

# Seed Borne Mycoflora of Maize (*Zea mays* L.) Seeds

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## Abstract:

Maize (*Zea mays* L.) is a cereal crop widely cultivated throughout the world. Maize crops are attacked by a number of pathogen in which many are seed-borne. Seed borne pathogen causes losses in seed quality and quantity. The mycoflora reduces the germination and seedling vigor.

The present study has provided information to compare species diversity between untreated and treated maize seed varieties. Mycological analyses showed a predominance *Aspergillus flavus*, *Aspergillus niger*, *Alternaria alternate*, *Fusarium moniliforme*, *Drechslera longirostrata* and *Rhizopus nigricans*. These fungal species were known to cause deterioration of maize seeds and due to the toxins they potentially produce has great impact on humans and animals.

## Introduction:

Maize (*Zea mays*) is one of the most versatile, emerging crops having wider adaptability under varied agro-climatic condition. Globally maize is known as queen of cereals because it is having the highest genetic field potential among the cereals. Maize is the third most important food crop in the world. (IITA, 2005). It is cultivated on nearly 190 million ha area in 165 countries having wider diversity of soil, climate, biodiversity and management practices and it contributes 39% in the global grain production. In India, maize is grown throughout the year; it is predominantly a kharif crop with 85% of the area under cultivation in the season. Karnataka is the leading producer of maize in India producing around 16% of India's total maize production. Maharashtra stands uniquely in the 5<sup>th</sup> position in the top 10 list of largest maize producing states in India.

Maize gets affected by number of diseases caused by fungi, bacteria and viruses. Many fungal species are reported to be seed-borne. The mycoflora has been studied by seed health management /testing method such as blotter paper method (Doyer, 1938), Study and isolation of seed borne fungi by rolled towel method and seed wash method (ISTA, 1996), Agar plate method (Malone and Musket, 1997). Many pathogenic fungi affect the disease during germination of seed. Seedling infection of rice due to *Rhizoctonia solani* screened by Kannayan and Prasad (1981). Several seed-borne mycobiota have been reported also to contaminate maize grains with hazardous metabolites implicated in several form of allergies, birth defects, cancers and even death in livestock and humans (Enyjukwu et.al.2014). Number of different genera of fungi is associated with maize seed like *Penicillium*, *Diplodia*, *Botrytis*, *Fusarium*, *Aspergillus*, *Rhizopus*, *Curvularia* and *Botrydipodia* have been variously documented (Kiran et. al. 2010; Debnath et. al. 2012; Hussain et. al. 2013). *Aspergillus* and *Fusarium* species are the most predominant fungi which infecting seed germplasm (Askun 2006, Fandohan et. al. 2003, Anne et. al. 2000. Curtui et. al. 1998, and Susan et. al. 2005).

The aim of this study is to isolate and identify the fungi associated with Maize grains in Latur area and to establish the species of the genera which will record high distribution percentage.

## Materials and Methods :

**Collection of seed samples:** Maize (*Zea mays*) seed samples of two variety Mahindra and Gruhalakshmi were collected from different talukas of Latur district during 2017-2018. Samples were brought to the laboratory in sterile cotton bags and kept at room temperature.

**Mycological analysis:** The seed-borne fungi of maize seeds were detected by blotter paper method and agar plate method as recommended by International Seed Testing Association. (ISTA, 1996).

**Isolation of Seed Mycoflora and Germination of Seeds:** Two different seed health testing method like blotter paper and agar plate method were used for estimation of seed mycoflora associated with maize seed samples. Mahindra and Gruhalakshmi variety of maize seed samples are treated with .01% mercuric chloride (Hgcl<sub>2</sub>). The germination of seed percent of treated and untreated seed were calculated. The fungi associated on seed surface and inner shows different changes in seeds. Different fungal colonies grown on untreated and treated maize seeds were calculated and percent infection assessed.

$$\text{Total fungal colonies (\%)} = \frac{\text{No of seeds colonized in each plate by a particular species}}{\text{Total no. seed in each plate}} \times 100$$

## Result and Discussion :

In the present investigation, mycological examination of the maize variety seeds were carried out for four months i.e. November and December 2017, January and February 2018. The seeds were tested for association internal as well as external fungi. The attack of different fungi on seeds shows different changes such as reduction in seed germination, discoloration of coat, loosening seed coat, bristling of seed coat and reduction in the length of radicals and plumule was studied.

### Blotter Paper Method for Maize variety.

**Table 1:** Mycoflora associated with untreated maize seed on Blotter paper.

Sr. No.	Type of Seed	Variety	% of incidence	% of germination	Length of radicals (cm)	Length of plumule (cm)	Fungi associated
1.	Red Maize	Mahindra	80	20	1	2.5	<i>A. flavus</i> <i>A. niger</i> <i>A. candidus</i>
2.	White Maize	Gruhalakshmi	90	35	1.1	5	<i>A. flavus</i> <i>A.niger</i> <i>Fusarium</i> <i>Alternaria</i>

**Table 2:** Mycoflora associated with treated maize seed on Blotter paper.

Sr. No.	Type of Seed	Variety	% of incidence	% of germination	Length of radicals (cm)	Length of plumule (cm)	Fungi associated
1.	Red Maize	Mahindra	20	85	1	1.5	<i>A. flavus</i> <i>A. niger</i> <i>A. candidus</i>
2.	White Maize	Gruhalakshmi	25	70	0.7	1	<i>A. flavus</i> <i>A.niger</i> <i>Fusarium</i> <i>Alternaria</i>

**Table 3:** Fungi wise percentage incidence of mycoflora on Blotter paper.

Sr. No.	Fungi Associated	% of Seed incidence		Damage caused by the fungus to seed
		Mahindra	Gruhalakshmi	
1.	<i>Aspergillus flavus</i>	30	24	Discoloration of seed and seed germination is reduced.
2.	<i>Aspergillus niger</i>	14	11	Discoloration of seed and loosening of seed coat.
3.	<i>Aspergillus candidus</i>	15	15	Inhibition of seed germination.
4.	<i>Fusarium moniliforme</i>	45	40	Discoloration of seed and loosening of seed coat.
5.	<i>Alternaria alternata</i>	50	40	Discoloration of seed and loosening of seed coat.
6.	<i>Drechslera longirostrata</i>	44	40	Discoloration of seed and loosening of seed coat.

**Agar Plate Method for Maize variety.****Table 1:** Mycoflora associated with untreated maize seed on Agar plate.

Sr. No.	Type of Seed	Variety	% of incidence	% of germination	Length of radicals (cm)	Length of plumule (cm)	Fungi associated
1.	Red Maize	Mahindra	100	20	0.9	1.1	<i>A. flavus</i> <i>A. niger</i> <i>A. candidus</i> <i>Drechslera</i>
2.	White Maize	Gruhalakshmi	70	35	1.1	1.4	<i>A. flavus</i> <i>A.niger</i> <i>Fusarium</i> <i>Alternaria</i>

**Table 2:** Mycoflora associated with treated maize seed on Agar plate.

Sr. No.	Type of Seed	Variety	% of incidence	% of germination	Length of radicals (cm)	Length of plumule (cm)	Fungi associated
1.	Red Maize	Mahindra	10	90	1	2.1	<i>A. flavus</i> <i>A. niger</i> <i>Fusarium</i> <i>Rhizopus</i>
2.	White Maize	Gruhalakshmi	40	70	1.1	2.2	<i>A. flavus</i> <i>A.niger</i> <i>Fusarium</i>

**Table 3:** Fungi wise percentage incidence of mycoflora on Agar plate.

Sr. No.	Fungi Associated	% of Seed incidence		Damage caused by the fungus to seed
		Mahindra	Gruhalakshmi	
1.	<i>Aspergillus flavus</i>	20	15	Discoloration of seed and seed germination is reduced.
2.	<i>Aspergillus niger</i>	15	10	Discoloration of seed and loosening of seed coat.
3.	<i>Fusarium moniliforme</i>	30	35	Discoloration of seed and loosening of seed coat.
4.	<i>Alternaria alternata</i>	20	25	Discoloration of seed and loosening of seed coat.
5.	<i>Drechslera longirostrata</i>	10	24	Discoloration of seed and loosening of seed coat.
6.	<i>Rhizopus nigricans</i>	10	15	Discoloration of seed and loosening of seed coat.

Seeds of two maize varieties viz. Mahindra and Gruhalakshmi were analysed for seed health as per ISTA (1996) by standard blotter paper and agar plate method.

In present investigation six seed borne fungal pathogen viz. *Aspergillus flavus*, *Aspergillus niger*, *Alternaria alternata*, *Fusarium moniliforme*, *Drechslera longirostrata* and *Rhizopus nigricans* were recorded in selected seed. We observed that considerable number of seed borne fungal pathogen belonging to *Aspergillus* and *Fusarium*. In untreated seeds the percentage of incidence of fungi in Mahindra variety and Gruhalakshmi were recorded 80 and 90 % respectively, where as the percentage of seed germination were recorded 20 and 30 respectively. The fungi associated on seed surface are *Aspergillus flavus*, *Aspergillus fumigates*, *Rhizopus nigricans*, *Fusarium moniliforme*, *Alternaria alternata* and *Drechslera longirostrata* etc., the percent of incidence on the seed surface is dominant *Aspergillus flavus*, *Fusarium moniliforme*, *Drechslera longirostrata* and *Alternaria alternata* as compared to other fungi. *Rhizopus nigricans* and *Aspergillus fumigates* fungal

species is also very less, attack of these fungi on seed surface of maize the seed surface shows different changes such as reduction in seed germination, discoloration of seed coat, loosening of seed coat, bristling of seed coat, reduction in the length of radicals and plumules. In treated seeds, the percentage of seed germination in Mahindra and Gruhalakshmi were 80 and 90 respectively, whereas the percentage of fungal incidence was reduced up to 20 and 25 respectively. The fungi associated with seed surface are *Aspergillus niger*, *Aspergillus flavus* and *Rhizopus nigricans* etc, both percent of incidence. Seed surface covers more in *Aspergillus niger* and *Aspergillus flavus* than other fungi and it is less in *Rhizopus nigricans* when these seeds are treated with fungicides like 0.1% HgCl<sub>2</sub> (Mercuric chloride) percentage of incidence of fungi on seed surface is less or they are sometimes completely disappeared. Treatment of 0.1% HgCl<sub>2</sub> increases percentage of seed germination, length of radicals and plumule also increases. The dominant fungi which are covered on seed surface show some changes on seed surface such reduction in seed germination, discoloration of seed coat, loosening of seed coat, brightening of seed coat reduction in the length of radicals and plumules.

In Agar plate method percent of untreated seed germination in Mahindra and Gruhalakshmi were 20 and 35 respectively. The percentage of fungal incidence was 100 and 75 respectively. The fungi associated on seed surface are *Aspergillus niger*, *Aspergillus flavus*, *Aspergillus fumigates*, *Fusarium moniliforme*, and *Drechslera longirostrata* etc. The percentage of incidence on seed surface is dominant with *Aspergillus niger*, *Aspergillus flavus*, *Fusarium moniliforme*, *Drechslera longirostrata* and *Alternaria alternate*. The attack of *Drechslera longirostrata* and *Aspergillus fumigates* is also very less. When these different fungi attacked on seed surface of maize then damaged the seed and show changes, loosening of seed coat, reduction in seed germination i.e. length of radicals and plumule is reduced, discoloration of seed coat and brightening of seed coat. In treated seeds the percentage of seed germination of Mahindra and Gruhalakshmi were 90 and 70 respectively. Whereas percentage of fungal incidence was recorded at 10 and 40 respectively. The fungi associated on seed surface are *Aspergillus niger*, *Aspergillus flavus*, *Fusarium moniliforme* etc. both the percentage of incidence and percentage of seed surface cover is more in *Aspergillus niger*, *Aspergillus flavus*, *Fusarium moniliforme*, *Drechslera longirostrata* and *Alternaria alternate*. Whereas percentage incidence of *Rhizopus nigricans* is very less percentage. When these seeds are treated with 0.1% HgCl<sub>2</sub> increased percentage of seed germination, length of radical and plumule also increase. The dominant fungi covered on seed surface *Aspergillus niger*, *Aspergillus flavus* which damages seed surface and causes loosening of seed coat, discoloration of seed surface.

Maize crops are attacked by a number of pathogen in which many are seed-borne. Seed borne pathogen causes losses in seed quality and quantity. The mycoflora reduces the germination and seedling vigor. The detection of seed-borne pathogenic fungi and seed disease management. Determining the presence of seed-borne pathogen allows to apply the appropriate controls or modifying management practices to avoid the problems in future.

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