



Mycoflora associated with stored grains and legumes and its public health importance

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*Grains and legumes are stored by the farmers as well as government and semi-government agencies for various purposes. Storage conditions play a significant role in maintaining the seeds viability and provides protection against various contaminants. A study was conducted to determine the fungi associated with wheat (*Triticum vulgare*), rice (*Oryza sativa*), maize (*Zea mays*), soybean (*Glycine max*) and moong (*Vigna radiate*) in storage. Eight different fungi were isolated namely, *Aspergillus niger*, *Aspergillus flavus*, *Aspergillus nidulans*, *Penicillium*, *Rhizopus*, *Fusarium* and *Helminthosporium*. The results of the study revealed that among the fungi isolated, three strains have been reported to produce toxic compounds that may pose a serious threat to human health.*

Key words : Cereals, Legumes, Storage Fungi..

Introduction :In India out of the total production of food grains, about 70% is retained and stored by farmers for consumption, seed, feed and payment of wages. Only about 30% is marketable surplus which is handled by the traders and government agencies (Bedekar & Singh, 1991).

At rural level, seeds are stored mostly from 3 months to 2 years, depending upon the need. Post harvest losses occur both in quantity and quality. During storage these are attacked by insects, rodents and microorganisms especially storage fungi. Apart from this, they are contaminated by the insect excreta and hairs and pellets of rats which may pose a serious threat to human health.

These fungi cause two major problems in storage grains; spoilage due to fungal growth and the production of poisonous mycotoxins (IRRI, 2006). These are classified into field fungi and storage fungi based on the percent relative humidity required for their growth. The field fungi invade the grains (generally limited to the pericarp) before harvest while crop is still in the field, or after the crops have been cut and stacked. They may survive in store grains but cannot grow as long as the grain moisture content is below 20%. Major genera of field fungi (molds) include, *Alternaria*, *Fusarium*, *Cladosporium*, *Curvularia* and *Helminthosporium*. The storage fungi on the other hand, grow in grains with

moisture content in equilibrium with 70-90% relative humidity (minimum moisture content of 13-13.5% in grains). These are the fungi that cause mustiness, heating, kernel damage and various deterioration changes in stored grains and grain products. Several species of *Aspergillus* and *Penicillium* comprise mainly the storage fungi.

The losses from spoilage may be of greater economic significance. Apart from causing spoilage of the grains, some of these species could be of public health importance as they produce mycotoxins which are carcinogenic. From this study an awareness can be created among the consumers on the dangers of consuming poorly stored grains and seeds.

Materials and Method :

The storage fungi were isolated from the stored grain/ legume samples of Wheat (*Triticum vulgare*), Rice (*Oryza sativa*), Maize (*Zea mays*), Soyabean (*Glycine max*) and Moong (*Vigna radiata*) on Potato Dextrose Agar medium.

These samples were surface sterilized in 0.1% mercuric chloride for 2 minutes and rinsed in two changes of sterile distilled water and after drying over the sterile filter paper were plated on Potato Dextrose Agar (PDA) medium at the rate of 5grains/legumes per plate. Twenty five grains/legumes were plated per crop

and the plates were incubated at 26±2°C for two weeks. Subcultures were made from emerging colonies and pure cultures were obtained for subsequent studies. The plates were examined regularly and no plate was discarded as negative until two weeks of incubation. The colonies were examined for their various morphological characteristics, such as, growth, pattern, topography, color (on both sides of Petri plates) and their texture. Finally the fungi were identified, using standard method of identification (Aneja, 2007).

Result and Discussion :

The study revealed that different grains/legumes were infested to various degree with storage and field fungi. A total of eight different fungal strains, including those commonly found in preharvest state, were recorded in the surface sterilized grains/legumes. These were *Aspergillus niger*, *Aspergillus flavus*, *Aspergillus nidulans*, *Penicillium*, *Rhizopus*, *Fusarium* and *Helminthosporium* and an unidentified fungal strain

(Table 1). The morphological characteristics such as, growth, topography, color and texture has been presented in Table 2.

Table 1 : Fungi isolated from five different samples of grains and legumes.

Grains	<i>Aspergillus niger</i>	<i>Aspergillus flavus</i>	<i>Aspergillus nidulans</i>	<i>Penicillium</i>	<i>Fusarium</i>	<i>Helminthosporium</i>	<i>Rhizopus</i>
Rice	-	+	+	-	-	-	-
Wheat	-	+	-	+	-	+	-
Maize	+	-	-	-	-	-	+
Soyabean	-	-	+	+	-	-	-
Moong	+	-	+	-	+	-	-

+ = Positive , - = Negative.

Table 2 : Colony Characteristics of isolated fungi.

Morphology	<i>Aspergillus niger</i>	<i>Aspergillus flavus</i>	<i>Aspergillus nidulans</i>	<i>Penicillium</i>	<i>Fusarium</i>	<i>Helminthosporium</i>	<i>Rhizopus</i>
Colour	Black	Light green with yellow margin	Light Green	Dark green with white margin	Light pink	Grey to brown	Grey
Margin	Regular	Regular	Regular	Regular	Regular	Regular	Irregular
Texture	Powdery	Powdery	Powdery	Powdery	Cottony	Cottony	Wooly
Elevation	Non-Elevated	Non-Elevated	Non-Elevated	Non-Elevated	Convex	Convex	Convex
Opacity	Opaque	Opaque	Opaque	Opaque	Opaque	Opaque	Opaque

The results of this study indicated that species of *Aspergillus* and , *Penicillium* were frequently present in all samples. Three of these isolates were different species of the genus *Aspergillus*. Amadi (2002) also reported 11 fungal species including *Alternaria*, *Aspergillus*, *Fusarium*, *Rhizopus*, *Penicillium* and *Mucor* in *Saccharum officinarum* seeds.

According to Agrios (1978) most of the decay and deterioration of the grains and legumes during storage is caused by several species of *Aspergillus* and *Penicillium*. Mohapatra(1969) reported that the small, light and air borne spores of these fungi are found in the atmosphere throughout the year with significant increase in warm and humid months. Thus, they easily contaminate the grains and seed which provide ideal substrate for their growth, being rich in nutrients. The

contamination usually occurs when the grain or seed is going into storage from the harvest, in handling, during transport or from spores already present in storage structures (IRRI, 2006). Under high temperature and moisture this small amount of inoculum multiplies rapidly and cause spoilage of the grains and seeds.

In storage, if the relative humidity of the air is greater than water activity(a_w) of grains or seeds, they take up moisture, thus increasing their moisture content, and further if the temperature is high, they become susceptible to storage molds. Storage molds can grow over a large range of temperature. On the other hand, if the relative humidity of the air is less than a_w of the grain or seeds, they loose water.

The other fungi i.e. *Helminthosporium*, *Fusarium*,

Rhizopus isolated belong to the field mold group and attack grains and legumes in the field. They require high moisture content in the grain or seed in order to grow and are, therefore unable to grow much in storage since the grain or seed is stored at a moisture content of 12-14% (Agrios,1978).

Apart from the economic loss due to spoilage, these fungi could be of public health importance too. Persons handling grains contaminated with *Aspergillus* spores may become prone to respiratory infection. Sandhu et. al, (1966) reported four cases of bronchopulmonary aspergilloma. They isolated *Aspergillus fumigatus*, *Aspergillus niger* and *Aspergillus japonicus* from the sputum and lung tissue. Further, toxic compounds are produced by fungi such as, *Aspergillus*, *Penicillium*, *Fusarium* (Agrios,1978), which may have a negative impact on the immune system, not only when they are present in relatively high concentration, but perhaps even more by their constant presence in food and feed consumed.

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