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Evaluation of Bioagents against Myrothecium Roridum, the Causal Agent of Leaf Spot in Sesame (Sesamum Indicum L.)

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ABSTRACT: Sesame (Sesamum indicum L.), an ancient oilseed crop, is widely cultivated for its high nutritional and economic value. However, its productivity is constrained by several diseases, among which leaf spot caused by Myrothecium roridum is of particular concern due to its widespread occurrence and damaging effect on yield and oil quality. In the present investigation, five fungal bioagents (Trichoderma harzianum, T. viride, Gliocladium virens, Aspergillus niger, andPenicillium citrinum) were evaluated against M. roridum through dual culture in vitro and seed treatment under glasshouse conditions. Results revealed that A. niger exhibited the highest inhibition of radial growth in vitro (72.3%), followed by T. harzianum (67.2%) and T. viride (61.5%). In contrast, pot experiments demonstrated that T. harzianum and T. viride were superior in reducing disease incidence, lowering it to 20.0% and 27.5% respectively, compared with 60.0% in the untreated control. The findings indicate the potential of Trichoderma spp. as effective biocontrol agents for the sustainable management of sesame leaf spot. The results are consistent with earlier studies on biocontrol efficacy, while recent advancements in microbial and molecular plant pathology further highlight their role in eco-friendly disease management.

KEYWORDS: Sesame, Myrothecium roridum, biocontrol, Trichoderma, leaf spot, disease management

I. INTRODUCTION

Sesame (Sesamum indicum L.), belonging to the family Pedaliaceae, is one of the oldest oilseed crops cultivated by humanity. It is commonly known as “Til” in India, “Gingelli” as described by Watt (1893), and referred to as “Tile” in ancient Sanskrit literature. The center of origin has been debated: De Candole (1886) reported cultivation beginning in the Euphrates Valley, while Watt (1893) suggested the region spanning southern Afghanistan and upper India. Today, sesame is cultivated in diverse agro-climatic zones across Asia, Africa, and Latin America (Anonymous, 2010; Adorada et al., 2025).

Sesame holds significant importance in the global oilseed economy, contributing nearly 10% of the world’s edible oils and fats (Anonymous, 2010). The seed contains ~50% oil and 18–20% protein, with methionine constituting 3–4%, making it a vital source of nutrition (Budowski& Markley, 1951). Its oil is rich in unsaturated fatty acids such as oleic and linoleic acids, in addition to antioxidants like sesamin and sesamol (Burton, 1976). Beyond nutritional use, sesame oil cake serves as livestock feed and organic manure, while the oil is widely used in medicine and cosmetics.

Despite its economic and nutritional value, sesame productivity is hampered by several fungal and bacterial diseases. Important fungal pathogens include Alternaria sesami, Cercospora sesami, Rhizoctonia bataticola, and Myrothecium roridum, while bacterial diseases such as blight (Xanthomonas sesami) and leaf spot (Pseudomonas sesami) are also prevalent (Singh &Srivastava, 1967; Adorada et al., 2025). Among these, leaf spot caused by M. roridum is particularly destructive, leading to premature defoliation, reduced photosynthesis, yield losses, and inferior oil quality.

Management of sesame leaf spot has traditionally relied on chemical fungicides, but concerns about cost, environmental hazards, and pathogen resistance necessitate eco-friendly alternatives (Farhaoui, 2025). Biocontrol using antagonistic fungi, particularly Trichoderma spp., has emerged as a promising strategy due to their mycoparasitism, competition, and induction of plant defense mechanisms (Wells, 1988; Poddar et al., 2004). Moreover, recent advances

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in plant pathology highlight the integration of biocontrol with molecular diagnostics, microbiome studies, and precision agriculture for sustainable disease management (Kumar et al., 2023; Krishnan et al., 2025; Hailu et al., 2025).

The present study was therefore undertaken with the objective of evaluating selected fungal bioagents against M. roridum under in vitro and in vivo conditions, with an emphasis on their potential use in integrated disease management.

II. MATERIALS AND METHODS

In vitro evaluation of bioagents (dual culture method)

Five bioagents—Trichoderma viride (Kanpur isolate), T. harzianum (Delhi isolate), Gliocladium virens (Pantnagar isolate), Aspergillus niger (Delhi isolate), and Penicillium citrinum (Lucknow isolate)—were tested against M. roridum using the dual culture method (Morton &Strouvel, 1955). Discs (5 mm) from seven-day-old cultures were placed on PDA plates, with the pathogen inoculated 72 h prior to the bioagent. Plates were incubated at 25 ± 1 °C. Percent inhibition of radial growth over control was calculated as.

$$\text{Per cent inhibittion of colony growth over control} = \frac{(\text{Growth of colony in control (mm)}\ \text{Growth of colony (mm)}}{\text{Growth (mm)incontrol}} \times 100$$

In vivo evaluation (pot experiment under glasshouse condition)

Seeds of sesame variety "T-4" were treated with each bioagent (4–6 g/kg seed) and sown in pots containing soil inoculated with M. roridum at 2% (w/w). Each treatment was replicated thrice in a completely randomized design (CRD). Disease incidence was recorded as:

$$\text{Disease incidence}(\%) = \frac{\text{Diseae plants in post}}{\text{Total no. of plant in pots}} \times 100$$

Statistical analysis

Data were subjected to analysis of variance (ANOVA). Significance was determined at the 5% probability level, and disease incidence values were transformed to angular values prior to analysis.

III. RESULTS

The dual culture assay showed that A. niger had the highest in vitro inhibition (72.3%), while T. harzianum (67.2%) and T. viride (61.5%) were also highly effective. However, under glasshouse conditions, T. harzianum (20.%) and T. viride (27.5%) significantly reduced disease incidence compared to the control (60.0%), proving superior to other bio agents. Overall, Trichoderma spp. emerged as the most reliable bio agents for eco-friendly management of sesame leaf spot.

Table1. Percent inhibition of Myrothecium roridum by different bioagents (dual culture method)

S.No.	Treatment	Radial growth (mm)	Inhibition (%)
1.	M. roridum + Aspergillusniger	18 (3.00)	72.3
2.	M.roridum +Trichoderma harzianum	21 (1.00)	67.2
3.	M. roridum + Trichoderma viride	25 (3.00)	61.5

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4.	M. roridum + Penicillium citrinum	28 (2.00)	56.9
5.	M. roridum + Gliocladium virens	31 (1.73)	52.3
	Control	65 (5.00)	
	CD at 5% level of significance	5.18	

Table2. Effect of bioagents on disease incidence of sesame leaf spot under glass house conditions

Bioagent	Dose (%)	Disease incidence (%)
Trichoderma harzianum	0.6	20.0 (0.71)
Trichoderma viride	0.6	27.5 (1.28)
Penicillium citrinum	0.4	35.0 (1.20)
Gliocladium virens	0.6	42.5 (1.15)
Aspergillus niger	0.4	50.0 (1.14)
Control	—	60.0 (1.75)
CD at 5% level of significance		2.22

Figure1:- Biassay of bio-agents against the pathogen in vitro (dual culture method)

1- Myrothecium roridum + Aspergillus niger
2- Myrothecium roridum + Trichoderma harzianum
3- Myrothecium roridum + Trichoderma virde
4- Myrothecium roridum + Penicillium citrinum
5- Myrothecium roridum + Gliocladium virens
6- Control

IV. DISCUSSION

The present study demonstrated the potential of bio agents in managing sesame leaf spot caused by M.roridum. In vitro, A. niger exhibited the highest inhibition of radial growth (72.3%), corroborating reports of its antagonistic activity against several plant pathogens (Singh et al., 2003). However, under in vivo conditions, T. harzianum and T. viride

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were superior, reducing disease incidence to 20.0% and 27.5%, respectively. These results agree with earlier findings by Poddar et al. (2004) and Wells (1988), who reported effective suppression of soil-borne pathogens by Trichoderma spp.

The differential performance of A. niger between in vitro and in vivo assays suggests that while it exhibits strong antagonism under laboratory conditions, its efficacy in the rhizosphere may be limited compared to Trichoderma, which is better adapted for colonization and competition. Similar observations have been made in studies where Trichoderma species exhibited dual mechanisms of antagonism, including antibiosis, mycoparasitism, and induction of systemic resistance (Howell, 2003).

Recent studies provide further support for integrating bio agents in sesame disease management. Krishnan et al. (2025) showed that microbiome shifts in sesame phyllody-infected plants may alter pathogen interactions, emphasizing the need for beneficial microbes. Hailu et al. (2025) demonstrated the use of artificial intelligence in disease detection, suggesting future prospects for integrating diagnostics with biocontrol. Farhaoui (2025) highlighted the devastating impact of Fusarium wilt in sesame, further underscoring the role of biological strategies in minimizing reliance on chemicals.

Taken together, the results affirm that Trichoderma spp. are among the most reliable biocontrol agents for managing sesame leaf spot, aligning with global efforts to promote environmentally safe and sustainable disease management practices.

V. CONCLUSION

The study established that bioagents, particularly Trichoderma harzianum and T.viride, are effective in reducing leaf spot incidence caused by M. roridum in sesame. While A.niger was highly effective under in vitro conditions, Trichoderma species performed better under pot experiments. Integration of such bioagents into disease management strategies offers a promising eco-friendly approach for sesame cultivation. Future studies combining microbial biocontrol with molecular diagnostics and precision agriculture tools may further enhance disease suppression and crop sustainability

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