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# Isolation and Identification of Fungi Responsible for Groundnut (*Arachis hypogaea* L.) :Post Harvest Losses: A Case Study of Wudil and Dawanau Markets of Kano State, North Western Nigeria

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## Abstract

*A study was carried out to identify the fungal pathogens responsible for post-harvest losses of groundnut on sale at Wudil and Dawanau, - markets for a period of four months (November, 2017 to February, 2018). Samples of groundnut were collected and analyzed for the presence of fungal species using standard microbiological methods. Fungal deterioration in the two markets were mostly due to *Aspergillus fumigatus* occurring at (21.16%), followed by *Rhizopus tolonifer* occurring at (26.38%), and then *Mucor spp* (22.22%). *Aspergillus niger* (15.27%), while *Aspergillus flavus* was the least occurring isolate at 10 (13.88%). The fungal deterioration of groundnut in the two markets and the two sampling dates were found to be statistically significant ( $p > 0.05$ ). The results of this study showed that post-harvest losses of groundnut in the two popular markets were due to infection by fungal pathogens. Therefore, effort should be made to ensure good handling methods during and after harvest.*

**Keywords:** Fungi, Groundnut, Postharvest Loss, Dawanau, Wudil

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## Introduction

Groundnut (*Arachis hypogaea* L.) is an important annual seed and staple food crop grown in Nigeria and more than 100 countries of the world (Richard *et al.*, 2017). About 23.95 million hectares of land were reported to have been devoted for groundnut cultivation worldwide with the total production of about 36.45 million tones with an average yields of 1520 kg/ha (Alao, 2000).

Food and Agricultural Organization (2011) reported that groundnut yield vary from 400 –1650 kg/ha and also that yield of more than 2200 kg/ha could be possible. The Nigeria's annual production of groundnut yield (in-shells) in 1990, 1995 and 1998 were 0.992, 1.6 and 2.6 million 3tones respectively while the areas under cultivation were 0.7, 1.8 and 2.3 million hectares respectively (Danladi, 2003). However, in developing countries including Nigeria, yield of groundnut are very low, ranging from 0.3 to 0.9 tons per hectare compared to very high yields of 2.8 tons per hectare in the United States of America (Richard *et al.*, 2017). A report published by Alao (2000) and Craufurd *et al.*, (2006) showed that, over 85% of the groundnuts produced in Nigeria were from Kano, Kaduna, Taraba, Bauchi, Borno and Adamawa States. Where Kano State is highly rated among the major groundnut producers in Nigeria (Craufurd *et al.*, 2006).

Umma *et al.*, (2014) showed that groundnut production, marketing and trade, provide major job opportunities, source of cash and foreign exchange before Nigerian independence. Also groundnut farming provided the basis for the agro-industrial development and assisted significantly in the commercialization, monetization and integration of the rural communities. The crop is grown sole or inter cropped with other crops and therefore serves as one of the prime

implemented to control losses of plant and their products in the developing countries (Richard *et al.*, 2017). However, in Kano State and other parts of Northern Nigeria, groundnut farmers are still at high risk of yield losses to disease probably due to lack of effective disease control approaches and lack of awareness of the disease and high exorbitant cost of chemical pesticides. Therefore, the study was carried to isolate and identify the fungal pathogens responsible for post harvest infection of groundnut which will provide a baseline information for the control strategies.

## **Materials and Methods**

### **Study Area**

**Dawanau Market:** It is located in Dawakin Tofa Local Government Area of Kano state Nigeria, at a distance of about 90 km away from Kano University of Science and Technology Wudil. It is the largest cereals market in Kano State, with different varieties of cereals being available to customers from the different parts of African countries. Despite being one of the largest cereal market in Africa, there is no provision of good storage facilities in the market. As a result, marketers store their groundnut on the floor of the storage facility, while others store it in sacks.

**Wudil Market:** It is located in Wudil local government headquarters of Kano State Nigeria, at a distance of about two kilometers away from Kano University of Science and Technology Wudil. Although it is far away from Dawanau market, they have similarities in structure and functions.

### **Isolation and Identification of Post-Harvest Fungi**

### **Pathogenicity Test**

A pathogenicity test was carried out to prove Koch's postulates. Fresh samples of groundnut free of any disease were surface sterilized by washing in 10% (v/v) sodium hypochlorite solution and rinsed three times in running tap water and allowed to dry. A smear of fungal hyphae isolated from groundnut was taken using sterilized needled and placed on the surface offresh sample of groundnut. However, samples for- control experiment were inoculated with sterile distilled water and material were placed under laboratory temperature. Re-isolation of the pathogen was done four days after inoculation and was placed onto PDA plates and incubated at  $25.7 \pm 2$  °C for three days fungal growth that appeared was observed and recorded.

### **Microscopic Examination**

Fungal mycelium was placed on clean glass slide and stain with cotton blue lacto phenol and observed under compound microscope at magnification of x10, x 40 and x 100 as Described by Dorothea *et al.*, (1976).

### **Statistical Analysis**

The data was analyzed statistically using one way analysis of variance (ANOVA) and differences among the means were determined for significance at  $P \leq 0.05$ . This was achieved using computer Statistical Program (SSPSS. 16.0).

### **Results**

A total of seventy two fungal isolates were counted during the study at both Dawanau and Wudil markets. *A. fumigatus* was the highest occurring specie with 21 (29.16%). This was followed by *R.*

### Total 1: Number of fungal colonies isolated in samples from Wudil and Dawanau Markets

Identified fungi	Wudil Market	Dawanau Market	Total	Mean	%
<i>A. fumigatus</i>	15		621	10.5	29.16
<i>A. flavus</i>			64	10.5	13.88
<i>A. niger</i>	5		61	15.5	15.27
<i>R. stolonifer</i>	9		81	199.5	26.38
<i>Mucorspp</i>	15		168		22.22
<b>Total</b>	<b>48</b>		<b>247</b>	<b>236</b>	<b>99.99</b>

Table 2: Total number of fungal colonies isolated on weekly basis in samples from Wudil and Dawanau Markets

Colonies	Weeks						Total	Mean	%	
	1	2	3	4	5	6				
<i>A. fumigatus</i>			523	4	43	21	10	29.16		
<i>A. flavus</i>	3	1	2	1	21	10	5	13.88		
<i>A. niger</i>	2	1	2	1	115	5	15	15.27		
<i>R. stolonifer</i>				3	4	2	4	3	199.526	26.38
<i>Mucorspp</i>	2		43	2		168	22	22.22		
<b>Total</b>	<b>16</b>	<b>9</b>	<b>13</b>	<b>15</b>	<b>13</b>	<b>13</b>	<b>7236</b>	<b>99.99</b>		

from harvest to storage.

The findings of this research also support the report of Sani and Alao (2006), who studied fungal deterioration of some vegetables in northern Nigeria and found that losses of perishables and nuts were mainly attributed to the activities *A niger*, *A flavus*, *R. stolonifer*, *Colletotrichum*, *Claudosporium*, and *Alternaria* species. The result of the study can also be compared with the results 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 other domestic animals (cattle, sheep and goats) at Wudil on each market day. This might have resulted in discharge of nutrients effluent in the surrounding area, which could have infected these fields. Such effluents may contain some nutrients that favours the growth of the fungi as against the lower number of isolate recorded at Dawanau market where the area is free from influx of domestic animals nutrient effluents (Yahaya *et al.*, 2015).

It is thus concluded that the four fungal species namely *R. tolonifer*, *A. niger*, *A. flavus*, *A. fumigatus* and *Mucor spp* were the common post harvest fungi associated with groundnut on sale at the two markets. The results obtained in this study indicate that Dawanau market is the most suitable for marketing of fresh and healthy groundnut. This is because in Dawanau market there is total absence of any effluents in the area surrounding the market which accounted for the low isolate count.

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