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Study of Viability and Occurrence of Fungal Infections in Brinjal, Coriander, and Cowpea Seeds

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Abstract:

Fungal infections in seeds pose significant challenges to agricultural productivity and food security. The present study investigates the viability and occurrence of fungal infections in Brinjal (*Solanum melongena*), Coriander (*Coriandrum sativum*), and Cowpea (*Vigna unguiculata*) seeds by agar plate method. The study aims to assess the prevalence and severity of fungal pathogens and identify potential risk factors. The research utilized laboratory analysis and microscopy to identify fungal species and evaluate seed viability. Results highlight the impact of fungal infections on seed quality and provide valuable insights for sustainable seed management practices.

Keywords: Brinjal, Coriander, Cowpea, Seeds, Fungal infections, Viability, Agricultural productivity, Seed quality, Preventive measures.

Introduction:

Fungal infections pose significant threats to economic crops worldwide, leading to substantial losses in agricultural productivity. These infections are caused by various pathogenic fungi, which target a wide range of crop species. The impact of these diseases extends beyond yield reduction to include quality deterioration, post-harvest losses, and increased production costs. Understanding the challenges posed by fungal infections is crucial in devising effective strategies for disease management and safeguarding global food security. Fungal infections can manifest in different forms, such as leaf spots, wilts, rots, and rusts, among others. Some notorious fungal pathogens include *Fusarium*, *Phytophthora*, and *Botrytis*, each capable of causing devastating damage to specific crops. The transmission of these pathogens occurs through various means, including contaminated soil, seed, water, and air, making it difficult to control their spread.[1,2,3,4]

Crop losses resulting from fungal infections can be severe. Yields may plummet by up to 50%, depending on the crop type and the severity of the infection. Additionally, fungal attacks can compromise the nutritional content and market value of affected produce. This results in reduced income for farmers and food shortages for communities reliant on these crops. To combat fungal infections, integrated disease management approaches are essential. These may include cultural practices, such as crop rotation and proper sanitation, to reduce

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pathogen buildup in soil and plant residues. Genetic resistance through breeding programs can also play a critical role in developing resistant crop varieties. Furthermore, the application of fungicides and biocontrol agents can help mitigate the impact of fungal infections when used judiciously and responsibly. Climate change exacerbates the risk of fungal infections, as altered weather patterns create favorable conditions for their proliferation. This underscores the importance of implementing adaptive measures and early detection techniques to minimize losses.[5,6,7]

Brinjal, also known as eggplant or aubergine, is a versatile and nutritious vegetable belonging to the Solanaceae family. It has a smooth, glossy purple skin and a soft, creamy flesh with small edible seeds. Native to India, brinjal is now widely cultivated worldwide due to its culinary significance and health benefits. Rich in vitamins, minerals, and antioxidants, it supports heart health, aids digestion, and boosts immunity. Its subtle flavor makes it a popular ingredient in various cuisines, used in dishes like curries, stir-fries, dips, and salads. Brinjal's unique texture and taste continue to delight food enthusiasts globally.[8,9]

Coriander, also known as cilantro or Chinese parsley, is a versatile herb renowned for its distinct flavor and culinary uses worldwide. Belonging to the Apiaceae family, *Coriandrum sativum* thrives in warm climates and is cultivated for its leaves and seeds. The vibrant green, feathery leaves are commonly used fresh as a garnish or ingredient in dishes, adding a citrusy and slightly peppery note. Meanwhile, the seeds are ground into a spice, offering a warm, nutty flavor that enhances curries, soups, and marinades. Beyond its culinary prowess, coriander possesses potential health benefits, including aiding digestion and providing essential vitamins and minerals.[10,11]

Cowpea, scientifically known as *Vigna unguiculata*, is a versatile legume plant widely cultivated in various regions around the world. With its origins in Africa, cowpea has become an essential crop due to its ability to thrive in diverse environments and its rich nutritional value. The plant produces elongated pods containing edible seeds, providing a vital source of protein, fiber, and essential minerals. Its drought tolerance and nitrogen-fixing capabilities make it suitable for sustainable farming practices. Cowpea plays a crucial role in food security, poverty alleviation, and soil improvement, making it a valuable crop for both subsistence and commercial farming.[12,13]

In the present study, we aimed to assess the viability of fungal infections in brinjal, coriander, and cowpea seeds, to determine the occurrence and prevalence of fungal infections in these seeds, to identify the specific types of fungi present, and to explore potential measures for mitigating fungal contamination and improving seed quality.

Materials and Methods:

- Sample collection

Seeds of Brinjal, Coriander and Cowpea were collected from Indian Institute of Horticultural Research, Bengaluru.

- Agar plate method

Potato dextrose agar media was prepared followed by autoclaving and adding amoxicillin to avoid bacterial contamination and then agar plates were prepared. Seeds of each type were surface sterilised with 0.2% sodium hypochlorite followed by rinsing in distilled water and

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drying in the hood of laminar air flow. 30 seeds of each type were arranged on each agar plate with the help of sterilised forceps and plates were sealed and incubated at 27°C for seven. Experiments were performed in triplicates. After seven days the seed viability and occurrence of fungal infections was observed and recorded. Fungi were mounted using lactophenol cotton blue method, identified baser on their colony characteristics and sporulation characteristics by direct microscopy.

Results:

The seed viability and occurence of fungal infections finding are as follows:

Table 1: Germination and infection in untreated cowpea seeds

SI No.	No. of seeds in petriplate	No. of seeds germinated	No. of seeds infected	Percentage of germination	Percentage of infection
1	30	30	18	100%	60%
2	30	30	17	100%	56.6%
3	30	30	4	100%	13.3%

Table 2: Germination and infection in treated cowpea seeds

SI No.	No. of seeds in petriplate	No. of seeds germinated	No. of seeds infected	Percentage of germination	Percentage of infection
1	30	30	0	100%	0%
2	30	30	6	100%	20%
3	30	30	20	100%	66.6%

Table 3: Germination and infection in untreated coriander seeds

SI No.	No. of seeds in petriplate	No. of seeds germinated	No. of seeds infected	Percentage of germination	Percentage of infection
1	30	4	29	13.3%	96.6%
2	30	5	27	16.6%	90%
3	30	4	30	13.3%	100%

Table 4: Germination and infection in treated coriander seeds

SI No.	No. of seeds in petriplate	No. of seeds germinated	No. of seeds infected	Percentage of germination	Percentage of infection
1	30	14	2	46.6%	6.6%
2	30	10	9	33.3%	30%
3	30	9	9	30%	30%

Table 5: Germination and infection in untreated brinjal seeds

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SI No.	No. of seeds in petriplate	No. of seeds germinated	No. of seeds infected	Percentage of germination	Percentage of infection
1	30	0	15	0%	50%
2	30	0	10	0%	33.3%
3	30	0	20	0%	66.6%

Table 6: Germination and infection in treated brinjal seeds

SI No.	No. of seeds in petriplate	No. of seeds germinated	No. of seeds infected	Percentage of germination	Percentage of infection
1	30	0	30	0%	100%
2	30	0	30	0%	100%
3	30	0	30	0%	100%

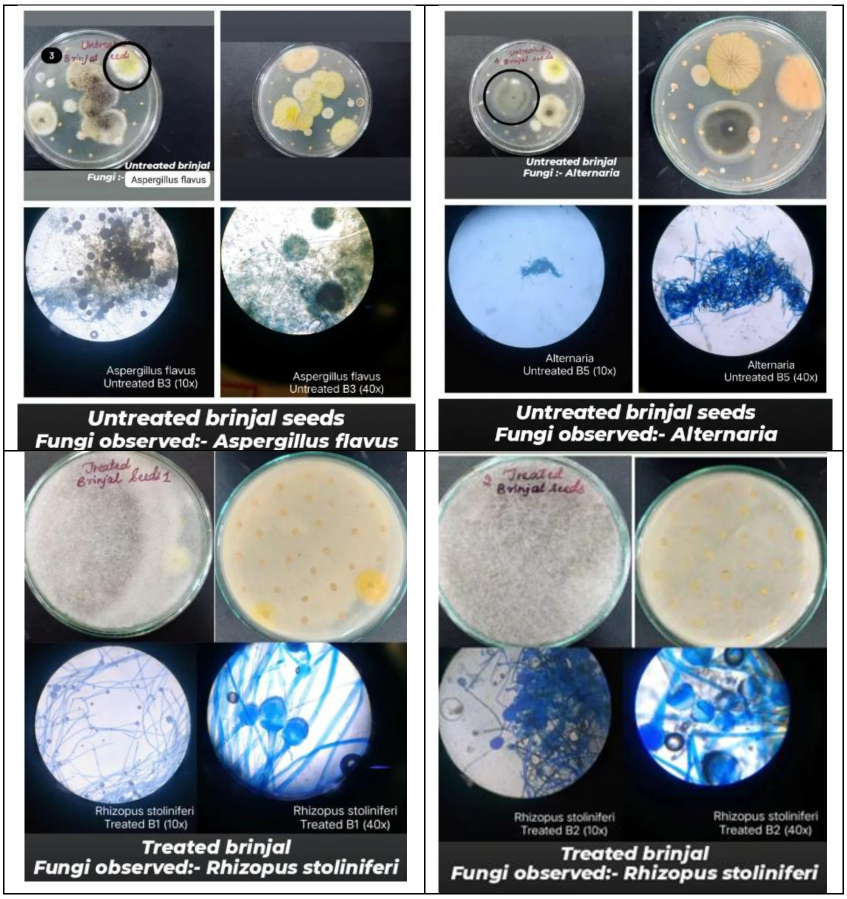

Fig 1: Fungal infections in brinjal seeds

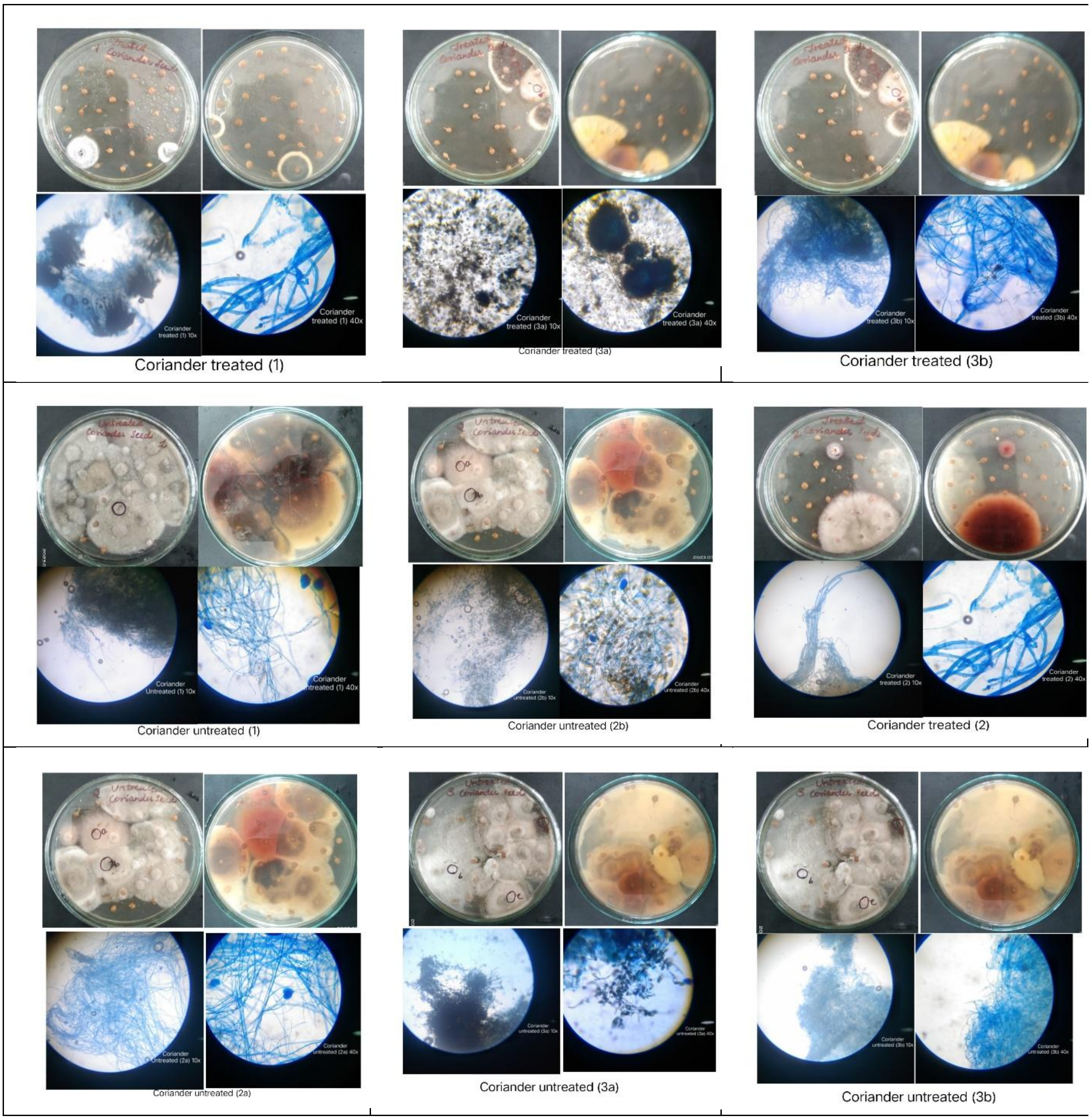

Fig 2: Fungal infections in coriander seeds

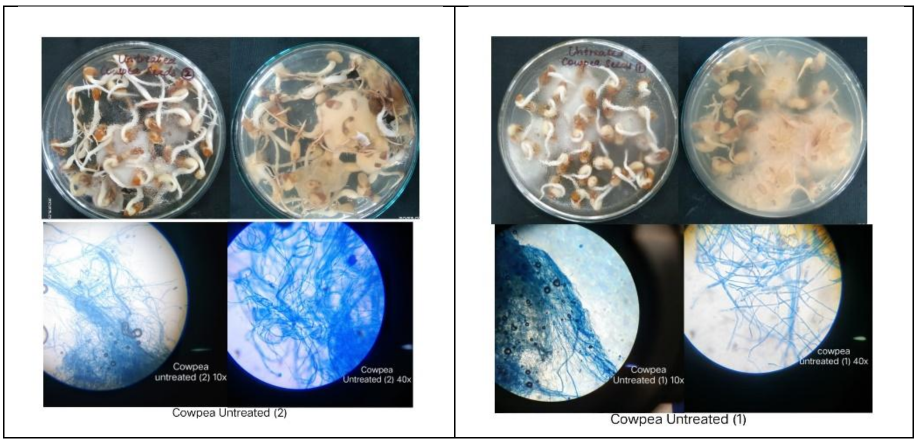

Fig 3: Fungal infections in cowpea seeds

Discussion:

The present study investigates the prevalence and viability of fungal infections in seeds of brinjal, coriander, and cowpea. The study aims to assess the potential risks of these fungal infections on seed germination and crop yield. In the present study, we collected seed samples from IIHR and subjected them to the agar plate method, a widely used technique to isolate and identify fungal pathogens. Each seed type was inoculated on separate agar plates and incubated under controlled conditions. After incubation, the plates were examined for fungal growth, and the percentage of infected seeds was recorded for each sample.

The results indicated varying levels of fungal infections across the three seed types. Brinjal seeds showed a higher incidence of fungal infections compared to coriander and cowpea seeds. Specific fungal species were identified, and their pathogenic potential was assessed. The study's findings have significant implications for agricultural practices, as fungal infections can lead to reduced seed germination, poor plant establishment, and compromised crop yield. Farmers and seed producers can use this information to implement appropriate seed treatment strategies and select disease-resistant cultivars to improve crop health. Moreover, understanding the occurrence of fungal infections in these seeds can aid in developing targeted control measures, such as using biofungicides or adopting proper storage and handling practices, to minimize seedborne diseases' spread. Overall, this research contributes to the existing knowledge on seed pathology and underscores the importance of regular monitoring and quality assurance in the seed production and distribution process to ensure better agricultural productivity and food security.

Singh D et al., has reported the occurrence of *Verticillium dahliae* and *Fusarium oxysporum* infections in brinjal.[14] Similarly, in the present study *Alternaria pseudoventricosa, Aspergillus flavus, Aspergillus niger* and *Rhizopus stolonifer* were reported from brinjal seeds. Kwon JH et al., had reported the occurrence of *Choanephora cucurbitarum* infections in brinjal.[15] Similarly, in the present study *Alternaria pseudoventricosa*, *Aspergillus flavus, Aspergillus niger* and *Rhizopus stolonifer* were reported from brinjal seeds. Nordin S et al., had studied the prevalence, identification and mycotoxigenic potential of fungi in common spices including coriander. Results revealed that *Aspergillus flavus* and *Aspergillus niger* were the most occurring fungi in coriander.[16] Similarly, in the present study *Alternaria pseudoventricosa, Aspergillus niger, Aspergillus flavus, Colletotrichum sp.*, and *Rhizopus sp.*, were reported from corianderseeds. Al jaradi at al., had studied the occurrence of fungal infections in cowpea and the results revealed the occurrence of *Alternaria*, *Aphanomyces, Aspergillus, Curvularia, Drechslera, Fusarium, Penicillium, Rhizoctonia* and *Rhizopus* species in cowpea.[17] Similarly, in the present study *Phytophthora sp., Rhizoctonia., Corynespora sp.*, and *Rhizopus sp*., were reported from the cowpea seeds.

However, to reduce losses in crop yield caused by seed-borne pathogens, farmers can implement several strategies. First, they should source high-quality seeds from reputable suppliers and ensure proper seed storage conditions to minimize pathogen contamination. Implementing seed treatment techniques, such as hot water treatment, chemical treatment, or biological agents, can effectively reduce pathogen load without harming seed viability. Crop rotation and intercropping are beneficial practices that disrupt pathogen cycles, reducing their buildup in the soil. Farmers should also practice field sanitation, removing crop debris and infected plants after harvest to prevent pathogen survival and spread. Regular scouting and disease monitoring allow for early detection, enabling timely intervention through targeted fungicide application or resistant seed varieties. Participating in extension programs and

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staying updated on best agronomic practices further enhances disease management. Promoting genetic diversity through the cultivation of disease-resistant varieties and using tissue culture techniques can also reduce susceptibility to seed-borne pathogens. Lastly, adopting integrated pest management (IPM) strategies that combine various control methods in a sustainable manner will contribute to long-term disease management and increased crop yields.[2,18,19,20]

Conclusion:

The present study investigated the prevalence and viability of fungal infections in seeds of brinjal, coriander, and cowpea. The results indicated varying levels of fungal infections across the three seed types. Brinjal seeds showed a higher incidence of fungal infections compared to coriander and cowpea seeds. Specific fungal species were identified, and their pathogenic potential was assessed. The study's findings have significant implications for agricultural practices, as fungal infections can lead to reduced seed germination, poor plant establishment, and compromised crop yield.

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