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Study Of Viability And Fungal Infections In Okra, Ridge Gourd And Watermelon Seeds Using The Agar Plate Method

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Abstract

The viability of seeds plays a critical role in determining their potential for germination and successful crop production. Fungal infections in seeds can significantly affect seed viability and subsequently impact crop yield. The present study aims to study the viability of okra (Abelmoschus esculentus), ridge gourd (Luffa acutangular) and watermelon (Citrullus lanatus) seeds and investigate the occurrence of fungal infections using the agar plate method. The study involved the collection of seeds, surface sterilization and their subsequent placement on agar plates for fungal growth observation. The results obtained from the present study provides valuable insights into seed viability and the prevalence of fungal infections, contributing to the development of effective seed treatments and crop management practices.

Keywords: Agar plate method, Crop management, Crop yield, Fungal infections, Seed treatment, Viability.

Introduction

Seed viability refers to the ability of a seed to germinate and develop into a viable plant. It is influenced by various factors such as age, storage conditions, and genetic characteristics. The viability of seeds decreases over time, and certain species have shorter viability periods than others. Seed viability is crucial for successful plant propagation and agriculture. Understanding seed viability helps farmers and seed banks determine the quality and shelf life of seeds, ensuring optimal germination rates. Maintaining optimal storage conditions, such as temperature and moisture, can help prolong seed viability.[1,2]

Fungal infections in seeds pose a significant threat to agricultural productivity and food security. These infections can result in reduced germination rates, seedling mortality, and crop yield losses. Various fungal pathogens, such as Fusarium, Alternaria, and Aspergillus, can infect seeds during storage, transportation, or planting. Factors such as high humidity, poor storage conditions, and inadequate seed treatment contribute to seed fungal contamination. Additionally, climate change and globalization have led to the emergence of new fungal species and the spread of existing ones, exacerbating the problem. Timely detection, proper seed treatment, and adherence to good agricultural practices are crucial for minimizing seed-borne fungal infections and ensuring sustainable crop production.[3,4]

The objective of this study is to assess the viability of okra, ridge gourd and watermelon seeds and evaluate their susceptibility to fungal infections using the agar plate method, providing valuable insights for seed quality control and disease management in these crops.

Materials and Methods

2.1 Seed Collection:

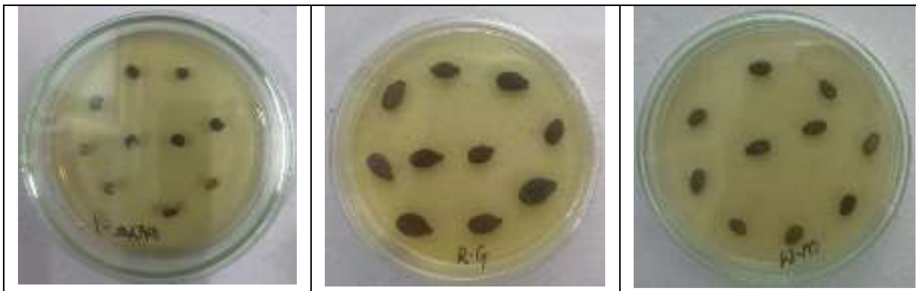
Untreated seeds of okra, ridge gourd and watermelon were collected from IIHR, Bengaluru.

2.2 Surface Sterilization:

Untreated seeds of okra, ridge gourd and watermelon were surface sterilised with 0.2% sodium hypochlorite following by washing in distilled water and drying in the hood of laminar air flow.

2.3 Agar Plate Method:

Potato Dextrose Agar was prepared according to manufacture's instructions given on product label. PDA was autoclaved and poured into the sterilised petriplates and left for solidification. After solidification of media ten surface sterilised seeds were arranged on agar media with the help of sterilised forceps and the plate was clinged wrapped and kept in a incubator.



Okra seeds	Ridge gourd seeds	Watermelon seeds

Fig 1: Okra, Ridge gourd and Watermelon seeds on agar plate

2.4 Incubation and Observation:

The petriplates were kept in incubator for 48 hours and after 48 hours the gemination and infection observed and percentage of germination and Infection was recorded.

Fig 2: Okra seeds infected with fungi

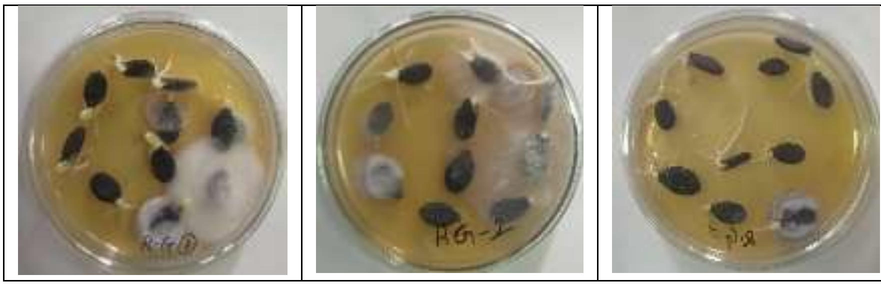


Fig 3: Rigde gourd seeds infected with fungi

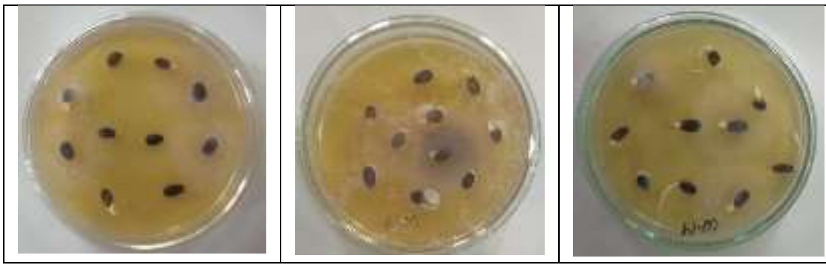


Fig 4: Watermelon seeds infected with fungi

2.5 Data Collection:

Percentage of germination and infection for each seed type was calculated and recorded after 48 hours of incubation.

Table 1: Percentage of germination and infection in untreated okra seeds

SL no.	No. Of seeds in petriplate	No. Of seeds germinated	No. Of seeds infected	Percentage of germination	Percentage of infection
1.	10	6	0	60%	0%
2.	10	9	2	90%	20%

Table 2: Percentage of germination and infection in untreated ridge gourd seeds

SL no.	No. Of seeds in petriplate	No. Of seeds germinated	No. Of seeds infected	Percentage of germination	Percentage of infection
1.	10	10	7	100%	70%
2.	10	8	8	80%	80%
3	10	9	3	90%	30%

Table 3: Percentage of germination and infection in untreated watermelon seeds

SL no.	No. Of seeds in petriplate	No. Of seeds germinated	No. Of seeds infected	Percentage of germination	Percentage of infection
1.	10	9	5	90%	50%
2.	10	7	8	70%	80%
3	10	5	6	50%	60%

Results

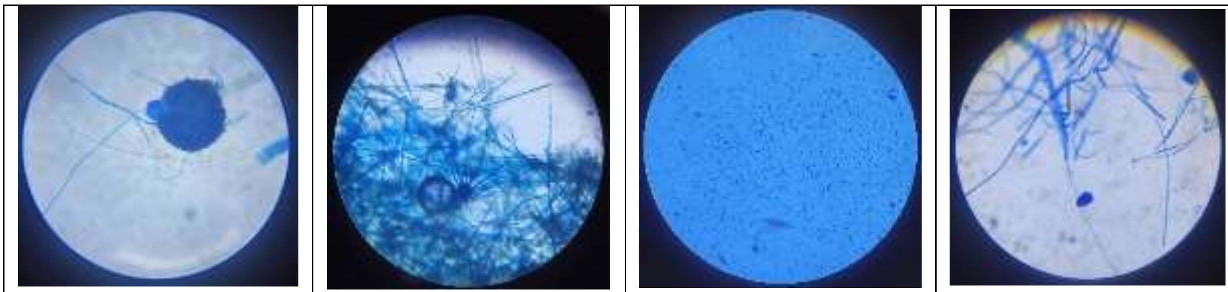
3.1 Seed Viability:

Seed viability test revealed that 75% of okra seeds were viable, 90% of ridge gourd seeds were viable and 70% of watermelon seeds were viable (Fig 2, 3 and 4).

3.2 Fungal Infections:

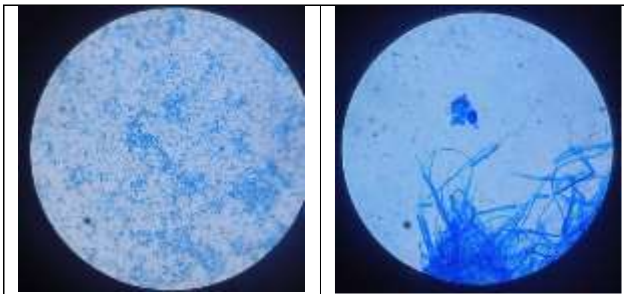
The okra seeds were infected with Aspergillus flavus, Aspergillus fumigatus and Aspergillus parasitus (Fig 2 and 5). Ridge gourd seeds were infected with Aspergillus sp., Colletotrichum sp., Fusarium graminearum., Pseudoperonospora sp., and Verticillium sp., (Fig 6). Watermelon seeds were infected with Fusarium sp., Chaetopsis grisea and Corynespora sp., and Macrophomina phaseolina (Fig 7). These fungal pathogens infect the agricultural crops causing the huge loss to the crop yield.

Fig 5: Aspergillus parasitus and Aspergillus fumigatus isolated from okra seeds



(a) Aspergillus (b) Colletotrichum (c) Fusarium (d) Pseudoperonospora

Fig 6: Aspergillus, Colletotrichum, Fusarium and Pseudopernospora isolated from ridge gourd seeds.



(a)Chaetopsis grisea (b) Corynespora

Fig 7: Chaetopsis grisea and Corynespora isolated from watermelon seeds.

Discussion:

4.1 Seed Viability Findings:

In a study by Chauhan et al. (2018), they assessed the seed viability of okra (Abelmoschus esculentus) seeds using the tetrazolium chloride test, finding a high viability rate of 91% after 12 months of storage.[5] Similarly, in research conducted by Naik et al. (2020), they investigated the effect of different storage conditions on okra seed viability. The results indicated that storing the seeds in a cool and dry environment maintained high viability rates of over 85% even after 18 months.[6] Similar to these studies, in the present study seed viability of okra when treated with 0.2% sodium hypochlorite was found to be 75%. A study by Singh et al. (2018) reported that ridge gourd seeds maintained high viability for up to two years when stored under cool and dry conditions, with germination rates exceeding 90%.[7] Similar to this study, in the present study seed viability of ridge gourd seeds was found to be 90%. Another research by Sharma et al. (2020) found that ridge gourd seeds treated with priming techniques such as hydropriming and osmopriming exhibited improved seed viability and enhanced germination performance.[8] Numerous studies have explored the viability of watermelon seeds, assessing their germination potential and agricultural applications. These investigations have revealed that watermelon seeds possess excellent viability, with high germination rates and robust seedling development. Furthermore, they exhibit considerable resistance to environmental stresses, making them suitable for diverse cultivation conditions.[9] In the present study seed viability of watermelon was found to be 70%.

4.2 Fungal Infections Findings:

In a study by Sharma et al. (2018), fungal infection in okra seeds was analyzed, revealing the prevalence of pathogens like Fusarium and Rhizopus, causing significant seed deterioration and reduced germination rates.[10] Another study conducted by Siddiqui et al. (2017) investigated the occurrence of fungal pathogens in okra seeds, identifying Aspergillus and Alternaria as common fungi responsible for seed rot and decay, emphasizing the need for effective disease management strategies.[11] Similarly, in the present study Aspergillus flavus and Aspergillus niger was isolated from okra seeds. Ridge gourd (Luffa acutangula) seeds are susceptible to fungal infections, posing a threat to their germination and overall seed quality. Several studies have focused on identifying the fungal species associated with these infections and assessing their impact. For instance, Sharma and Verma (2017) identified Alternaria alternata and Fusarium solani as the predominant fungi causing seed rot and decay in ridge gourd seeds.[12] Similarly, Ram et al. (2019) reported the presence of Aspergillus niger and Rhizopus stolonifer, leading to seed deterioration and reduced germination rates. These studies highlight the importance of implementing effective control measures to mitigate fungal infections in ridge gourd seeds, ensuring successful cultivation.[13] Similar to these studies, in the present study ridge gourd seeds were infected with Aspergillus sp., Colletotrichum sp., Fusarium graminearum., Pseudoperonospora sp., and Verticillium sp.,

There is limited literature available specifically focusing on fungal infections in watermelon seeds. However, studies have highlighted the susceptibility of watermelon seeds to fungal contamination, which can lead to reduced seed quality and germination rates. A study by Sharma et al. (2018) reported the presence of several fungal species, including Fusarium and Alternaria, in watermelon seeds. Another study by Madariaga-Navarrete et al. (2017) identified various fungi, such as Penicillium and Aspergillus, in watermelon seeds collected from different regions. In the present study Fusarium sp., Chaetopsis grisea and Corynespora sp., and Macrophomina phaseolina were isolated from watermelon seeds. These findings emphasize the need for proper seed storage and management practices to minimize fungal infections and maintain seed quality.

4.3 Future Research:

Future research will include focusing on exploring the efficacy of alternative antifungal treatments, investigating the impact of environmental factors on fungal growth and assessing the long-term storage viability of infected seeds.

Conclusion:

In conclusion, the viability study conducted on okra, ridge gourd and watermelon seeds using the agar plate method provides valuable insights into the presence of fungal infections. The results indicate varying levels of fungal contamination among the three seed types. Ridge gourd seeds exhibited the highest incidence of fungal infections, followed by watermelon and okra seeds. These findings highlight the importance of seed quality management and proper storage conditions to minimize fungal contamination and ensure healthy seedlings. Further research and implementation of preventive measures, such as seed treatment and quality control practices, are recommended to enhance seed viability and reduce the risk of fungal infections in these crops.

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