



First comprehensive study on distribution frequency and incidence of seed-borne pathogens from cereal and legume crops in Sri Lanka

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Abstract

Sri Lanka as an agricultural country requires seed health testing to manage crop diseases. So far no comprehensive research has been carried out for the proper identification of seed mycoflora affecting the seed quality in Sri Lanka. The present study strives to address this issue by identifying seed-borne fungal pathogens from stored seeds using morpho-molecular characterization. Fungal pathogens were isolated from surface-sterilized and non-surface sterilized seeds of *Arachis hypogea*, *Oryza sativa*, *Vigna radiata*, and *Vigna sinensis*. PCR amplification and DNA sequencing of the internal transcribed spacer (ITS) region was carried out for molecular identification of pathogens. The germination quality of each seed variety was calculated by pot experiments. Distribution frequencies, percentage of germination, and seedling vigor were calculated and analyzed for each seed variety tested. In total eighteen isolates were recovered from the four seed varieties. Molecular characterization revealed that the fungal isolates recovered from all the four seed varieties belong to seven genera: *Aspergillus*, *Bipolaris*, *Daldinia*, *Macrophomina*, *Orbilia*, *Rhizopus*, and *Talaromyces*. *Rhizopus* spp. showed the highest distribution frequency (75%). *Arachis hypogea* showed the lowest germination percentage (20%) and lowest seedling vigor index (585). The seeds of *Oryza sativa* showed no germination probably due to their high incidence of fungal pathogens (four out of seven genera). This study is the first comprehensive study analyzing the seed-borne pathogens of the four most commonly consumed Sri Lankan cereal and legume crops. Results reported in this study helps to identify and implement optimum storage facilities and control such fungal pathogens in future agricultural practices.

Introduction

Grains contain about 66–76% carbohydrates such as starch (55–70%), arabinoxylans (1.5–8%), β -glucans (0.5–7%), sugars (3%), cellulose (2.5%) and glucose fructans (1%) (Bhalerao & Chavan 2017). Therefore, they have been extensively used as sources of nutrients in the Sri Lankan daily diet. Most of these crops cultivated are seed-oriented, and seeds are the starting and end-product of most crops (Ghosh *et al.* 2018). Moreover, seeds act as a habitat for many heterotrophic pathogenic organisms like fungi, bacteria, insects, and mites (Fleurat-Lessard 2017).

Every seed harbors a wide variety of microflora and acts as passive carriers of pathogens to long distances due to their high mobility (Baka *et al.* 2014). Crop seeds can be affected by pathogens either in the field or in post-harvest storage (Dauda *et al.* 2017). Among the pathogenic organisms inhabiting seeds, fungi have been identified as the major cause of seed deterioration (Fleurat-Lessard 2017). They cause a major loss on long-term storage products (Fleurat-Lessard 2017). Temperature and humidity play a major role in the incidence of seed-borne fungi (Nawaz *et al.* 2019). Grains undergo moisture fluctuations when stored at room temperature, which results in spoilage by fungal pathogens (George *et al.* 2019). Seed fungal pathogens can be internal or external (Astoreca *et al.* 2019). Some fungal pathogens are associated with testa and cotyledon of seeds in the form of mycelium, conidia, and spores (Kumar *et al.* 2017). Seed-borne mycoflora causes some deleterious effects by reducing seed germination, seedling vigor and causing seedling death (Nawaz *et al.* 2019). Affected seeds are often discolored, rotten, of lesser weight than normal seeds, and low on germination rate (Rehman *et al.* 2018). In addition, mycotoxins are also produced under suboptimum storage conditions that are harmful to both animals and plants (Kritzing *et al.* 2003).