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FUNGAL INFECTION OF BANANA (*MUSA SAPIENTUM*) SOLD AT WUDIL AND YANLEMO MARKETS OF KANO STATE

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Abstract

Experiment was carried out to determine the fungal pathogens responsible for post-harvest losses of banana on sale at Wudil and Yanlemo, market for a period of Four months (November, 2017 to February, 2018). Samples of banana were collected and analyzed for the presence of fungal species using standard microbiological methods. Fungal deterioration in the two markets were mostly due to Rhizopus stolonifer occurring with 20 (27.02%) and Aspergillus niger 16(21.62). Then A. flavus and Y. saccharomycete had 10 (13.51%) while the least occurring isolate with 8 (8.10) was Mucor spp.The differences in fungal deterioration of the banana was found to be statistically significant (P>0.05) between the two sampling markets. The results of this study suggest that a post-harvest loss of the banana in the two vegetable markets could be due to attack by fungal species. Therefore, effort should be made to ensure good handling methods during and after harvest.

Keywords: Banana, Fungi, Incidence, Yanlemo, Wudil

INTRODUCTION

Banana *Musa species* is a large monocotyledonous and herbaceous plant considered to have originated from Southeast Asia and is believe to be the first crop domesticated by man some ten thousand years ago (Molnár *et al*. 2015). It is regarded as one of the most popular fruit consumed as dessert and also as staple food in certain parts of world (Molnár *et al*. 2015). It is one of the major dietary sources of carbohydrates and vitamins A, B6, C, minerals like potassium, calcium, phosphorus and fiber (Guarro 2013). Banana is believed to have around 300 or more cultivars and almost all of them are developed from two seeded, diploid species, *Musa acuminate* Colla and *M. balbisiana* Colla and it is either diploid, triploid and or tetraploid hybrids among the subspecies of *M. acuminata*, and between *M. acuminata* and *M. balbisiana* (Guarro 2013). The total world production of Banana is estimated at about 69.51 million tones and India is the leading world producer of banana with 16 million tones production during 2001 and the productivity with 32.65 tones \ ha from 0.49 million ha area (Triest 2015). While in 2009, banana was the most important export commodity for Ecuador, Costa Rica, Panama, and Belize, and the second or third most important in Colombia, Guatemala, the Philippines, Honduras, and Cameroon (FOSTAT 2013). The remaining 85% is consumed by producers, or sold in local or regional markets (FOSTAT 2013). Locally consumed bananas are staple foods or significant additions to the diets of those in Africa, southern Asia, and tropical America (Van den Bergh *et al*. 2013).

Large quantities of banana are produced in Nigeria however; accurate production figures are not available. Alao (2000) showed that in Nigeria production of perishables including banana is seasonal resulting in glut during the season and scarcity at off seasons. However, because of their soft texture they are easily wounded as a result of harvesting, and other post harvest handling operations such as packaging, transportation and storage (Alao 2000; Hayatu 2000; Sani and Alao 2006). Alao (2000) observed that the long chain of marketing

system of perishables between the producer and consumer makes it difficult to accurately assess the correct level of damage.

Banana fruit has high water content which makes it easily susceptible to microbial attack (Kamel *et al*. 2016). Due to poor marketing of the commodity high losses are incurred which are attributed to the attack by micro-organisms most especially fungal pathogens (Mustapha and Yahaya 2006). In 2000, Hayatu observed that the spoilage and contaminating agents of fruits and vegetables might be present in the building used for storage and ripening. The fungi capable of food spoilage may multiply in walls, ceiling and even on the floor, or the wood used for packaging cases. The spore of these fungi may be dispersed in the atmosphere or carried by water of condensation thereby making contamination possible.

Despite its importance banana is affected by several fungal diseases, leading to rot disease such as crown rot caused by *Colletotrichum musae* and *Fusarium* spp resulting in postharvest losses causing scarcity and high cost (Mustapha and Yahaya 2006; Kamel *et al*. 2016). Banana diseases cause a serious problem for growers and marketers; and once the banana became infected by many diseases there are no opportunities for their control (Cho 2008). The fungal infection of banana normally starts at harvest, and the first symptoms of crown rot appear only after packaging and shipping from producing areas to consuming areas (Kamel *et al*. 2016).

The present study was aimed at isolating and identifying fungal species associated with post-harvest losses of banana with a view to providing baseline information for the development of control strategies for reducing post-harvest losses which will increase availability and reduce cost of the produce.

MATERIAL AND METHODS

Study site

Wudil Market: - Is located Wudil Local Government Area of Kano State. It is one of the largest markets in Kano State. Despite being one of the largest markets in Kano State, there are no good storage facilities in the market. Some marketers store their vegetables on rusted basins. Marketers hardly used chemicals on their vegetables.

Yan lemo Market: - Is located at Kumbotso local government area of Kano State. It is one of the grains market in Kano State. Despite being one of the popular fruits and vegetables market in Kano State, there are no good storage facilities in the market. Some marketers store their vegetables in rusted basins or on the floor of the stores. Markets hardly used chemicals on their vegetables.

Experimental procedure

In this study a survey was carried out to provide information on the incidence of fungal species responsible for the losses of banana on sale at Wudil and Yan lemo markets. The investigation period was from November, 2017 to February, 2018.

Sample collection and collection site

Five samples of banana were obtained randomly twice a week directly from Banana sellers each at Wudil and Yan lemo Markets and transported to laboratory at Kano university of Science and Technology in polyethylene bags for plating. The methodology used in this research was similar to the one used by Yahaya *et al*. (2016).

Sample handling

Banana obtained from Wudil and Yan lemo Market were surface sterilized by immersion in 3% (v/v) sodium hypochlorite solution for three minutes. Washed with running tap water and allowed to dry. Portions (2mm) was cut with sterilized scarpel and placed on PDA plate and incubated at 37^{o}c for three days.

Isolate count and subculture

Each week, growth of fungal isolates was monitored and the number of isolates that appeared were counted and recorded. Each distinct isolates was subcultured into fresh PDA.

Pathogenicity test

Pathogenicity tests were conducted to prove Koch postulate. Diseases free banana were surface sterilized with 10% (v/v) sodium hypochlorite solution and rinsed in three changes of running tap water and allowed to dry. A 2mm diameter cycle was made on the samples then samples were streak with fungal hyphae on the cycle portion. Controls were inoculated with sterile distilled water. Materials were placed on the laboratory bench. Sterilized forceps were used to remove portions from diseases areas on the 4th day and placed on freshly prepared PDA plates and incubated at 37^{0}c for three days. Fungal growth that appeared was recorded.

Microscopic examination

For each examination a streak of fungal mycelium was placed on a clean glass slide. One drop of cotton blue lactophenol was added and the cover slip placed. The slide was mounted on the microscope and observed at magnification of x10 and x40. Morphological characteristics of fungi isolated were determined and identified using method described by Dorothea, *et al* (1976).

Statistical Analysis

The data were also analysed statistically using one way analysis of variance (ANOVA) and differences among the means were determined for significance at $P \leq 0.05$.

RESULT

A total of seventy four fungal isolates were counted during the study at both Wudil and Yan lemo markets. *Rhizopus stolonifer* was the highest occurring species with 20 (27.02%). This was followed by *Aspergillus niger 16(21.62).* The third occurring colonies was *A. flavus* and *Y. saccharomycete* with 10 (13.51%) While the least occurring isolate 8 (8.10) was *Mucor spp* (Table 1).

Variation of the colony counted in Wudil and Yan lemo market

Higher numbers of fungal species were isolated at Wudil market with 49 (66.21%). While Yan lemo market recorded 23 (31.08%) species (Table 1). The differences of the colonies counted at Wudil and Yan lemo markets were statistically significant (P< 0.005). During the study, high numbers of fungal species were recorded in the fourth week 15(20.27%). While the least number of fungal species 8 (10.81%) was recorded in the second week (Table 2).

Pathogenecity Test

The results of the pathogenicity test confirmed all the four criteria outline in Koch postulates for identification of the causative agent of a particular disease. The pathogen where present in all cases of the disease. The same pathogens was isolated from the diseased host and grown in pure culture. When inoculated into a healthy sample of banana fruit the pathogen from the pure culture causes the same disease. The same pathogen was re isolated from the new host and shown to be the same as the originally isolated pathogen (Table 3).

Total 1: Number of fungal colonies isolated at Wudil and Yan lemo Markets

Identified fungi	Wudil Market	Yan lemo market	Total	Mean	%
A. niger	18	2	20	10	27.02
A. flavus	5	5	10	5	13.51
Mucor spp	8	8	18	8	8.10
R. stolonifer	4	6	10	5	13.51
Y. saccharomycete	14	2	16	8	21.62
Total	**49**	**23**	**74**	**36**	**99.99**

Table 2: Total Number of Fungal colonies Isolated on weekly basis at Wudil and Yan lemo Markets

Colonies	Weeks						Total	Mean	%
	1	2	3	4	5	6			
A. niger	4	1	5	4	3	3	20	10	27.02
A. flavus	1	1	2	1	3	2	10	5	13.51
M. spp	3	3	2	4	3	3	18	8	8.23
R. Stolonifer	3	2	3	3	2	3	16	8	21.62
Y. Saccharomycete	1	2	2	1	2	2	10	5	13.51
Total	12	9	14	13	13	13	74	12	99.99

Table 3: Pathogenicity test after inoculation for 4 days on fresh Banana

Fungi	*A. niger*	*A. flavus*	*Mucor Spp*	*R. stolonifer*	*Y. saccharomyses*
pathogenicity		+	+	+	+
test	+	+	+	+	+

Key: + = Isolates grow with a similar growth characteristic features to the original diseased samples

DISCUSSION

In this study out of the 74 fungal isolates recorded during the study *R. stolonifer* was the most frequently occurring fungal isolate in the two markets with the percentage occurrence of 27.02%. While the least occurring isolate was *Mucor* spp with percentage occurrence of 8.10%. In addition the result of the pathogenicity test confirmed the pathogens as originally isolated pathogen of banana sample from Wudil and Yanlemo markets.

Yahaya *et al* (2015) showed that most of the post-harvest diseases of fruits and vegetable occur as a result of infections by pathogenic microorganisms in the field which continue to develop after harvest. In a related study (Molnár *et al*. 2015) reported that fungi are the most common cause of spoilage on fruits and vegetables and several fungi like *Fusarium* spp, *Colletotrichum, Cladosporium* spp, and *Altternaria phomopsis* are known to cause large scale storage loss of fruits and vegetables from harvest to storage.

The finding of this research support the report of (Sani and Alao 2006) who studied fungal deterioration of some vegetables in northern Nigeria and found that losses in banana is attributed to the activities *A niger, A flavus, R. stolonifer*, *Colletotrichum, Cladosporium, Altternaria* species. The result of the study can also be compared with the result of Hayatu (2000) who isolated, *A. niger, A. flavus, Rhizopus, and Mucor* from samples of vegetables grown at Nassarawa local government area of Kano state.

The high colony counts obtained at Wudil could be attributed to the high influx of customers and animals (ie cattles, sheeps and goats) at Wudil on each market day. This might have resulted in discharge of nutrients effluent in the surrounding area, which might have infected these fields. Such effluents could contain some nutrients that might favour the growth of the fungi as against the lower number of isolate recorded at Yanlemo market where the area is free from influx of domestic animals nutrient effluents (Yahaya *et al*. 2015).

It is concluded that the four fungal species namely *R. stolonifer*, *A. niger, A. flavus*, *Mucor spp* and *Yeast saccharomycetes* were the common post harvest fungi associated with banana on sale at the two markets. The results obtained in this study indicate that Yanlemo market is the most suitable for marketing of fresh and healthy banana. This is because in Yanlemo

market there is total absence of any effluents in the area surrounding the market this accounted for the low isolate count.

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