affect mung bean, including powdery mildew (*Erysiphe polygoni* DC), Cercospora leaf spot (*Cercospora canescens*, *C. cruenta*), root disease complex (*Pythium spp.*, *Macrophomina phaseolina*, *Fusarium spp.*), Anthracnose (*Colletotrichum lindemuthianum*) and Bacterial leaf blight caused (*Xanthomonas phaseoli*). Among these diseases, powdery mildew (PM), caused by the obligate biotrophic fungus *Erysiphe polygoni* DC, is considered one of the most destructive diseases affecting mung bean. This fungus is ectoparasitic, extracting nutrients from the host plant through specialized structures called haustoria. The fungus produces oidia/conidia in chains, which are ovate, hyaline and thin-walled, measuring approximately 20-25 × 10-15 µm (Salmon, 1900).

Powdery mildew (PM) affects all green, aerial parts of the mung bean plant, including leaves, stems, branches, pods and flowers. The disease typically begins on the older leaves, particularly at the collar region of the plant. Initially, small, scattered, circular or irregular white powdery spots appear on the upper surface of the leaves. Under favourable conditions, the white powdery growth of the fungus expands, coalescing to cover the entire leaf surface and spreading to the lower surface. Plants heavily infested with PM display a talcum powder-like appearance, with small, pale-yellow leaves. As the disease progresses, the plants become stunted and fail to grow properly. Hence experiment to find out effective fungicides against *powdery mildew* was conducted under field condition.

2. MATERIAL AND METHODS

The field experiment was conducted at Experimental Field of Department of Plant Pathology, College of Agriculture, Latur during the *Kharif* season 2024-25, The trial was laid in Randomized Block Design (RBD) with nine treatments including untreated control and each replicated thrice. Mung bean crop variety JL-781 was sown in second week of July with spacing of 30 cm and 10 cm between rows and plants, adopted in plot size 3×3m², respectively. Generally powdery mildew disease appeared at 35-40 days *after* sowing. Observations on powdery mildew disease intensity were recorded on randomly selected five plants of upper, middle and lower leaves from per plot. The powdery mildew was graded on the basis of disease intensity observed on leaves by applying 0-5 disease rating scale developed by Mayee and Datar (1986) as described in (Table.2).

Table 1: List of fungicides.

Tr. No.	Treatments	Tr. No.	Treatments
T ₁	Azoxystrobin 11% + Tebuconazole 18.30% SC	T ₆	Azoxystrobin 23% SC
T ₂	Tebuconazole 50% + Trifloxystrobin 25% WG	T ₇	Wettable Sulphur 50% WP
T ₃	Hexaconazole 5% SC	T ₈	Dinocap 48% EC
T ₄	Tebuconazole 25.9% SC	T ₉	Control (Untreated)
T ₅	Myclobutanil 10% WP		

Table 2: Disease Rating Scale.

Disease Scale	Per cent Leaf area coverage	Description
0	0	Plants free from infection
1	1-10	Plant showing traces up to 10 % infection on leaves, stem free from infection
2	10.1-25	Slight infection with thin coating of powdery growth on leaves covering 10.1-25 % leaf area, slight infection on stem, pods usually free
3	25.1-50	Dense powdery coating covering 25.1 to 50 % leaf area, moderate infection on stems, slight infection on pods
4	50.1-75	Dense powdery coating covering 50.1 to 75 % leaf area, stem heavily and pods moderately infected. Infected portion turns greyish
5	>75	Severe infection with dense powdery growth, covering more than 75 % area of the whole plant including pods, plants resulting in premature defoliation and drying

The disease severity of powdery mildew was recorded before first spray, ten days after first spray and ten days after second and third spray using 0-5 rating scale and per cent disease index (PDI) was calculated using the formula given by wheeler (1969).

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

Where,

PDI = Percent Disease Intensity

Yield

The yield data from all the pickings of mature pods during the experimentation were measured. The grain yield per treatment per replication was calculated, and the final marketable grain yield was expressed on a qt/ha basis. The percent increase in yield over control was determined using the following formula, Panse and Sukhatme (1978).

$$\text{Yield increase over control (\%)} = \frac{\text{Yield in treatment plot} - \text{Yield in control plot}}{\text{Yield in control plot}} \times 100$$

Statistical Analysis

The data were analysed statistically using Randomized Block Design (RBD). Data recorded in percentage were first transformed to arcsine values before analysis and the treatment was compared to means of critical differences at 5 per cent level of significance, as per the procedure given by Panse and Sukhatme (1978).

3. Result and Discussion

The results and discussion of the experiment conducted on various aspects of powdery mildew of mung bean caused by *Erysiphe polygoni* D.C. with reference to evaluation of disease intensity (%) on leaves and seed yield (q/ha) affected by fungicides are presented here under.

In present study, the results of the field experiment presented in (Table.3) clearly indicate that the disease intensity was significantly low in all the treated plots compared to the unsprayed control plot after three sprays. Disease intensity was recorded four times before spray.

Thus, from the mean PDI data (Table.3) it was found that all the treatments recorded the minimum mildew intensity over unsprayed control. However, Tebuconazole 50% + Trifloxystrobin 25% WG @ 0.05 % was found to be most effective with lowest mean PDI of 19.61%. The second and third best fungicides were Azoxystrobin 11% + Tebuconazole 18.30%

SC @ 0.1% and Azoxystrobin 23% SC @ 0.1% which recorded comparatively minimum disease intensity of 22.10 and 24.17 %, respectively. Another fungicides in the order of merit found effective were Hexaconazole 5% SC @ 0.1% (27.04 PDI), Tebuconazole 25.9% SC @ 0.1% (29.27 PDI). Dinocap 48% EC, Wettable sulphur 50% WP and Myclobutanil 10% WP also recorded mean PDI of 32.03, 34.90 and 39.85, respectively over unsprayed control (57.73 PDI).

Mean per cent disease control (PDC) data shows that maximum per cent disease control was achieved with Tebuconazole 50% + Trifloxystrobin 25% WG @ 0.05 % (65.52 %) followed by Azoxystrobin 11% + Tebuconazole 18.30% SC @ 0.1% (61.30 %), Azoxystrobin 23% SC @ 0.1% (57.56 %), Hexaconazole 5% SC @ 0.1% (52.44 %), Tebuconazole 25.9% SC @ 0.1% (48.47 %), Dinocap 48% EC @ 0.2% (43.80 %), Wettable sulphur 50% WP @ 0.3% (38.59 %) and Myclobutanil 10% WP @ 0.1 % (30.39 %).

The results presented in (Table.3) indicated that all the treatments effectively controlled the mildew intensity, significantly reduced over unsprayed control and increased the grain yield over unsprayed control. The grain yield in respect of all treatment ranged from 8.91 to 14.45 qt/ha as against 7.86 qt/ha in unsprayed control plots. Highest grain yield (14.45 qt/ha) was recorded with Tebuconazole 50% + Trifloxystrobin 25% WG @ 0.05 %. The second best, Azoxystrobin 11% + Tebuconazole 18.30% SC @ 0.1% recorded grain yield up to 13.59 qt/ha. This was followed by Azoxystrobin 23% SC @ 0.1% (12.86 qt/ha), Hexaconazole 5% SC @ 0.1 % (12.19 qt/ha), Tebuconazole 25.9% SC @ 0.1% (11.33 qt/ha). Dinocap 48% EC @ 0.2%, Wettable sulphur 50% WP @ 0.3 % and Myclobutanil 10% WP @ 0.1 % also recorded significantly maximum yield of 10.67 qt/ha, 9.72 qt/ha and 8.91 qt/ha, respectively over unsprayed control (7.86 qt/ha).

All the treatments were found effective in recording per cent increased grain yield over unsprayed control (Table.3). The per cent increase in grain yield ranged from 13.35% to 83.99%. However, significant and maximum increased in grain yield (83.99 %) was recorded with Tebuconazole 50% + Trifloxystrobin 25% WG @ 0.05 %. This was followed by Azoxystrobin 11% + Tebuconazole 18.30% SC @ 0.1% (72.93 %), Azoxystrobin 23% SC @ 0.1% (63.60 %), Hexaconazole 5% SC @ 0.1 % (55.13 %), Tebuconazole 25.9% SC @ 0.1% (44.19 %). Dinocap 48% EC @ 0.2% (35.75 %), Wettable sulphur 50% WP @ 0.3 % (23.69%) and Myclobutanil 10% WP @ 0.1 % (13.35%) also recorded significant increase in the grain yield over unsprayed control. However, least increase in grain yield (13.35 %) was recorded with Myclobutanil 10% WP @ 0.1 %.

Earlier reports also supported the current findings like Khunti *et al.* (2002) who also tested 10 fungicides for controlling powdery mildew in mung bean and found effectiveness of Contaf (0.05%), Calixin (0.04%), Karathane (0.024%), Carbendazim (0.025%), and Sulfex (0.02%). Suryawanshi *et al.* (2009) recorded the lowest mean disease intensity (15.14%) and the highest grain yield (1425 kg/ha) and test weight (58.00 g) with treatment of Karathane 48 % EC, when spray at 0.1 %. Dinesh *et al.* (2011) assessed fungicide efficacy in field trials and found that two sprays of Difenconazole at 0.05% and Propiconazole at 0.1% were the most effective treatments, resulting in the lowest disease index and higher seed yield.

Results documented in the (Table.3) showed that, all the treatments recorded overall benefits over control. Hexaconazole 5% SC gave highest net benefits with highest ICBR 1:10.88. The second-best treatment was found to be T1: Azoxystrobin 11% + Tebuconazole 18.30% SC with ICBR 1:7.33, followed by treatments T2, T7, T4, T8, T6 and T5 which recorded ICBR as, 1:6.27, 1:5.09, 1:3.50, 1:3.38, 1:2.81 and 1:0.88, respectively over the untreated control.

Earlier reports in respect of economics of fungicide in management of powdery mildew of mung bean and urd bean given by several workers like the Das and Narain (1990) who evaluated several fungicides, including Karathane, Bavistin, Topsin-M, Carbendazim and Wettable sulphur, against mung bean powdery mildew and reported that spraying 0.4% Wettable sulphur (Sulfex) was the most effective, providing the highest cost-benefit ratio of 3:3 for disease control. Suryawanshi *et al.* (2009) calculated the cost-benefit ratio of various treatments used in management of powdery mildew of mung bean and showed that tested treatments were economically viable, with Sulfex being the most cost-effective, yielding a C:B ratio of 1:21.11, followed by botanical NSKE (1:12.76), Contaf (1:7.83), plain water (1:7.61) and Calixin (1:7.28).

Table .3: Effect of foliar sprays of fungicides on powdery mildew intensity and yield of mung bean during *Kharif*, 2024.

Tr. No.	Treatments	Conc. (%)	After third spray		Yield (Qt/ha)	Percent increase yield over control	ICBR
			Mean PDI	Mean PDC			
T ₁	Azoxystrobin 11% + Tebuconazole 18.30% SC (@ 0.1 %)	0.1	22.10*	61.30	13.59	5.73	1:7.33
T ₂	Tebuconazole 50% + Trifloxystrobin 25% WG (@ 0.05 %)	0.05	19.61	65.52	14.45	6.59	1:6.27
T ₃	Hexaconazole 5% SC (@ 0.1 %)	0.1	27.04	52.44	12.19	4.33	1:10.88
T ₄	Tebuconazole 25.9% SC (@ 0.1 %)	0.1	29.27	48.47	11.33	3.47	1:3.50
T ₅	Myclobutanil 10% WP (@ 0.1 %)	0.1	39.85	30.39	8.91	1.05	1:0.88
T ₆	Azoxystrobin 23% SC (@0.1 %)	0.1	24.17	57.56	12.86	5.00	1:2.81
T ₇	Wettable Sulphur 50% WP (@ 0.3 %)	0.3	34.90	38.59	9.72	1.86	1:5.09
T ₈	Dinocap 48% EC (@ 0.2 %)	0.2	32.03	43.80	10.67	2.81	1:3.38
T ₉	Control (Untreated)	-	57.73	-	7.86	-	-
	S.E.±	-	0.60	-	1.05	-	-
	C.D. at 5 %	-	1.81	-	3.12	-	-

*: Mean of three replications

4. CONCLUSION

The results of the conducted experiment documented that, The Foliar spraying of Tebuconazole 50% + Trifloxystrobin 25% WG (@ 0.05 %), Azoxystrobin 11% + Tebuconazole 18.30% SC (@ 0.1 %) and Azoxystrobin 23% SC (@ 0.1 %) were the most effective in reducing disease severity with highest yield as compare to control. However maximum ICBR was recorded in Hexaconazole.

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