  UGC CARE Listed (Group -I) Journal Volume 11, Iss 12, 2022

Comparative Study of Fungal Infections in Untreated and Treated Seeds of *Lablab purpureus*

Veena M R.,[1] Prathibha. K. Y.,[*2] Sunaina N.,[3a] Sinchana S.,[3b] Marhoob Banu.,*[3c]

[1] HOD, Assistant Professor, Department of Biotechnology, Government Arts and Science College, Karwar, Karnataka, India, 581301

[2] Professor, Department of Botany, Maharani Cluster University, Palace Road, Bengaluru, Karnataka, India, 560001

[3a, 3b, 3c] Research Scholars, Department of Botany, Maharani Cluster University, Palace Road, Bengaluru, Karnataka, India, 560001

***Corresponding authors: Prathibha K Y and Marhoob Banu**

Email: kyprathibha3@gmail.com, marhoobbanu@gmail.com

Abstract

Fungal infections in agricultural seeds can significantly impact crop yield and quality. *Lablab purpureus* is an essential leguminous crop known for its nutritional value and versatility in various agroecological zones. This research paper aims to investigate the prevalence and severity of fungal infections in untreated and treated seeds of *Lablab purpureus*, exploring the effectiveness of seed treatments in mitigating fungal diseases. The study employed a comprehensive analysis of fungal species diversity, pathogenicity assessment, and seed germination rates between untreated and treated seeds. Seeds treated with captan fungicide were compared with untreated control seeds to assess their efficacy in reducing fungal infections. The findings of this research will aid in devising better strategies for seed treatment and disease management in *Lablab purpureus* cultivation, thus ensuring enhanced agricultural productivity.

Keywords: *Lablab purpureus*, fungal infections, seed treatment, fungicides, disease management, crop yield, seed germination.

Introduction

Fungal infections pose significant threats to agricultural crops, leading to substantial losses in yield and economic repercussions. These infections are caused by various fungal pathogens that thrive in favorable environmental conditions, including humidity and temperature. Crop losses due to fungal infections result from several factors. First, the pathogens can infect various plant parts, such as leaves, stems, and fruits, compromising their ability to photosynthesize, transport nutrients, and produce viable seeds. This reduction in crop productivity directly affects farmers' income and food availability. Secondly, fungal infections can lead to post-harvest losses during storage and transportation, affecting the quality and market value of crops. Contaminated produce becomes unsuitable for consumption, leading to food waste and financial losses for both farmers and consumers. Furthermore, the widespread use of monoculture practices and lack of crop rotation contribute to increased susceptibility to fungal infections. As the same crop is cultivated year after year, the buildup of pathogens in the soil intensifies, making crops more

ISSN PRINT 2319 1775 Online 2320 7876
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vulnerable to diseases. To manage these infections, farmers employ various strategies, including chemical fungicides, resistant crop varieties, and cultural practices. However, excessive use of fungicides can lead to environmental pollution and the development of resistant fungal strains, necessitating a more sustainable and integrated approach to disease management in agriculture. Implementing proper crop rotation, encouraging biodiversity, and promoting disease-resistant crop varieties are crucial steps toward mitigating fungal infection losses and ensuring food security.[1,2,3]

The agar plate method is a widely used technique in microbiology for cultivating and isolating microorganisms. A nutrient-rich agar medium is poured into a sterile petri dish, where it solidifies to create a gel-like surface. Samples of seeds or any plant part is kept on the media for screening the pathogens. The plates are incubated at an appropriate temperature, allowing the microorganisms to grow into visible colonies. Each colony represents a single type of microbe, enabling researchers to study and identify different species. This method is crucial in various applications, including clinical diagnostics, environmental monitoring, and research studies on microbial diversity and behavior.[4]

The standard blotting method is a widely used laboratory technique for studying seed germination and pathogen screening. It involves sterilizing the petriplates followed by adding the 2 to 3 layers of moist blotting paper in it. Then the seeds samples are arranged on the blotters and plates are incubated in controlled conditions.[5,6]

Lablab purpureus, commonly known as lablab bean or hyacinth bean, is a versatile and nutritious legume cultivated worldwide. This annual vine belongs to the Fabaceae family and boasts vibrant flowers, enhancing its ornamental value. Its young pods, leaves, and seeds are edible and rich in protein, fiber, and essential nutrients. Lablab beans play a crucial role in sustainable agriculture due to their ability to fix nitrogen in the soil, enhancing fertility. Additionally, they offer fodder for livestock, contributing to animal nutrition. Furthermore, this drought-tolerant plant serves as a cover crop, preventing soil erosion. Overall, *Lablab purpureus* is a beneficial crop with diverse agricultural and nutritional benefits. *Lablab purpureus* is susceptible to various fungal infections that can significantly impact its growth and yield. Some of the common fungal diseases affecting this legume include anthracnose, powdery mildew, and rust. Anthracnose, caused by the fungus *Colletotrichum lindemuthianum*, is a prevalent disease that causes dark, sunken lesions on leaves, stems, and pods. It can lead to defoliation and premature fruit drop, reducing crop productivity. Powdery mildew, caused by the fungus *Erysiphe polygoni*, appears as a white powdery growth on leaves and can reduce photosynthesis, leading to stunted growth and decreased yield. Rust, caused by the fungus *Uromyces phaseoli typica*, results in orange-brown pustules on leaves and stems, affecting nutrient absorption and causing wilting.[7,8,9,10]

To manage these fungal infections, farmers can implement cultural practices like crop rotation, proper sanitation, and avoiding overhead irrigation. Fungicides can be used as a preventive measure, but care should be taken to follow recommended application guidelines to avoid resistance development. Planting disease-resistant varieties and ensuring proper air circulation around the plants can also reduce the risk of fungal infections. Monitoring the crop regularly for

ISSN PRINT 2319 1775 Online 2320 7876
Research paper UGC CARE Listed (Group -I) Journal Volume 11, Iss 12, 2022

early signs of infection and taking prompt action is essential to mitigate the impact of fungal diseases on *Lablab purpureus* cultivation. In the present study we aimed to study the viability and fungal infections in treated and untreated seeds of Lablab purpureus.

Materials and Methods

Collection of Sample

Untreated and treated seeds of *Lablab purpureus* were collected from Indian Institute of Horticultural Research, Bengaluru, Karnataka, India and packed in the sterile air tight containers and bought to laboratory for the study.

Infections and Viability Testing

Treated seeds were subjected to Standard blotting method and untreated seeds subjected to both agar plate method standard blotting method. Seeds of both the types were surface sterilised with 0.2% sodium hypochlorite followed by rinsing in distilled water and drying in the hood of laminar air flow. After surface sterilisation, the seeds were arranged on the blotting paper and agar plates with the help of sterilised forceps. Agar plates were kept in incubator at 28°C for 48 hours and Standard blotting method plates were also kept in incubator at 28°C for seven days. Drops of water were added to the standard blotting method plates to maintain moisture content. After incubation period the viability and occurrence of fungal infections in both the seeds types were observed and recorded. Fungi were mounted using lactophenol cotton blue method and identified with the help of direct microscopy.

Results

The findings of this study reveal significant insights into the prevalence of fungal infections in *Lablab purpureus* seeds. It helped in determining that seed treatment effectively reduces fungal infections in terms of disease resistance. The comparative study revealed that the incidence of fungal infections was more in untreated seeds as compared to the treated seeds. In Untreated seeds of *Lablab purpureus*, fungal infections of *Aspergillus fumigatus*, *Aspergillus flavus, Aspergillus niger, Aspergillus parasitus*, *Corynespora sp.*, and *Fusarium sp.*, was observed. In treated seeds of *Lablab purpureus*, fungal infections of *Aspergillus flavus*, *Aspergillus niger, Aspergillus parasitus* and *Rhizopus stolonifer* were observed.

Table 1: Infections in untreated seeds of *Lablab purpureus*

Sl.no	No. of seeds in petri plate	No. of seeds infected	No. of seeds not infected	% of infection
1	10	04	06	40%
2	10	07	03	70%
3	10	08	02	80%
4	10	10	00	100%
5	10	06	04	60%

Table 2: Infections in treated seeds of *Lablab purpureus*

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Sl.no	No. of seeds in petri plate	No. of seeds infected	No. of seeds not infected	% of infection
1	10	10	00	100%
2	08	08	00	100%
3	10	10	00	100%
4	10	10	00	100%
5	10	10	00	100%

The viability findings revealed that untreated seeds were more viable as compared to treated seeds.

Table 3: Viability of untreated seeds of *Lablab purpureus*

Sl.no	No. of seeds in petri plate	No. of seeds germinated	No. of seeds not germinated	% of germination
1	10	10	00	100%
2	10	08	02	80%
3	10	10	00	100%
4	10	09	01	90%
5	10	10	00	100%

Table 4: Viability of treated seeds of *Lablab purpureus*

Sl.no	No. of seeds in petriplate	No. of seeds germinated	No. of seeds not germinated	% of germination
1	10	10	00	100%
2	08	06	02	75%
3	10	10	00	100%
4	10	10	00	100%
5	10	08	02	80%

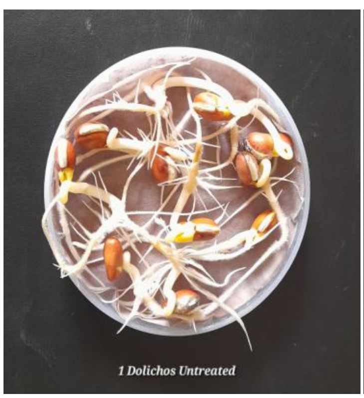

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Figure 1: Infections in utreated seeds of *Lablab purpureus* on SBM

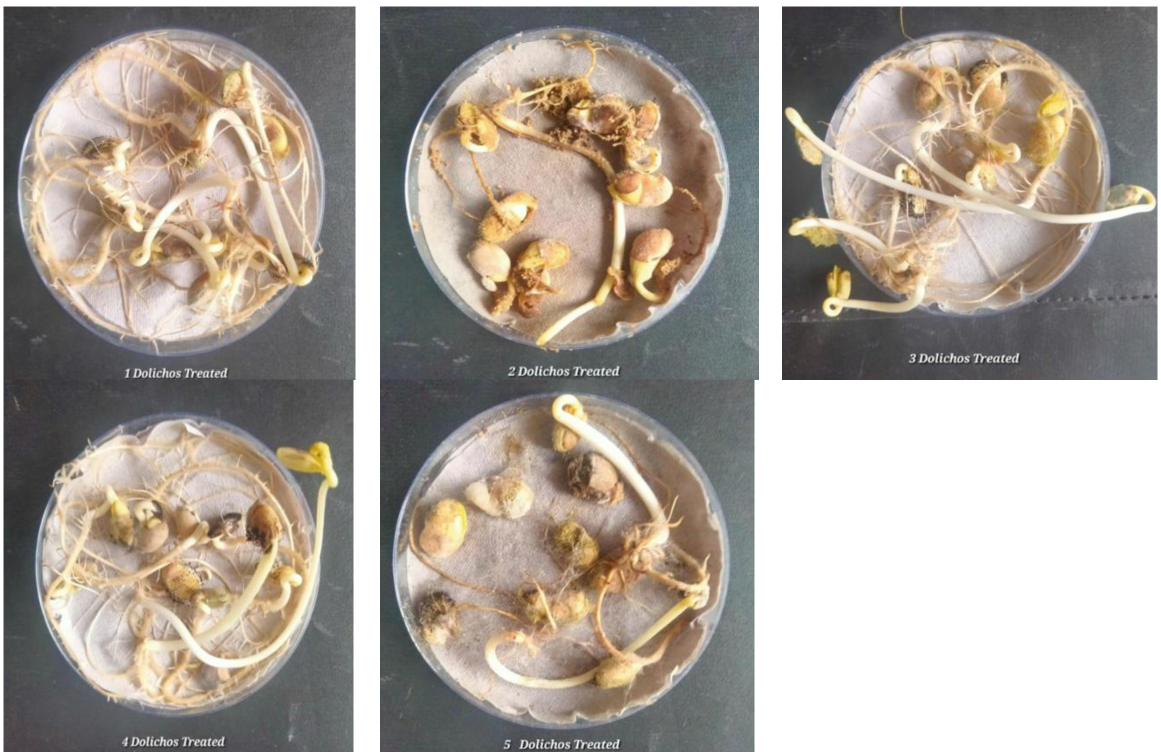
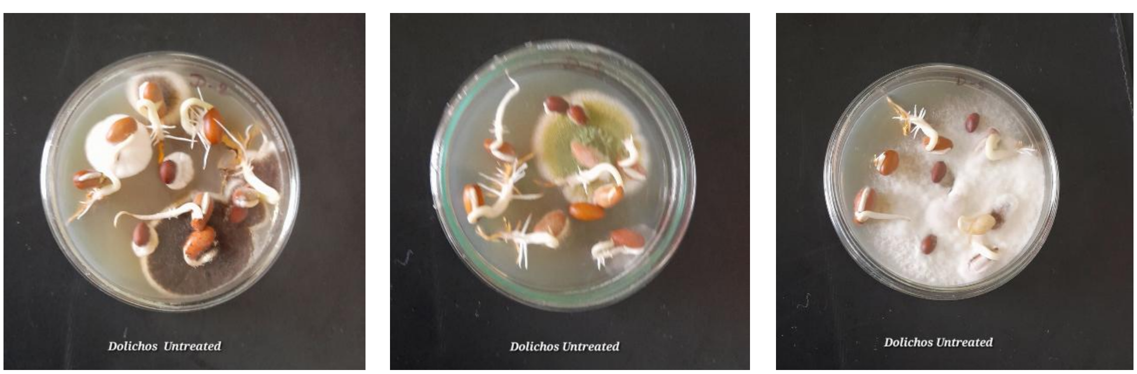


Figure 2: Infections in treated seeds of *Lablab purpureus* on SBM



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  UGC CARE Listed (Group -I) Journal Volume 11, Iss 12, 2022

Figure 3: Infections in untreated seeds of *Lablab purpureus* on agar plate

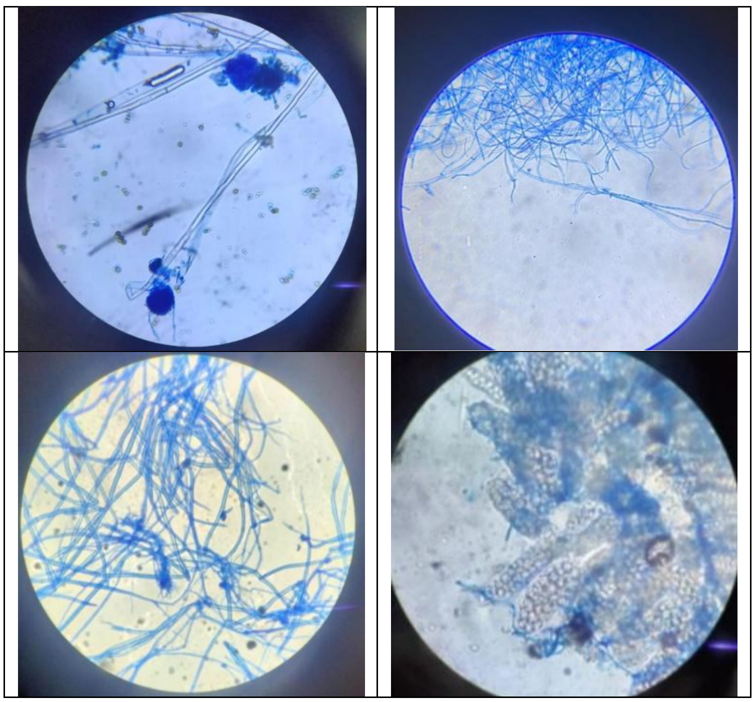

Figure 4: Fungi isolated from *Lablab purpureus*

Discussion

The comparison of fungal infections between treated and untreated seeds will shed light on the practical benefits of seed treatment. Understanding the impact of seed treatment on the overall health and resilience of *Lablab purpureus* crops will aid in developing sustainable agricultural practices. The research outcomes will guide farmers in making informed decisions on seed treatment strategies that balance disease control and environmental concerns.

Fungal infections can have a significant impact on *Lablab purpureus*, also known as hyacinth bean or lablab bean, and subsequently affect crop yield. These infections often occur due to environmental conditions favoring fungal growth, such as high humidity and moisture. When the plant is infected, the fungi may attack various parts, including leaves, stems, and pods. The infection can lead to wilting, discoloration, and necrosis, ultimately compromising the plant's ability to photosynthesize and produce energy. As a result, the crop yield can be drastically reduced. Fungal infections can also lead to premature leaf drop, reducing the photosynthetic area and diminishing nutrient uptake, further impacting the overall plant health and yield. Additionally, infected pods may fail to develop properly, leading to reduced seed formation and quality. To mitigate the impact of fungal infections on *Lablab purpureus*, farmers can adopt preventive measures such as crop rotation, proper irrigation practices, and ensuring good airflow to reduce humidity around the plants. Early detection and appropriate fungicide application can also help control the spread of infections. Overall, managing fungal infections in *Lablab purpureus* is crucial for sustaining crop yield and ensuring food security in agricultural communities. By implementing preventive strategies and timely interventions, farmers can enhance plant health and maximize their harvest.[11,12,13,14,15]

Prova A et al., had isolated *Sclerotinia sclerotiorum* from *Lablab purpureus*.[16] Similarly, in the present study *Aspergillus fumigatus, Aspergillus flavus, Aspergillus niger, Aspergillus parasitus, Corynespora sp., Fusarium sp.,* and *Rhizopus stolonifer* were reported from *Lablab purpureus*. Kader M A et al., had reported the *Rhizoctonia* from *Lablab purpureus*.[17] Similarly, in the present study *Aspergillus fumigatus, Aspergillus flavus, Aspergillus niger, Aspergillus parasitus, Corynespora sp., Fusarium sp.,* and *Rhizopus stolonifer* were reported from *Lablab purpureus*. Biswa et al., has reported *Aspergillus sp, Fusarium sp, Rhizopus sp, Penicillium sp., Curvularia sp., Colletotrichum sp.* and *Alternaria sp,* from *Lablab purpureus*.[18] Similarly, in the present study *Aspergillus fumigatus, Aspergillus flavus, Aspergillus niger, Aspergillus parasitus, Corynespora sp., Fusarium sp.,* and *Rhizopus stolonifer* were reported from *Lablab purpureus.*

Conclusion

In conclusion, this comparative study of fungal infections in *Lablab purpureus* seeds offers valuable insights into the effectiveness of seed treatment in managing fungal diseases. The results will contribute to enhancing crop productivity and promoting sustainable agricultural practices in the context of *Lablab purpureus* cultivation. Further research may explore specific mechanisms of fungal resistance and alternative eco-friendly approaches to control fungal infections in agricultural seeds.

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