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Mould and Mycotoxin Contamination in Maize Grains

Shyam Govind Singh
Assistant Professor,
Deptt. of Botany,
Agra College,
Agra, U.P., India

Abstract

Investigations revealed the presence of 35 fungal species. Out of which 20 fungal species from preharvest, 24 fungal species from post harvest and 34 fungal species from stored samples maize were recorded. *Fusarium* species were much frequently and abundantly present during winter season in comparison to summer and rainy seasons. A total of species of *Fusarium* were recorded from maize grains during winter summer and rainy seasons. Highest percentage frequency was noted in case of F. moniliforme (45.28%) during winter season.

Keywords: Myocotoxins, Fumonisins, Zea mays L.

Introduction

Depending upon the time of invasion of the fungi christensen (1957) divided the fungi in two groups, (a) field fungi and (b) storage fungi. Field fungi are the predominant fungi, which invade the developing or mature seeds while it is still attached to the parent plant. On the other hand storage fungi are those, which get associated with seeds during storage. Nearly 150 species of fungi have been found to be associated with seeds of various crops (Christensen and Kauf mann, 1969). Among these, species of *Aspergillus Penicillium* and *Fusarium* are more frequent and abundant.

Fusarium moniliforme is one of the most prevalent seed borne fungi associated with corn (Zea mays L.) Further, *Fusarium* Species produce a variety of mycotoxins with widely divergent biological and toxicological effects in humans and animals consuming the infected grains (Marasas, 1994). Fumonisins are a group of recently discovered mycotoxins that are produced primarily by *F. moniliforme* (Gelderblom et. al., 1998).

Aim of the Study

In the present study association of different species of *Fusarium* with pre and post harvest sample of maize grains was studied.

Materials and Methods

The maize grain sample of preharvest post harvest and stored conditions were collected from different places and screened for the association of moulds following seed plating method (ISTA, 1966) using potato dextrose agar media. From one sample, 400 seeds were taken and plated @ 5 seeds/ plate.

Composition of Potato Dextrose Agar Medium

Potato starch	-	500 ml
Sucrose	-	20 gm
Agar-agar	-	20 gm
Distilled water	-	1000 ml

The petriplates were kept in sterilized polythene bags and incubated at 28±2^{0}C for 6 to 7 days. After incubation, the seeds were examined and studied for the presence of different moulds. The percent frequency and average abundance were calculated following Weaver and Clements (1938):

Results and Disscussion

In the present investigations, 151 samples (52 preharvest, 45 post harvest and 54 stored) of maize grains were collected from different places of Agra region and subsequently screened for the moulds infestation.

In all 35 fungal species were found to be associated with these maize grain sample however 20, 24 and 34 fungal species were recorded from the maize grains, during perharvest, postharvest and stored conditions respectively (Table 1). These 35 fungal species include 11 species of *Aspergillus,* 7 species of *Fusarium*, 3 species of *penicillium*, 2 species of *Alternaria* and one species each of *Acremonium*, *Bipolaris,*

Botryotrichum, Chaetomium, Cladosporium, Curvularia, Helminthosporium, Mucor, Rhizopus, Trichoderma and Verticillium.

The perharvest and postharvest samples showed the presence of 5 species of *Fusarium* while stored samples of maize grains have revealed the presence of 7 species of *Fusarium.* These included F. *equiseti,* F. *moniliforme*, F. *oxysporum,* F. *roseum*, F. *semitectum*, F. *sporotrichioides* and F. *solani*, out of which F. *equiseti* and F. *solani* could not exist in preharvest and post harvest samples. It has also been noted that *Fusarium* species were much frequently and abundantly found during winter season followed by summer and rainy seasons (Table 2).

In the preharvest maize sample, F. *semitectum* had maximum abundance of 3.14 followed by F. *roseum* (2.76), F. *oxysporum* (2.59), F. *moniliforme* (2.00) and F. *sporotrichioides* (1.35). Interestingly F. moniliforme showed maximum frequency (25.00%) in preharvest condition.

Among all the *Fusarium* species in post-harvest maize grains, the maximum abundance was of F. *semitectum* (2.52) followed by F. *oxysporum* (2.45), F. *moniliforme* (2.35). F. *roseum* (2.00) and F. *sporotrichioides* (1.90) Highest percentage frequency was noted in case of F. *moniliforme* (Table 2)

In stored samples, out of 7 species of *Fusarium* F. *oxysporum* was most abundantly present showing abundance of 3.00 during winter season, followed by F. *moniliforme* (2.84), F. *Roseum* (2.06), F. *semitectum* (1.97), F. *sporotrichioides* (1.60), F. *equiseti* (1.50), F. *solani* (1.40). Further, F. *moniliforme* showed maximum percentage frequency (45.28%) in stored maize grains.

In summer season, F. *oxysporum*, F. *semitectum*, F. *moniliforme*, and F. *roseum* showed abundance of 2.70, 1.80, 1.29 and 1.58 respectively. However F. *semitectum* showed maximum (35.84%) and F. *moniliforme* Showed minimum (3.77%) percentage frequency.

The perusal of table 2 indicates that 5 species of *Fusarium* including F. *moniliforme*, F. *semitectum*, F. *oxysporum*, F. *roseum*, F. *sporotrichioides* showed abundance 2.20, 2.14, 2.00 1.70 and 1.20 respectively during raining season. However, F. *moniliforme* showed least percentage frequency (7.40%) during this season.

Few reports regarding mycoflora of maize grain sample are available. Logrieco et. al., (1995) collected forty two samples of maize from Italy and examined for the relative incidence of *Fusarium proliferatum* and its toxigenicity, this study revealed that F. *proliferatum* (34%), together with F. *moniliforme* (54%) were the predominant species in infected ear kernels. Julian et. al., (1995) analysed sixty nine sample of maize and analysed for fungal apollage on artificial media. The major components of ear rot complex were *Fusarium moniliforme, penicillium* species, *Stenocarpella maydis*, *S. macrospora* and *Acremonium* species.

Marin et. al., (1998) studied that F. *moniliforme* and F. *proliferatum* were very competitive and dominant against the *Penicillium* species and *Asperfillus flavus*, He also found that F. *moniliforme* and F. *proliferatum* demonstrated dominance against all species over a range of temperature and (0.994 to 0.96 aw). At lower at levels they were less competitive.

Previous work has already been done on the ability of *Fusarium* species to grow and produce, fumonisins under different at temperature conditions (Alberts et. al., 1990; LeBars et. al., 1994; Cahagnier et. al., 1995; Marin et. al., 1995a; Marin et.al., 1995b).

Conclusion

It may be concluded from these findings, that F. *moniliforme* exists both in standing crop and storage, which can lead to fumonisim mycotoxin production in grains.

Table 1: Distribution of Mycoflora associated woth maize grains during preharvest, Postharvest and storage conditions.

S. No.	Name of Fungi	Preharvest (52 Samples)	Preharvest (45 Samples)	Storage (54 Samples)
1.	*Acremonium vitis*	-	-	+
2.	*Alternaria alternate*	+	+	+
3.	*A. tenuis*	-	-	+
4.	*Aspergillus candidus*	-	+	+
5.	*A. Flavus*	+	+	+
6.	*A. fumigatus*	-	-	+
7.	*A. japonicus*	-	-	+
8.	*A. niger*	+	+	+
9.	*A. ochraceus*	-	-	+
10.	*A. sydowi*	-	-	+
11.	*A. sulphureus*	-	-	+
12.	*A. tamarii*	-	+	+
13.	*A. terreus*	+	+	+
14.	*A. ustus*	-	+	+
15.	*Bipolaris specifera*	+	+	+
16.	*Botryotrichum sp.*	+	+	+
17.	*Chaetomium globosum*	+	-	-
18.	*Cladosporium herbarum*	-	+	+
19.	*Curvularia lunata*	+	+	+

20.	*Fusarium equiseti*	-	-	+
21.	*F. moniliforme*	+	+	+
22.	*F. oxysporum*	+	+	+
23.	*F. roseum*	+	+	+
24.	*F. semitectum*	+	+	+
25.	*F. sporotichioides*	+	+	+
26.	*F. solani*	-	-	+
27.	*Helminthosporium microsporum*	+	+	+
28.	*Mucor sp.*	+	+	+
29.	*Penicillium chrysogenum*	+	+	+
30.	*P. citrinum*	+	+	+
31.	*P. expansum*	-	-	+
32.	*Rhizopus sp.*	+	+	+
33.	*Trichoderma viride*	+	-	+
34.	*T. roseum*	-	+	+
35.	*Verticillium albo-atrum*	+	+	+
	TOTAL NO. OF MOULD SPECIESL OCCURRED	20	24	34

+ Denotes Presence of mould species in samples
- Denotes absence of mould species in samples

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