NDC E-BIOS (Online) Volume 3, pp 15-20 (2023)
ISSN: 2583-6447

https://doi.org/10.5281/zenodo.11122765

ORIGINAL ARTICLE

DIVERSITY OF SEED MYCOFLORA: ITS IMPACT ON GERMINATION AND NUTRITIONAL VALUES OF TWO VEGETABLE SEEDS IN STORAGE, PURULIA, WEST BENGAL

Dipali Mahato and Subrata Raha*

Department of Botany, Sidho-Kanho-Birsha University, Purulia, West Bengal, India.
*Correspondence: subrata-raha@skbu.ac.in

Abstract: *The present investigation was carried out to identify the diversity of seed mycoflora, decrease in nutritional values, and loss of germinability in the case of two fresh and stored vegetable seeds, Abelmoschus esculentus (Okra) and Hibiscus sabdariffa (Roselle). Vegetable seeds were collected from the village farmers of Purulia District, West Bengal, India. Thirteen fungal genera were prevalent in Okra and Roselle seeds during the incubation test. The fungal genera were Rhizopus sp. Aspergillus niger, A. flavus, Mucor mucedo, Macrophomina phaseolina, Fusarium sp. Curvularia lunata, Cladosporium sp., Alternaria sp., Diplodia sp., Chaetomium sp., Trichoderma sp., Paecilomyces sp., and sterile mycelia. From both of the vegetable seeds, Roselle showed a higher diversity of seed mycoflora than the Okra seeds in storage. The nutritional values like protein content decreased from 21.62% to 12.24% and from 18.86% to 13.03% whereas carbohydrate content decreased from 13.95% to 10.09% and from 28.7% to 26.1% in Roselle and Okra respectively. The germination rate decreased from 82% to 39% in okra seeds and from 79% to 28% in the case of roselle seeds indicating that the storage environment and seed mycoflora play a vital role in seed deterioration and proper harvesting with scientific storage is essential for the viability and health of stored seeds.*

Keywords- *Seed-mycoflora, Abelmoschus esculentus, Hibiscus sabdariffa, Nutritional value, Germination rate.*

Communicated: 30.10.2023 Revised: 6.11.2023 Accepted: 8.11.2023

1. INTRODUCTION

Seed-borne mycoflora has been found to affect the growth of crop plants. After harvesting invading seed mycoflora affects the entire seed bulk and creates a favourable environmental condition for other fungi and microorganisms that deteriorates the stored seeds and decreases their nutritional values and

germination rate. *Abelmoschus esculentus* (L.) Moench (Okra) and *Hibiscus sabdariffa* L. (Roselle) are economically important crops. Both of the vegetables are members of the family Malvaceae, widely cultivated in Purulia because of their heat and drought-tolerant capability. A few researchers [1-4] observed that some dominant fungi (*Aspergillus candidus*, *A. flavus*, *A. niger*, *A. terreus*, *A. ruber*, *Rhizopus* sp., *Mucor* sp., *Curvularia* sp., *Fusarium* sp.) are responsible for fungal infection in storage seeds that are decline carbohydrate and protein content. The present study indicates the diversity of the seed mycoflora in fresh and one-year stored two vegetable seeds with reference to their deteriorative changes.

2. MATERIALS AND METHODS

Collection of seed samples and storage

For studying mycoflora associated with two vegetable seeds, fresh and stored *Abelmoschus esculentus* (Okra) and *Hibiscus sabdariffa* (Roselle) were collected from local farmers of Purulia, West Bengal. The collected seed samples were shade-dried and stored in paper bags at room temperature for further studies.

Study of Seed Mycoflora

Types of fungi associated with seeds and the extent of fungal infection were determined by the Agar-plate method [5]. Seed samples were surface sterilized by 2% sodium hypochlorite solution for two minutes followed by washing three times with sterilized distilled water. The extent of fungal infection was determined by placing a hundred surface sterilized seeds (disinfected with 2% sodium hypochlorite solution for two minutes followed by washing three times with sterilized distilled water) on Potato Dextrose Agar media (PDA media), the pH of the media was kept at 5.6. Petri- dishes were incubated at 30 to 32 □ in darkness for seven days. Fungi developed on seeds were counted, identified using an identification key and literature [6-7], and maintained as pure cultures.

Determination of germinability

Germinability was determined by randomly placing 100 seeds in three replicates after the surface was disinfected by 2% sodium hypochlorite solution, on sterilized Petri dishes containing three layered moist filter papers. Petri dishes were incubated at 30 to 32□ for seven days with alternate twelve hours of light and twelve hours of darkness (International Seed Testing Association, 1966) [8]. Seedlings with normal roots of 5 mm were counted as germinated.

Study of Biochemical changes in seeds due to storage:

Total carbohydrate content: The total extraction of protein was done using the method of Chow and Landhäusser (2004) [9]. The quantitative estimation of the total carbohydrates (Both soluble and non-soluble) of test seeds was done by following the anthrone method.

Protein content: Protein content was estimated quantitatively followed by Lowry et al. [10].

2. RESULTS AND DISCUSSION

Thirteen fungal genera and sterile mycelia were ubiquitous in Okra and Roselle seeds during the incubation test. The fungal genera were *Rhizopus* sp., *Aspergillus niger*, *Aspergillus flavus*, *Mucor mucedo*., *Macrophomina phaseolina*, *Fusarium* sp., *Curvularia lunata*, *Cladosporium* sp., *Alternaria*

sp., *Diplodia* sp., *Chaetomium* sp., *Trichoderma* sp. and *Paecilomyces* sp. From the fresh seed sample of okra *Aspergillus niger* (12%) was associated with the highest frequency followed by *Chaetomium* sp. (10%), *Aspergillus flavus* (6%), *Cladosporium* sp. (4%), *Curvularia lunata* (2%) and sterile mycelia (6%). In the case of fresh seeds of Roselle *Rhizopus* sp. (30%) was associated with the highest frequency, followed by *Alternaria* sp. (16%), *Diplodia* sp. (16%), *Curvularia lunata* (14%), *Aspergillus flavus* (12%), were also observed in this sample [Figure 1].

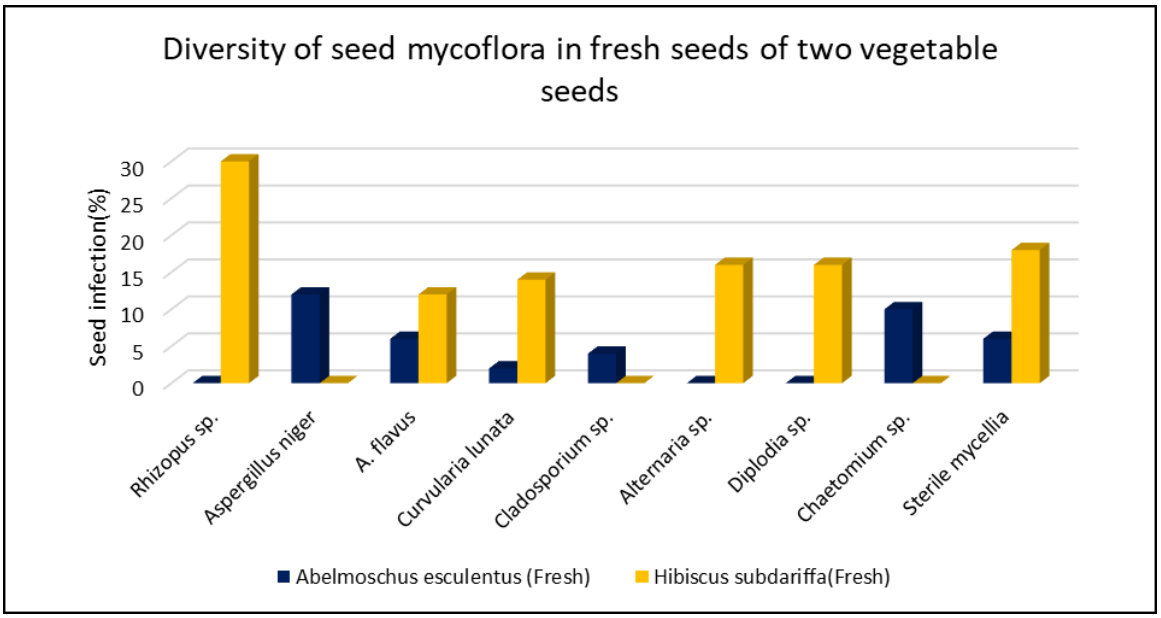

Figure 1: Diversity of seed mycoflora in *Abelmoschus esculentus* and *Hibiscus sabdariffa* fresh seeds.

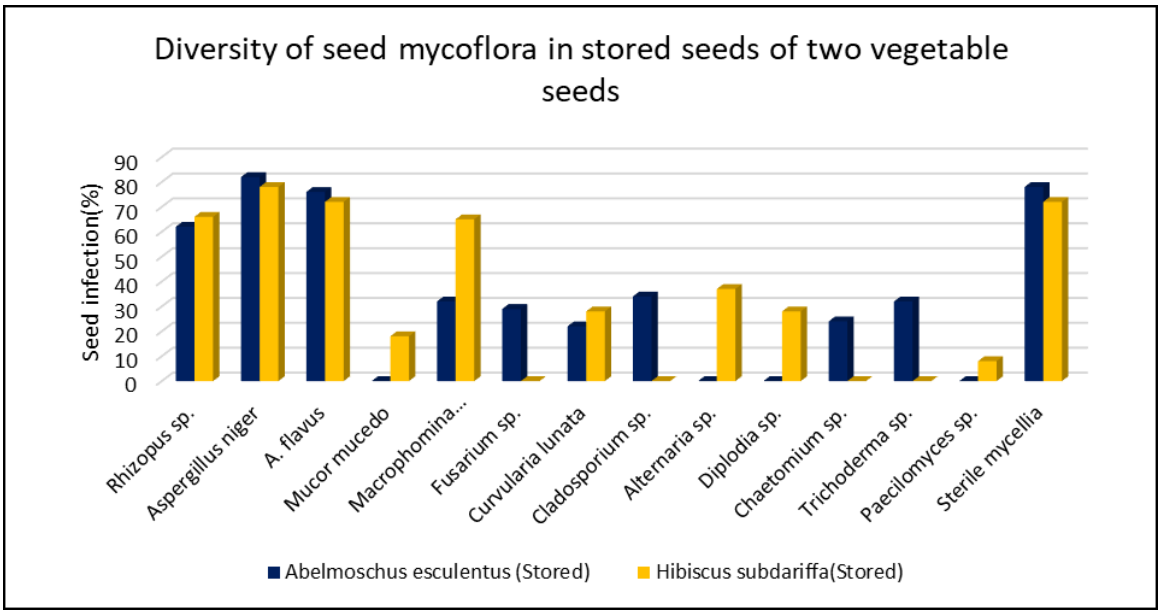

Figure 2: Diversity of seed mycoflora in *Abelmoschus esculentus and Hibiscus sabdariffa* stored seeds.

In the old seed sample of Okra *Aspergillus niger* (82%) was recorded as the highest frequency, followed by sterile mycelia (78%), *A. flavus* (76%), *Rhizopus* sp. (62%), *Trichoderma* sp. (32%),

Cladosporium sp. (34 %), *Macrophomina phaseolina* (32%), *Fusarium* sp. (29%), *Chaetomium* sp. (24 %), *Curvularia lunata*. (22%). were also found in the sample. In stored seeds of Roselle, the prevalence of *Aspergillus niger* (78%) was recorded highest followed by *Aspergillus flavus (*72%*)*, sterile mycelia (72%), *Rhizopus* sp. (66%), *Macrophomina phaseolina* (65%), *Alternaria* sp. (37%), *Curvularia lunata* (28%), *Diplodia* sp. (28%), and *Mucor mucedo* (18%) and *Paecilomyces* sp. (8%) [Figure 2]. In both cases fresh seeds showed less diversity of seed mycoflora amongst which okra seeds in their fresh condition showed a higher occurrence of seed mycoflora than the Roselle seeds, whereas one-year stored seeds showed more diversity of seed mycoflora where Roselle seeds showed high occurrence of seed mycoflora which indicates storage condition and storage environment influence seed deterioration.

Nutritional values

The percentage of total carbohydrate content decreased from 28.7%% to 26.1% in the case of Okra whereas protein content decreased from 18.86% to 13.03% in one year of storage (Fig-3). In the case of Roselle, the percentage of total carbohydrate content decreased from 13.95% to 10.09% whereas protein content decreased from 21.61% to 12.24% [Figure 3].

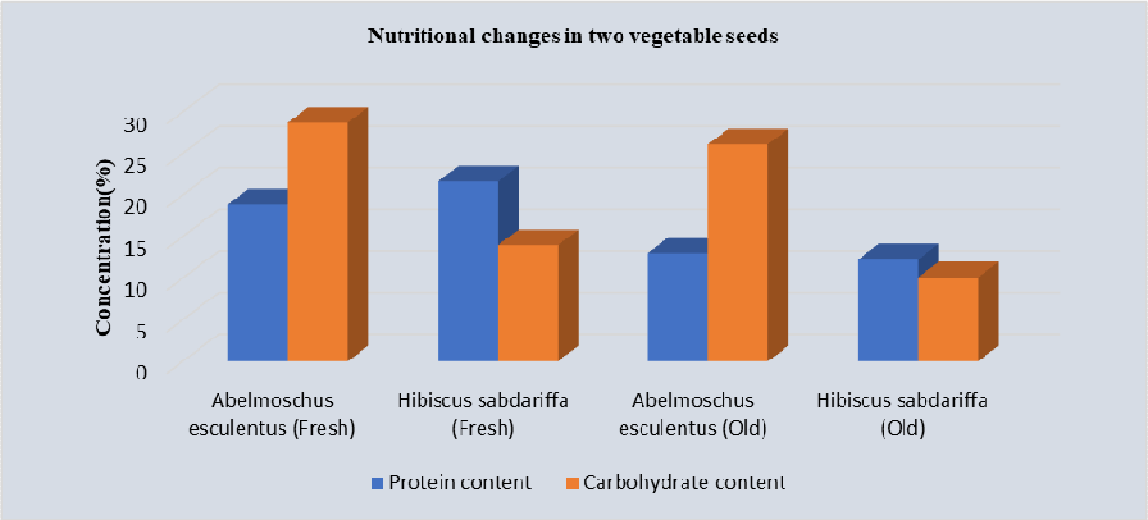

Figure 3: Nutritional changes in fresh and stored seeds of *Abelmoschus esculentus* & *Hibiscus sabdariffa.*

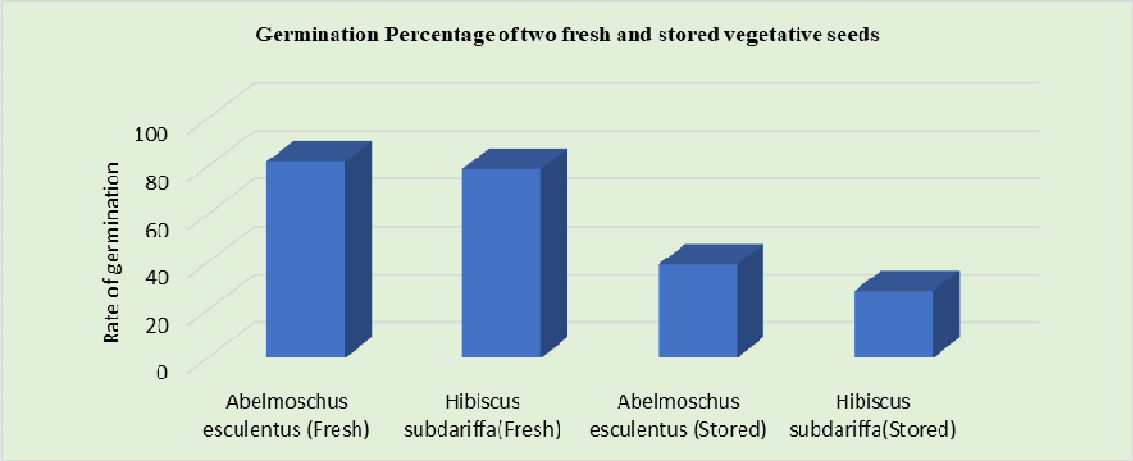

Figure 4: Germination Percentage of fresh and stored seeds of *Abelmoschus esculentus* & *Hibiscus sabdariffa.*

Germination rate decreased from 82% to 39% in Okra seeds and from 79% to 28% in the case of Roselle seeds [Figure 4] indicating that during the storage period seed mycoflora play a vital role in seed deterioration and proper harvesting with scientific storage is essential for the germination and health of stored seeds. Fakir 1986 [4], identified 17 fungi representing a total of 12 genera in Okra seeds, collected from 3 districts viz. Bogra, Mymensingh, and Rajshahi., the most common fungi were *Aspergillus flavus*, *Chaetomium globosum*, *Mucor* sp., *Aspergillus niger*, *Curvularia* sp., *Fusarium* sp. from seeds. Bhattacharya and Raha [1] recorded that the germination rate in stored seeds gradually decreases probably due to fungal invasion leading to damage to the embryo or due to depletion of food reserve and production of toxic metabolites. The rate of decrease of protein and carbohydrate content in all seeds increased with the time of storage. As fungal mycelia could not be separated from seeds the value represented both the seed and fungal protein [11].

4. CONCLUSION

Seed is a vital input in crop production and are of immense biological and economic importance. Storage conditions and storage environment diversely affect seeds in storage. Seed-borne fungi are a serious problem that adversely affects the seeds, changes in quality, loss of vitality and vigor will affect germination and further loss of nutritional values likely Protein content, carbohydrates content, etc. Seed constitutes basic agricultural productivity. Seed vigor may reduce due to seed-borne mycoflora causing disastrous diseases and weakening the plant at the initial stage of growth. Seed-borne microflora is comparatively challenging to manage as the fungi hyphae get established and become dormant. The vegetable seeds are attacked by several seed mycoflora, and these pathogens may affect the crop resulting in a reduction of the seed's growth, seedling abnormality, and productivity. In this study commonly occurring seed-borne mycoflora were *Aspergillus niger*, *Aspergillus flavus*, *Alternaria* sp, *Cladosorium* sp, *Rhizopus* sp, *Curvularia* sp, *Macrophomina phaseolina*, *Diplodia* sp. and sterile mycelia, causes reduction in yield as well as germination rate, loss of nutritional values. Out of all the above-mentioned mycoflora, *Aspergillus* sp. was the most destructive pathogen of vegetable seeds during storage. Amongst both of the vegetable seeds, Roselle seeds were highly affected by seed mycoflora during storage and decreased nutritional values and germination rate due to storage in moist environment, and low maintenance whereas Okra seeds were less affected. This study indicates that farmers should pay attention during the harvesting, storage, and processing of vegetable seeds and treat their seeds with proven agro-technologies as well as efforts should be given by the government to boost their production.

5. REFERENCES

1. *Bhattacharya, K. and Raha, S., "Deteriorative changes of maize, groundnut and soybean seeds by fungi in storage", Mycopathologia, vol 155(3), (2002), pp 135-141.*
2. *Kandhare, A. S., "Effect of storage containers on seed mycoflora and seed health of green gram (Vigna radiata L.) and its cure with botanicals", Agricultural Research & Technology Open Access Journal, Vol 14(2), (2018), pp 56-59.*
3. *Banvasi, P., Khare, C. P., Awadhiya, G. K., Singh, V. and Baghel, D. "Study of seed mycoflora in different samples of Abelmoschus esculentus (L.) Moench", International Journal of Current Microbiology and Applied Sciences, vol 8(12), (2019), pp 2426-2433.*
4. *Fakir, G. A., "Seed Pathology sub-project", Dept. Of Plant Patol., BAU, Mymensingh, Annual Progress Report, (1986), p 17.*
5. *Muskett, A. E., "Technique for the examinations of seeds for the presence of seed-borne fungi", Trans Br Mycol Soc, vol 30, (1948), pp 74–83.*
6. *Nagamani, A., Kunwar, I. K. and Manoharachary, C., "Handbook of soil fungi", I. K. International Publishing House, (2006).*
7. *Watanabe, T., "Pictorial atlas of soil and seed fungi: morphologies of cultured fungi and key to species", CRC Press, 3rd edition, (2010).*
8. *International Seed Testing Association. International rule for seed health testing. Proc Inter Seed Text Assoc., vol 31, (1966), pp 1– 152.*
9. *Lowry, O. H., Rosenbrough, N. J., Farr, A. L., Randall, R. J., "Protein measurement with the folin phenol reagent. Journal of Biological Chemistry'', vol 193, (1951), pp 265-275.*
10. *Chow, P. S. and Landhäusser, S. M., "A method for routine measurements of total sugar and starch content in woody plant tissues", Tree Physiology, vol 24(10), (2004), pp 1129-1136.*
11. *Cherry, J. P, "Protein degradation during seed deterioration", Phytopath, vol 73, (1983), pp 317–321.*
