

## RESEARCH ARTICLE

## Seed borne fungi of rice from South Tamil Nadu

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## Abstract

Fungi associated with seeds of five cultivars of rice were isolated by agar and blotter paper methods. The fungus was isolated from the contaminated surface of unmilled rice grain and identified based on their typical structure and basic characters as suggested by Barnett and Hunter (1972). Five pathogenic fungi, namely *Aspergillus flavus*, *A. niger*, *Penicillium citrinum*, *Alternaria padwickii* and *Rhizopus oryzae* were isolated and identified from different varieties of rice seeds. The findings suggest that there is a need for proper storage of rice seed to minimize the fungal infestation and their mycotoxin production. This study also reveals that the presence of diverse mycoflora of both pathogenic and non-pathogenic fungi in rice seeds in ruling varieties and hybrids in Tamil Nadu.

**Keywords:** Rice, *Aspergillus flavus*, *Penicillium citrinum*, *Alternaria padwickii*, *Rhizopus oryzae*, mycotoxin.

## Introduction

Rice is grown in 114 countries across world, occupying a total area of 150 million hectares and 90% of world's rice is grown and consumed in Asia. Rice is the most important staple food crop in India. Frequent and heavy rainfall and floods particularly near harvest in the different parts of the country wet the crop and make panicles more prone invasion by fungal species (Reddy *et al.*, 2004). Fungi are a major cause of reduction in the quality of rice due to high moisture and temperature conditions before its harvest. India stands first in rice area and second in production in which almost tripled from 30.4 million tons in 2001-02. Microorganisms play an important role in affecting the quality of seed of which fungi are the largest group. These pathogens are disastrous as they reduce seed vigor and weaken the plant at its initial growth stages. Seed borne diseases caused by fungi are relatively different to control as the fungal hyphae get established and become dormant. Apart from being seed borne pathogens, fungi may grow on storage products. These fungi may decrease seed germinability cause seed discoloration, produce toxins that may be injurious to man and domestic animals and may reduce seed weight also. This study was aimed to isolate and identify fungi from seeds of different cultivars of rice from South Tamil Nadu, India.

## Materials and methods

**Collection of samples:** Seeds of 5 rice cultivars viz., Karnataka Ponni, Athisaya Ponni, Culture Ponni, Chellam Ponni and ADT39 were obtained from the various fields of south Tamil Nadu, namely Tuticorin, Thovalai, Tirunelveli, Virudhunagar and Tirumangalam. The seeds were collected in sterilized polythene bags and stored at 4-5°C until used in any treatment.

**Isolation and identification of fungi:** Two standard methods i.e. blotter and agar plate (ISTA 1976) were used for the isolation of fungi from rice seeds. In the blotter paper method, the seeds were surface sterilized using 2.5% bleach NaOCl for 1 min and untreated seeds were placed on moisture blotter paper. In agar plate method, 20 mL of PDA was poured in glass petriplates of 2 cm dia. In each case, 5 treated and untreated seeds were used and replicated 4 times. The petriplates were incubated at 25-27°C ± 2°C under 12 h alternating cycles of fluorescent light and darkness for a week. Fungi were identified on the basis of their typical structure and basic characters as suggested by Barnett and Hunter (1972).

## Results and discussion

**Assessment of grain discoloration:** Incidence of grain discoloration in rice varieties under natural field conditions at various places in TN, India is presented in Table 1. The percent discoloration varied from 28 to 46. Discoloration of grains is an everlasting problem in rice growing countries as it is mainly caused by fungi with the congenial environment. Due to this, there is a loss in weight of grains, nutritive quality and hazardous to consumers, perhaps by the presence of aflatoxins.

**Isolation of pathogen:** *Aspergillus flavus*, *A. niger*, *Penicillium citrinum*, *Alternaria padwickii* and *Rhizopus oryzae* were found associated with the seeds of different varieties of rice.

Table 1. Percent occurrence of discoloration in rice varieties.

Locality	Variety	Discolored grains (%)
Virudhunagar	Karnataka Ponni	46
Tuticorin	Athisaya Ponni	36
Tirunelveli	Culture Ponni	30
Thovalai	Chellam Ponni	28
Tirumangalam	ADT39	41

Table 2. Pathogen associated with discolored rice grains.

Variety	Percentage of association				
	<i>A. niger</i>	<i>A. flavus</i>	<i>Alternaria padwickii</i>	<i>Penicillium citrinum</i>	<i>Rhizopus oryzae</i>
Karnataka Ponni	16.24	18.00	17.50	6.00	2.00
Athisaya Ponni	16.00	15.00	8.00	4.25	0.00
Culture Ponni	15.00	13.00	14.28	8.25	7.50
Chellam Ponni	12.00	12.50	8.25	4.75	1.60
ADT39	17.60	9.25	11.25	5.25	2.50

The frequency of fungal association and occurrence was varied in different varieties of rice seeds. Earlier observations reported the occurrence of *Pyricularia oryzae*, *Alternaria alternata*, *A. padwickii*, *A. longissima*, *Curvularia oryzae*, *C. lunata*, *Drechslera oryzae*, *A. niger*, *Fusarium moniliforme*, *F. semitectum*, *F. oxysporum*, *F. solani* and species of *Phoma*, *Cercospora*, *Chaetomium*, *Sclerotium*, *Penicillium*, *Myrothecium* and *Colletotrichum* from seeds of different varieties of rice (Khan, 2000; Wahid *et al.*, 2001; Javaid *et al.*, 2002; Nguefack *et al.*, 2007). In this study, it was observed that *Aspergillus niger*, *A. flavus*, *Penicillium citrinum*, *Alternaria padwickii* and *Rhizopus oryzae* presence in the seeds of different rice varieties. In Karnataka Ponni, highest percentage (18%) of *A. flavus* association was observed. *Aspergillus niger* showed 17.6% of occurrence in ADT39 followed by 17.5% in Karnataka ponni.

The fungal association with the selected rice varieties is depicted in Table 2. Suleiman and Taiga (2009) reported fungal pathogen as the major cause of reduction in the quality of stored rice when insects and rodents are controlled. Rice growing in the field is contaminated with numerous fungi which include rice blast caused by *Magnaporthe grisea*, rice sheath blight caused by *Rhizoctonia solani*, brown spot caused by *Cochliobolus miyabeanus* and false smut caused *Ustilaginoidia virens* (Nguefack *et al.*, 2007). Stored rice grains are prone to fungal attack, especially at a moderate temperature and high humidity. Spoilage of stored rice is attributed to storage fungi which were introduced during the post-harvest handling process (Javaid *et al.*, 2002). In this study, *Aspergillus niger* was isolated from 3 samples collected from 3 major markets of the study areas. This confirms that the fungus is widely associated with unmilled rice grain and in storage which may result in deterioration in form of discoloration and bad odors may occur with reduction in milling yield due to partly growth of mould and other microorganisms. The isolated fungus was associated with stored rice with varying frequencies in the 5 localities sampled (Table 2). Presence of *Aspergillus* spp., especially *A. niger* and *A. flavus* on seeds of rice in higher frequencies and its association with ungerminated seeds of rice confirmed that species of *Aspergillus* though occur as saprophytes may cause low germination in seeds. A number of fungi isolated in this study are known to produce mycotoxins which are harmful for human health.

Mycotoxins can cause severe damage to liver, kidney and nervous system of man even in low dosages (Rodricks, 1976). *Aspergillus* spp. are common fungal contaminants of cereals and also produces mycotoxins (Bakan *et al.*, 2002; Toth and Teren, 2005). *Aspergillus flavus* produces aflatoxins which were carcinogenic and produce liver cancer (Purchase, 1974; Diener and Davis, 1969; Pesta and Bonday, 1990). So, from the study, it is noted that there is a need for proper storage of rice seed to minimize the fungal infestation and mycotoxin production during storage and provide disease free seeds for human consumption. This study also reveals the presence of diverse mycoflora of both pathogenic and non-pathogenic fungi in rice seeds in ruling varieties and hybrids in Tamil Nadu.

### Conclusion

Five pathogenic fungi, namely *Aspergillus flavus*, *A. niger*, *Penicillium citrinum*, *Alternaria padwickii* and *Rhizopus oryzae* were isolated from different varieties of rice seeds. The study revealed the presence of diverse mycoflora of both pathogenic and non-pathogenic fungi in rice seeds in ruling varieties and hybrids in Tamil Nadu. To conclude, the findings suggest that there is a need for proper storage of rice seed to minimize the fungal infestation and their mycotoxin production in near future.

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