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A Brief Study on the Effect of Aflatoxin B_1 on the germination of Maize seed

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Abstract

Maize is an important cereal crop for domestic markets as well as foreign trade in several developing countries. In India, it is the most valuable cash crop. *Aspergillus flavus is* commonly present in the soil. It produces a highly carcinogenic toxin called aflatoxins which are health hazardous to animals. Due to the presence of *A. flavus*, aflatoxin affected the germination of maize (*Zea mays L.*). There are vast economical losses due to aflatoxin infection in maize seeds. During the investigation, Study was done about the contamination during the germination of maize seeds and the expected trial steps of elimination from infection of aflatoxinB1, Aflatoxin B1 (AFB_1) produced by *A. flavus* linked with seed affect amylase activity that inhibits the starch hydrolysis and consequent unavailability of sucrose to the axis of the embryo during the period of imbibition and investigation about the effect of Moringa leaf Extract on that type of seeds.

Keywords: Maize. Aflatoxin, Aspergillus, amylase activity. starch hydrolysis.

Introduction

Maize (*Zea mays*) also known as corn in North America and Australian English is a cereal grain first demonstrated by indigenous people in Southern Mexico about 10,000 years ago. It is one of the most important cereal crops in the human diet and animal feed worldwide (Wu Guclu 2012). There are advancements in corn genetics, breeding, and agronomic technologies that have resulted in a tremendous increase in corn yield (Chavas et al.2014). climate change has emerged as a global concern for food security and food safety. In this respect, the effects of climate change on the yield and quality of food crops are directly related to any alteration in the scheduled life cycle of the maize plant. Aflatoxin infection is common in the maize seed that hinders crop production. It is a naturally occurring toxin produced by Aspergillus flavus. The fungus is recognized as gray-green or yellow-green mold growing on the corn kernel either in the field or in storage. There are so many causal factors that are responsible for the infection with A. flavus producing aflatoxin are very hazardous directly or indirectly to warm-blooded animals The word aflatoxin came from Aspergillus flavus toxin because A. flavus and A. parasitics are the predominant producers of aflatoxin (Yu et al.,2004). The *A. flavus* Link (Ascomycota, Eurotiales), is a pervasive contaminant of agricultural produce (J.W. Bennet and S. kale, 2007). These are highly toxic secondary metabolites derived from polyketides produced by fungal species such as *A. flavus*, *A. parasiticus*, and *A. nomius* (Payne and Brown,1998). Aspergillus is a common mold in tropical and subtropical countries. These were first discovered and characterized in the early 1960s when more than 10000 Turkeys poults in England died. two toxic components of aflatoxin AFB and AFG were identified

on the thin layer chromatography plates because of their blue-green fluorescence under ultraviolet light, respectively (Sargeant et al.1963). Aflatoxins are considered not only hazardous for humans but also for animals. They can cause different acute and chronic diseases. Aflatoxicosis is a type of poisoning associated with the extensive consumption of *Aspergillus* species, mainly *A. flavus* in the form of spores or contaminated food that can cause chronic or acute aflatoxicosis in humans and animals. Chronic aflatoxicosis includes liver cancer, human hepatic cell carcinoma, and reduced immunity, acute aflatoxicosis includes high fever, vomiting, ascites, liver failure, and jaundice with a high mortality rate compared to chronic aflatoxicosis (Dhansekaran;2011). It is not to be confirmed what are the accurate values of the aflatoxin concentration that causes aflatoxicosis; however, with the help of a few studies, it is to be expected that generally 1000 µg/kg of aflatoxin concentration in food can cause aflatoxin toxicity in humans (WHO;2018). Whereas in the case of animals, a tolerable amount is 40–200 µg/kg (Grace D.;2015). Major outbreaks of aflatoxicosis were reported in India and Kenya in 1974 and 1981, respectively. It is evaluated that 500 cases and 200 deaths have occurred due to aflatoxicosis worldwide since 2004 (Kumar P., Mahto D.K.;2017).

Aflatoxin and Maize Plant Health

The aflatoxin problem is a postharvest problem, it was known in the past 80s, but it was cleared through a variety of investigations that these problems also arise due to a lack of proper storage and storing techniques. According to some surveys and reports about this, the causal factors are available in the soil thus the problem is also a preharvest problem. Groundnut is at high risk due to aflatoxin contamination is understood through the different surveys in different parts of India (Ghewande et. al., 1989; Sahay and Ranjan, 1990; Kohle et al., 1994). Climate change has caused the alteration of fungal strain distribution and their associated mycotoxin that grow in maize cultivation with different growing seasons. Kos et. al. (2018) concluded that increased aflatoxin levels in maize are mainly due to climatic extremes such as severe drought and high summer temperatures. Study on Effect of aflatoxin contamination in maize seed and observations of treatment with plant extracts of order cruciferales (*Moringa olifera*) leaf juice during seed germination.

Material and Methodology

Aflatoxin-infected maize seeds were collected from the field of Mahishi block of Saharsa district (Supaul)(Bihar) in **June-July 2022**. Preparation of Moringa leaf juice was done through the collection of fresh and healthy green leaves of the order cruciferales drumstick (*Moringa orifera*) were crushed to a fine pulp. The juice was collected by pressing the pulp of moringa leaf and heated at 95^0C. After this, filtration was done and the filtrate (0.2%) was used for further study.

Treatment of seeds with Moringa Leaf Extract

Maize seeds which were infected with aflatoxin B1 were at first surface sterilized by 0.1% $HgCl_2$ solution, washed repeatedly with distilled water, and shade dried. Sterilized seeds were soaked for 10 hrs. in 200ppm Moringa leaf extract. The treated seeds were allowed to germinate in five replicates. Some seed germinations were also allowed to germinate at 28 ± 2^0C. Data for the rate of germination, seedling growth, and enzyme activities were recorded after ten days of sowing for both treated and untreated seeds.

Results and Discussion

The effect of Moringa leaf Extract on the germination of aflatoxin-infected maize seeds was clearly shown in **data 1** given below. There was an increase in the rate of seed germination and seedling growth. Moringa leaf Extract is full of protein, β-carotene, vitamin B1, and Vitamin C. Vitamin C (Ascorbic acid) causes a significant inhibition in aflatoxicosis (Bilgrami et al. 1983). Some crucifer plant extracts also inhibited the aflatoxin biosynthesis and growth of *Aspergillus flavus* (Kumar, Mishra& Tiwari,1993). According to the data investigation after treatment with moringa leaf extract to the maize seed there was about a 67%,40%, and 33.3% increase in the rate of germination, shoot length, and root length respectively. After this application, there was a significant increase in imbibition rate that was profitable for seed germination.

Treatments	**Seed-Germination**	**Shoot-Length**	**Root-Length**
Control	37.1±1.2	5.3±0.58	8.1±0.27
Moringa Leaf Juice	94.2±1.6	9.6±0.04	10.92±0.68

Conclusion

Donil and Dauda, 2003 recommended aqueous moringa seed extract (AMSE)as a fungicide which potentially reduced the growth of *A. niger, A. flavus, Rhizoctonia stolonifera, and Mucor* species in groundnut. According to my study moringa leaf extract is very much influential in aflatoxin-infected maize seed germination.

References

Bassappa, S.C. (1983) Mycotoxins in food and feeds. In: Bilgrami, K.S., Prasad, T. and Sinha, K.K., Eds, *The Allied Press*, Bhagalpur, 251-275

Chatterjee, D. 1988. Inhibitory effects of aflatoxin B1 on amylase of maize seed. Letters in *Applied Microbiology*. 7: 9- 11.

Chavas JP, Shi G, Lauer J. *The effects of GM technology on maize yield. Crop Science*. 2014; 54:1331-1335

Dhanasekaran, D.; Shanmugapriya, S.; Thajuddin, N.; Panneerselvam, A. Aflatoxins and aflatoxicosis in humans and animals. In *Aflatoxins: Biochemistry and Molecular Biology*; Guevara-González, R.G., Ed.; BoD–Books on Demand: London, UK, 2011; Volume 10, pp. 221–254.

Grace, D.; Lindahl, J.F.; Atherstone, C.; Kang'ethe, E.; Nelson, F.; Wesonga, T.; Manyong, V. *Aflatoxin Standards for Feed. Building an Aflatoxin Safe East African Community Technical Policy Paper 7*; International Institute of Tropical Agriculture: Ibadan, Nigeria, 2015

Kumar, P.; Mahato, D.K.; Kamle, M.; Mohanta, T.K.; Kang, S.G. Aflatoxins: A global concern for food safety, human health, and their management. *Front. Microbiol.* 2017, *7*, 2170.

Kumar, R., Mishra, A. K., Dubey, N. K. and Tripathi, Y. B. 2007. Evaluation of Chenopodium ambrosioides oil as a potential source of antifungal, antiaflatoxigenic, and antioxidant activity. *Int. J. Food Microbiol.* 115: 159-164.

Payne, G.A. and Brown, M.P. (1998) *Genetics and Physiology of Aflatoxin Biosynthesis*. Annual Review of Phytopathology, 36, 329-362.http://dx.doi.org/10.1146/annurev.phyto.36.1.329

Sargeant, K.; Carraghan, R.B. & Allcroft, R. (1963). Toxic products in groundnuts. *Chemistry and origin. Chem. And Ind*, pp.53-55

World Health Organization (WHO). *Aflatoxins*; WHO: Geneva, Switzerland, 2018

Wu Guclu 2013. Wu F, Guclu H. Aflatoxin regulations in a network of global maize trade. *PLoS ONE*. 2012;7(9):e45141. doi: 10.1371/journal.pone.0045151.

Yu et al.2004 Yu J, Whitelaw CA, Niermann WC, Bhatnagar D, Cleveland TE, Aspergillus flavus expressed sequence tags for identification of genes with putative roles in aflatoxin contamination of crops. FEMS Microbial Letters. 2004; 237(2):333-334