

Mycoflora Associated with Rice Grains Stored in Rice Mills and Warehouses

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Rice (*Oryza sativa* L.) is stored in the form of paddy or rough rice, milled raw rice, milled boiled rice, bran or broken grain by governmental organizations like, Central Warehousing Corporation, Food Corporation of India, private traders as well as millers. Due to poor storage conditions and shortage of storage space in godowns, food grains are often stored in open, covered with thick black polythene sheets, which leads to heavy quantitative and qualitative loss of food grains [1-4]. Present study was undertaken to evaluate the quality in terms of grain moisture and associated fungal flora of rice grains of different types stored in different rice mills, FCI and warehouse godowns at the time of collection, and after storage under ambient conditions.

Eighty-one rice grain samples of white rice, brown rice and paddy of both Basmati and Non-Basmati types were collected from rice mills, FCI and state warehouse godowns from different regions of India. The moisture content and per cent incidence of mycoflora of the collected samples was estimated by hot air oven and blotter methods, respectively [5] at the time of collection and again after storage of samples for different durations under laboratory ambient conditions.

The moisture content in different rice samples varied from 8.9 to 15.2 per cent at the time of storage, which got decreased after storage under ambient conditions and varied from 9.5 to 12.5 per cent. The occurrence of fungi varied from 12 in sample 20 and 21 collected from rice mills located

at Karnal to 157 in sample 73 collected from a seed processing unit at Kanchipuram in South India, at the time of storage. After storage for different durations under ambient conditions the incidence of mycoflora got reduced to zero per cent in 22 samples of rice and highest incidence (108) was recorded in sample 32 collected from FCI, Karnal.

Rhizopus stolonifer (33.2%), *Drechslera oryzae* (10.2%) and *Aspergillus flavus* (6.8%) were the main fungi recorded. The other mycoflora comprised mainly of *Curvularia lunata*, *Alternaria padwickii*, *Fusarium* sp., *Penicillium* sp., *Aspergillus niger*, *A. fumigatus*, etc. (Table 1). However, all the fungi were not found associated with all the rice samples. The field fungi disappeared during storage and only storage fungi were found associated with stored rice grains (different types) in the mills/godowns. Analysis of rice samples collected from storehouses, grain retailers and warehouses in different states showed the presence of various fungal species [6-9].

The incidence of mycoflora on rice grains of (different types) was 76.04 per cent at the time of storage, which got reduced to 23.96 per cent after storage due to reduction in the grain moisture. The incidence of mycoflora in rice grains of basmati type was 13.62 per cent as against 62.43 per cent in rice grains of non-basmati type at the time of storage but after storage it got reduced to 0.04 and 19.66 per cent, respectively, recording a 13.58 and 42.77 per cent reduction in basmati

Table 1. Incidence of some fungi associated with rice grains in different rice types

Fungi	Incidence at the time of storage (%)	Incidence after storage (%)
<i>Alternaria alternata</i>	1.4	-
<i>Alternaria padwickii</i>	1.0	-
<i>Aspergillus flavus</i>	6.8	1.3
<i>Aspergillus niger</i>	0.6	0.4
<i>Aspergillus sp.</i>	0.4	0.5
<i>Chaetomium sp.</i>	0.1	-
<i>Cladosporium sp.</i>	0.4	-
<i>Curvularia lunata</i>	1.9	-
<i>Drechslera oryzae</i>	10.2	-
<i>Epicoccum sp.</i>	0.3	-
<i>Fusarium sp.</i>	0.2	-
<i>Penicillium sp.</i>	1.5	1.2
<i>Rhizopus stolonifer</i>	33.2	20.2

and non-basmati rice types, respectively. A low incidence of mycoflora and low grain moisture was recorded on paddy as against rice grains. Amongst the white rice, brown rice and paddy types the reduction in the incidence of mycoflora was 29.02, 8.25 and 19.45 per cent, respectively after storage. The moisture content of rice grains after storage also decreased by 0.5 to 0.9 per cent in rice samples of different types (Table 2). The decrease in the

Table 2. Effects of storage on incidence of mycoflora and moisture in different rice types

Rice type	Per cent mycoflora		Per cent grain moisture	
	At the time of storage	After storage	At the time of storage	After storage
Basmati	13.62	0.04	11.4	10.9
Non-basmati	62.43	19.66	11.8	10.9
White rice	43.98	14.96	11.9	11.1
Brown rice	11.16	2.91	11.7	11.2
Paddy	25.54	6.09	11.3	10.9

fungal incidence is possibly due to decrease in the moisture content of rice grains during storage. Rice grains were stored on the shelves under laboratory conditions, which had proper aeration, and so the temperature and the humidity did not exceed a critical level. The moisture content of the rice grains at the time of collection was low in most of the samples and did not support development of mold fungi in high intensity. Milner et al. [10] found no increase in molds in wheat seed stored at moisture content <14.5 per cent. The molds are responsible for respiration, heating and chemical deterioration of the grains stored commercially. The critical moisture values, where respiration increases rapidly and biochemical changes become more pronounced correspond to the minimum relative humidity (75%) at which molds normally present on and in the grains will grow. However, suppression of mold growth prevents the deterioration of grains, which invariably occur at favourable temperatures when grain is stored at moisture levels exceeding the critical values.

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