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Detection of Seed Borne Fungi on Market Storing Sorghum (*Sorghum Bicolor* L.) Seeds in Mogadishu, Somalia

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Abstract The seed-borne fungi are serious parasitic pathogen that invades the quality and health of seeds. The objective of this study was to determine dominant seed-borne fungi in market stored sorghum seeds in Mogadishu Somalia. Health seeds acts an important role in successful farming, the detection of a crop Fungi are the main part of microflora connected with seeds. **Methods.** The study design was experimental research using standard blotter methods, the study was conducted in Mogadishu, the capital city of Somalia. Four samples of sorghum seeds were collected 250gs per sample from different market place In Mogadishu, like Bakara Market, Suuqbacad market, Seybiyano Market, and Dayniile market, the samples were used for the finding of seed-borne fungi. The first group was washed with distilled water and rubbed before planting, while the second group was not washed directly planted. Five hundred seeds were put on wet plastic soft tissue and then placed in a Petri dish at the rate of 25 seeds/plate. **The result:** The totality of positive sample in all seeds (n=100 washed, n=400 unwashed), was 106 seeds with (21.2%). The two serious fungi species, Fusarium spp, and Aspergillosis spp with percentages of 25(6.25%) and 11(2.75%) respectively. The occurrence of the seed-born fungi in sorghum seeds is a primary sign of the existence of other seed-borne pathogens which can affect the seeds and consumer health. The recommendation is to start farmers learning the safe storage techniques of seeds, and safe seed treatment before use.

Keywords: *seed, fungi, market and sorghum, Mogadishu, Somalia*

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1. Introduction

Seed is germinating embryo for many crop plants and is essential for increasing of production. Pathogen is biological agent living outer and inner part of seeds. The healthy seeds are instantly needed for increasing plant populations and harvest yield. [1].

This pathogen can take as form of seed born pathogen, these pathogens include Bacteria, fungi, parasites and Insects which responsible to cause seed borne diseases. This study focuses on to discover the fungi pathogen or seed born fungi of sorghum seeds in Somalia. As we know this seed born fungi can produces mycotoxic substances. [2].

The common fungi species that can prevalent to the sorghum is Aspergillus flavus, Fusarium solani, fusarium moniliforme, Curvularia lunata and Aspergillus niger. The two Aspergillus and Fusarium species have ability to produce toxin which known as aflatoxins. [3]. As WHO (2018), define Aflatoxins as are toxic substances produced by some kinds of fungi (moulds) that are found naturally all over the world; they can contaminate food crops and pose a serious health threat to humans and livestock. [4].

This study was discovered some existing seed borne fungi, which was problem to the farmer, mostly they did not know it. The objective of this study was to determine dominant seed borne fungi in market stored sorghum seeds in Mogadishu Somalia.

2. Literature Review

Sorghum [Sorghum bicolor (L.) is a fundamental food crop for human being as well as for domestic animals in many parts of world. In somalia, is staple food southern region like Bakool, bay, Gedo and Lower Jubba regions in Somalia. [1].

Sorghum (Sorghum bicolor L. Moench) is an herbaceous yearly grass of tropical origin that is planted from seeds; it is seems a crops with universal importance because it can be grown in tropical, subtropical, temperate,

and semi-arid regions of the world. It is used as a source of forage and silage for farm animals' production systems. [5].

Varies research Described toxins of fungi and their effects on plants. Some study found the seed mycoflora particularly the species Aspergillus flavus was inhibitory growing part of plant. Some fungi of plants can affect the germination of seed [6,7,8].

Some study indicating the contamination of fungi species can come into different ways, some sorghum grain taken from different threshing methods were contaminated with both Aspergillus and Fusarium species. [9].

Health seeds acts an important role in successful farming, the detection of a crop Fungi are the main part of microflora connected with seeds and are the main reason of deterioration and loss during storage. The seed borne fungi can also cause infections of systemic or local of crop plant parts, after that disease can emerge and inter the development of the later stages of the crop growth [10,11].

The contamination of food and feed by mycotoxins is existing problem in the worldwide but significant to sub-Saharan Africa. In Somali the staple foods contaminated by mycotoxin was determined by Queen's University Belfast. So this study will be primary detection of some mycotoxin producing fungi, using standard blotter methods for germinating seed to test presence of fungi species. The aflatoxine B1 (AFB1) is the major toxine with they revealed a mean national margin of exposure of 0.62 for AFB1 this toxin can associated the developing primary liver cancer as they estimated at 75 cancers per year per 100 000 people for white-maize consumption alone. The aflatoxine and other mycotoxin toxins are high risk to population and can cause cancer. [12].

3. Materials and Methods

3.1. Experimental Location

The laboratory test was conducted in faculty of Agriculture science at University of Somalia (Uniso), in Mogadishu. This study facilitated by Agriculture class Ag19A, during learning Agricultural microbiology.

The experiment was standard blotter methods, is international testing procedure of detecting seed born fungi, and it is a primary for testing seed health, which contains many plates seed germinating in hydroponic way with duration of minimum 7days.

3.2. Study Area

The study was Mogadishu, the capital city of Somalia, Somalia is the east African country, it had border with East Indian Ocean, west Ethiopia, and north Djibouti and with the south Kenya. The Mogadishu province is benadir region, Mogadishu has many markets, the largest market is Bakaro located in the Howlwadaag district which is the center of the city, and the next market is Suuqbacad market located Warta nabad district. Other market has smaller than those. But researcher selected according availability of sorghum seeds such markets is Seybiyano and Deynile market.

3.3. Sources of Experimental Materials

Four samples of sorghum seeds were collected 250gs per sample from different market place In Mogadishu, like bakara Market, Suuqbacad market, Seybiyano Market and Dayniile market, the sample were used for the finding of seed-borne fungi.

3.4. Physical Inspection of the Seeds

The Four samples of sorghum seeds physically checked with the naked eye, they were divided into abnormal seeds, inert matter and Normal seeds. Normal seeds were collected to germinate in the petri dish.

3.5. Plating of the Seed Component

The 125 Seeds took from each samples and the total seeds was 500, then separated into two groups. The first group was washed with distilled water and rubbed before planting, while the second group was not washed directly planted. Five hundred seeds were putted on wet plastic soft tissue and then placed in Petri dish at the rate of 25 seeds/plate. Then Plates were incubated for 7 days, during which time they were studied regular for fungal growth. The seeds were examined under a microscope, using slide preparation to observe the growth of fungi, and then identified type of fungi using identification bases to detect the name of fungi studying fruiting structure of each fungi.

3.6. Data Analysis

The data were analyzed with Microsoft excel 2013©, and then presented as table with descriptive statistics were used, the data was presented as frequency table and percentage of data put in all data. The researchers collected Pictures of the samples showed in microscope of detected seed born fungi pathogens, the pictures took by cell phone Samsung A10© camero, and then collected in Computer and then separated and put in frame.

4. Result

4.1. The Physical Classification of Seeds

Table 1. Physical Examination of sorghum seeds obtained from Four Different markets in Mogadishu.

Sample*	Normal seeds (g)	Abnormal seeds (g)	Inner matter (g)	Total (g)
Daynile	239.4 (95.8%)	7.6 (3.0%)	3.0 (1.2%)	250
Seybiyano	234.4 (93.8%)	8.6 (3.4%)	7.0 (2.8%)	250
Bakaro	232.0 (92.8%)	9.6 (3.8%)	8.4 (3.4%)	250
Suuqbacad	235.4 (94.2%)	9.6 (3.8%)	5.0 (2.0%)	250
Total	941.2	35.4	23.5	1000

Source: primary data.

The above table (Table 1) presented that the four samples of sorghum seeds obtained from Four Different markets in Mogadishu, the sample Seeds divided into three conditions the mostly normal seeds Daynile 239.4g (95.8%), Seybiyano 234.4g (93.8%), Bakaro 232.0g (92.8%) and Suuqbacad 235.4g (94.2%). Abnormal seeds occurred in the range of 7.6 (3.0%), 8.6 (3.4%), 9.6 (3.8%) and 9.6 (3.8%), while inert matter constituted 3.0 (1.2%), 7.0 (2.8%), 8.4 (3.4%) and 5.0 (2.0%). Sorghum seed samples with normal seeds weight were 941.2g, the abnormal seeds 35.4g, while the inert matter 23.5g the total was 1kg (1000g) obtained from four different market places.

The table (Table 2) shows you the four samples of sorghum seeds **washed with distilled water and rubbed with soft tissue**, each market place took one plate or petri dish containing 25 seeds, (25seed* 4sample, total 100 seeds "n=100"), but the total seeds were 500 seeds in the different market place in Mogadishu, each market took 125 seeds, So each sample had 25.0% in totality, the washed seeds of samples were 100 seeds with 20percentage in totality. Negative samples without detected any fungi were 76.0% or seeds and 24% or seeds were positive samples (**Rhizopus spp, Fusarium spp**, **and Aspergillosis spp**). The positive samples 19.0% of them were (**Rhizopus spp**), (3.0% Daynile, 4.0% Seybiyano 4.0% Bakaro, and 8.0% Suuqbacad). The 4.0% was (**Fusarium spp)** that occurred in two places, 3.0% were seeds took in Seybiyano market and 1.0% were taken in Suuqbacad market. The next fungi detect in washed samples was **Aspergillosis Spp** was only 2.0% or seeds in one Suuqbacad market and Seybiyano market. The Fusarium Spp and Aspergillosis spp were negative of seeds collected in Deynile and Bakaro market in the washed seeds.

Table 2. The fungi Species connected with seeds washed with distilled water and rubbed with soft tissue (n=100)

Sample	Neg (-)	Post (+)	Rhizopus spp	Fusarium Spp	Aspergillosis Spp.
Daynile	22.0%	3.0%	3.0%	0.0	0.0
Seybiyano	17.0%	8.0%	4.0%	3.0%	1.0%
Bakaro	21.0%	4.0%	4.0%	0.0	0.0
Suuqbacad	16.0%	9.0%	8.0%	1.0%	1.0%
Total	76.0%	24.0%	19.0%	4.0%	2.0%

Source: Primary data.

Table 3. The fungi Species connected with unwashed seeds in sample (n=400)

Sample	Neg (-)	Post (+)	Rhizopus spp	Fusarium Spp	Aspergillosis spp.	Curvularia Spp
Daynile	82 (20.5%)	18 (4.5%)	7(1.75%)	5(1.25%)	3(0.75%)	3(0.75%)
Seybiyano	81(20.25%)	18(4.5%)	10(2.5%)	3(0.75%)	2(0.5%)	3(0.75%)
Bakaro	77(19.25%)	24(6.0%)	12(3.0%)	8(2.0%)	2(0.5%)	2(0.75%)
Suuqbacad	78(19.5%)	22(5.5%)	5(1.25%)	9(2.25%)	4(1.0%)	4(1.0%)
Total	318(79.5%)	82 (20.5%)	34(8.5%)	25(6.25%)	11(2.75%)	12(3.0%)

Source: Primary data.

The above Table 3 presented the fungi Species connected with unwashed seeds in the sample (n=400), the negative fungi diseases were 318 seeds out of 400 seeds as a percentage (79.5%), the positive seeds were 82 seeds out of 400 with percentage (20.5%)), the Fungi pathogens prevalent in the local staple foods like sorghum is very high, the common fungi pathogen includes Rhizopus spp Fusarium Spp, Aspergillosis spp, and Curvularia spp, the Curvularia spp was absent into the washed seeds in above Table 2. Rhizopus is the highest pathogen of sorghum present most of the market seeds in Mogadishu, the 34(8.5%) of seeds were rhizopus spp in Daynile 7(1.75%), Seybiyano 10(2.5%), Bakaro 12(3.0%) and Suuqbacad 5(1.25%). The next fungi pathogen was **Fusarium spp with** percentage 25(6.25%), out of 82 (20.5%) positive sample of unwashed seeds, percentage of the market place, Daynile 5(1.25%), Seybiyano 3(0.75%), Bakaro 8(2.0%) and Suuqbacad 9(2.25%).

The most dangerous species of fungi pathogens was **Aspergillosis spp, market seeds in Mogadishu the prevalence was** 11(2.75%), out 82 (20.5%) positive sample of unwashed seeds. The **Aspergillosis spp** were divided according to the marketplace collected with it, in Daynile 3(0.75%), Seybiyano 2(0.5%), Bakaro 2(0.5%), and Suuqbacad 4(1.0%). The last fungi pathogen was **Curvularia spp, with the** percentage of 12(3.0%). In market place were had different percentage such as Daynile 3(0.75%), Seybiyano 3(0.75%), Bakaro 2(0.5%) and Suuqbacad 4(1.0%).

The both species **Aspergillosis spp and Curvularia spp had the same** percentage of sample seeds in Deynile market, and in Bakaro market, also Suuqbacad market.

5. Discussion

There is no doubt for the existence of seed born fungi in our local sorghum, which was known to include the staple food of Somalia communities, as researchers, we did not use complex procedures, but we use simple blotter methods of seed germinating in plates (petri dish). So that totality of positive sample in all seeds (n=100 washed, n=400 unwashed), was 106 seeds with (21.2%). The washed sample (n=100) had the prevalence of fungi pathogens of three different kinds like Rhizopus spp, Fusarium Spp, and Aspergillosis Spp, but Rhizopus spp, had more prevalence than the Fusarium spp, and Aspergillosis spp.

The Table 3, the unwashed seeds, had more fungi pathogens with four different species, three of them were mentioned in washed seeds, but not unwashed samples is **Curvularia spp.**

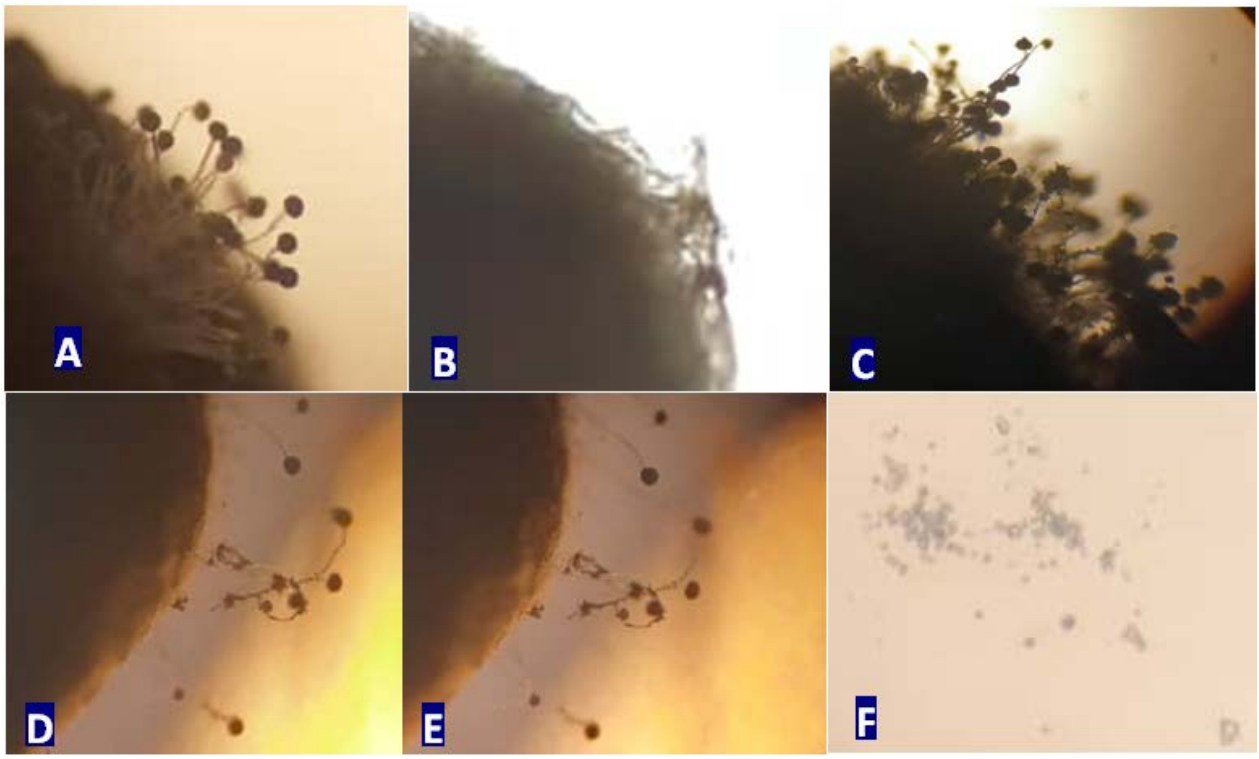

Figure 1. This picture of fungus under seed directly on microscopic study, 10x **A.** Aspergillus spp, **B.** Fusarium spp, **C.D.E** Rhizopus spp and **F**. Curvularia spp

The Washed and unwashed samples had two serious fungi species, Fusarium spp, and Aspergillosis Spp with percentages of 25(6.25%) and 11(2.75%) respectively. This fungus have an ability to produce mycotoxin known as Aflatoxin which can cause cancer in the liver, the Somali communities have a case of hepatocellular carcinoma (HCC), as mentioned Hassan-Kadle, M.A. (2017) With his topic The Diagnostic Challenges of Hepatocellular Carcinoma in Somalia deeply addressed the existence of this type of cancer and its Diagnostic challenges of health workers [13]. Wielogorska, E., etc (2019). A study conducted in Queen's University Belfast. They *Found* 77 toxins of mycotoxin in Maize, sorghum, and wheat in local staple food in Mogadishu, Somalia. And all toxins have a related risk of rising primary liver cancer to consumers [12].

6. Conclusion

The occurrence of the seed born fungi in sorghum seeds are the primary sign of the existence of other seed-borne pathogens which can affect the seeds and consumer health. As we know the sorghum is the staple food of Somali communities the common cultivated in rainfed agriculture areas like Bay, Bakool, Middle Shabelle and Hiran regions. There is no agency try to detect the seed born pathogen of farmer seeds, as researchers we recommended to plan and begin extension campaign to farmers to safe storage techniques of seeds, and safe seed treatment before use, also the government and local and international agency to do periodical training to the Farmers for good agricultural practice. The researcher advises to make a study of directly detecting of mycotoxin causing liver cancer in the seeds and make further differentiation of existing toxins.

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