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Evaluating The Efficacy of Bavistin Against *Rhizoctonia* sp., *Helminthosporium* sp., & *Alternaria* sp.

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Abstract

This study assesses the fungicidal efficacy of Bavistin (Carbendazim 50% WP) against three significant pathogens—*Rhizoctonia* sp., *Helminthosporium* sp., and *Alternaria* sp.—via the poison food method. Depending on the concentration, Bavistin inhibited fungal growth in varying degrees, with LD_{50} values determined as 68 ppm, 648 ppm, and 71 ppm respectively. These findings underscore the potential of Bavistin as a cost-effective, targeted solution to fungal infestations, offering economic and ecological benefits for Indian farmers, particularly in West Bengal. Optimizing dosage can address resistance and environmental impact concerns while enhancing crop yield.

Keywords: Bavistin, *Rhizoctonia*, *Helminthosporium*, *Alternaria*, Poison Food Method

INTRODUCTION

Fungal diseases are a major challenge in agriculture, causing significant crop losses worldwide. In India, pathogens such as *Rhizoctonia sp.* (Boerema & Hamers, 1988), *Helminthosporium sp.* (Thuy *et al.,* 2023), and *Alternaria sp.* (Simmons, 2000) affect essential crops like rice, wheat, and vegetables, critical for food security and the economy, especially in regions like West Bengal. The chemical fungicide Bavistin, a carbendazim-based formulation, has been widely used to mitigate fungal infections (Kumar & Reddy, 2021). However, unregulated usage often leads to resistance, environmental concerns, and financial strain on farmers. This study employs the poison food technique (Nene & Thapliyal, 1979) to quantify Bavistin's efficacy and establish optimal dosages for effective pathogen control.

MATERIALS AND METHODS

Experimental Setup

- **Pathogens Tested**: Cultures of *Rhizoctonia sp.*, *Helminthosporium sp.*, and *Alternaria sp.* (7 days old).
- **Fungicide**: Bavistin (Carbendazim 50% WP) at varying concentrations.

- **Media Preparation**: The Potato Dextrose Agar (PDA) medium was prepared using boiled potato extract, dextrose, and agar-agar powder.
- **Concentrations**: Working solutions of Bavistin were prepared at 50, 100, 250, 500, and 1000 ppm, alongside a control group with no fungicide.

Poison Food Method

1. Sterile PDA media were infused with respective fungicide concentrations.
2. Mycelial discs (6 mm diameter) were placed at the centre of PDA plates.
3. Plates were incubated at 25 ± 1°C for three days in a controlled environment.
4. Radial mycelial growth was measured, and percentage inhibition was calculated using the formula:

$$Percent\ Growth\ Inhibition(\%) = \frac{Diameter\ in\ Control - Diameter\ in\ Treatment}{Diameter\ in\ Control} \times 100$$

LD_{50} Determination

The LD_{50} value for each pathogen was graphically estimated by plotting inhibition percentages against fungicide concentrations. The value corresponds to the concentration inhibiting 50% growth (Nene & Thapliyal, 1979).

CALCULATION

Dose (in ppm)	Diameter of Different Mycelial Growth (in cm)			Percentage Inhibition in Fungal Mycelia (%)		
	***Rhizoctonia* sp.**	***Helminthosporium* sp.**	***Alternaria* sp.**	***Rhizoctonia* sp.**	***Helminthosporium* sp.**	***Alternaria* sp.**
Control	**4.2**	**2.5**	**9**	**0**	**0**	**0**
50	2.8	2.4	5.9	≈ 33.33	≈ 4	≈ 34.44
100	1.5	2.3	3.7	≈ 64.28	≈ 8	≈ 58.89
250	1.4	2	3.6	≈ 66.67	≈ 20	≈ 60
500	1.3	1.4	2.9	≈ 69.05	≈ 44	≈ 67.78
1000	1	1	2.7	≈ 76.19	≈ 60	≈ 70

Table 1: *Tabulation of the Observed Mycelial Growth Rate of three pathogens and per cent inhibition calculations (As per the aforesaid formula) at different doses of Bavistin application.*

COMPUTATION

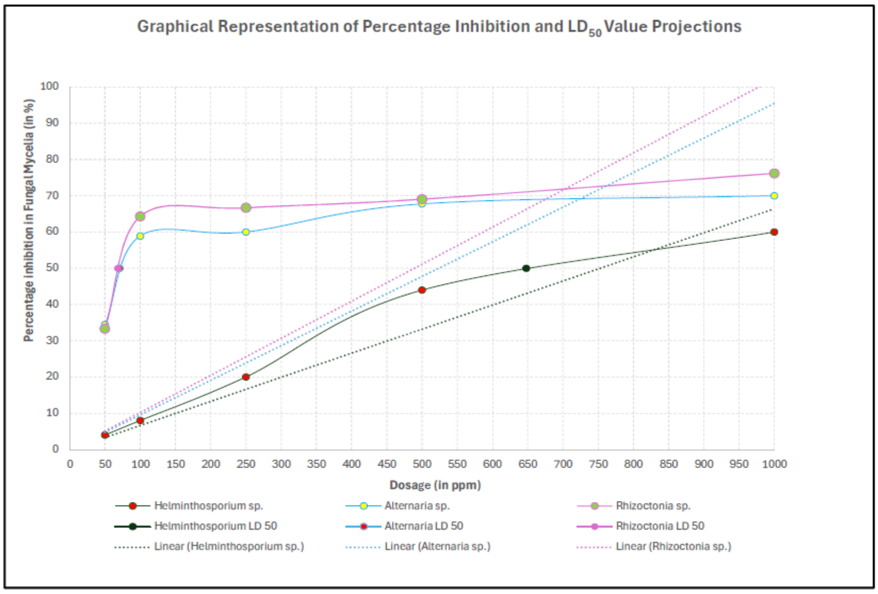

Figure 1: *Graphical computation of the data calculated in Table 1 via MS Excel 365/Microsoft 365 and observation of the LD_{50} Values for each pathogen.*

Name of the pathogen	Ordinate (y-coordinate)	Axis (x-coordinate/LD_{50} Values)
***Rhizoctonia* sp.**	50	**≈ 68**
***Helminthosporium* sp.**	50	**≈ 648**
***Alternaria* sp.**	50	**≈ 71**

Table 2*: Computation of the LD_{50} values for all the pathogens observed from* ***Figure 1****.*

RESULTS AND DISCUSSION

Growth Inhibition Trends: *Rhizoctonia sp.* showed increasing inhibition with concentration, reaching 76.19% at 1000 ppm, while *Helminthosporium sp.* was less sensitive, achieving a maximum inhibition of 60% at 1000 ppm and *Alternaria sp.* exhibited 70% inhibition at the highest concentration.

LD_{50} Values:

- *Rhizoctonia* sp.: 68 ppm
- *Helminthosporium* sp.: 648 ppm
- *Alternaria* sp.: 71 ppm

Discussion

Bavistin demonstrated high efficacy against *Rhizoctonia sp.* and *Alternaria sp.*, with relatively low LD_{50} values indicating effectiveness at lower concentrations. However, *Helminthosporium sp.* required significantly higher doses for comparable inhibition, suggesting intrinsic resistance mechanisms. This highlights the need for tailored fungicide applications based on pathogen-specific sensitivity to prevent overuse and resistance.

Relevance to West Bengal Agriculture

West Bengal, a region heavily reliant on crops like rice, jute, and vegetables, suffers substantial economic losses due to fungal infections. Using Bavistin at optimal concentrations can Reduce crop losses by targeting specific pathogens and enhance productivity, directly benefiting small-scale farmers (Kumar & Reddy, 2021).

CONCLUSION

This study confirms Bavistin's utility as an effective fungicide for managing *Rhizoctonia sp.*, *Helminthosporium sp.*, and *Alternaria sp.* in controlled settings. Adopting precise application strategies based on LD_{50} values can significantly improve its field efficacy, offering a sustainable solution for combating fungal diseases in Indian agriculture. Further field trials are recommended to validate laboratory findings under real-world conditions.

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