Occurrence of Aflatoxin Producing Mould in *Irvingia Gabonensis* (Bush Mango) Seeds Sold Within Jos Metropolis

Katnap Ramnan Selvyat¹, Arome A. F.¹, Zakari H.¹, Juliet Okechalu¹, Nanbol K. K.²,
Kumzhi P. R.³, Joseph Aje Anejo-Okopi¹

¹Department of Microbiology, Faculty of Natural Sciences, University of Jos, Jos, Nigeria
²Department of Plant Science and Technology, Faculty of Natural Sciences, University of Jos, Jos, Nigeria
³Department of Nursing Science, Faculty of Medical Sciences, University of Jos, Jos, Nigeria

Email address: katsonworld@gmail.com (K. R. Selvyat)

*Corresponding author

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Abstract: This study was conducted to determine the occurrence of aflatoxin producing mould in *Irvingia gabonensis* (Bush Mango) seeds sold within Jos metropolis. The total fungal load per sample was gotten from plate count and expressed as Colony Forming Units per gram of sample (cfu/g). The aflatoxigenicity of the fungal isolates was also evaluated on Coconut Extract Agar (CEA) by exposing the reversed side of plates to 365nm ultraviolet light. The result showed that mean fungal count of *I. gabonensis* ranges from $3.2 \times 10^6$ to $4.0 \times 10^6$ cfu / g. The fungi that were implicated for the contamination of the *I. gabonensis* include: Aspergillus flavus, Aspergillus fumigatus, Aspergillus parasiticus, Aspergillus niger, Penicillium chrisogenum, Verticillium lecanii, Rhizopus oryzea, Fusarium sporotrichoides and yeast. Strains of *V. lecanii*, yeast and *A. flavus* were the most predominant at 47.9%, 37.5% and 35.4% respectively. By a way of comparison, the result also showed that Bush Mango seeds from Terminus and Gadabiyu were the most contaminated, followed by Faringada and then Angwa Rukuba. Out of the 39 *Aspergillus* species isolated, only 4 strains exhibited aflatoxin producing potential. The presence of these aflatoxigenic mould on *I. gabonensis* seeds presents high health risk and calls for more regulations and periodical assessment of Bush Mango seeds sold in open markets.

Keywords: Aflatoxinogenic, Fungi, *Irvingia Gabonensis*, Mycotoxin

1. Introduction

Fungi are ubiquitous which make them major spoilage agents of agricultural crops, foods and feedstuffs, that results in the reduction of postharvest quality of crops. Their occurrence in food pose potential health hazard to human beings and animals, due to their ability to produce poisonous secondary metabolites (Mycotoxin), that when ingested have enormous public health significant (Williams et al., 2004; Miller et al., 1996). Humans can ingest aflatoxins by the periodic consumption of contaminated food. Aflatoxin have been seen to occur in different kind of foodstuffs, such as fruits, spices, cereals, oils, milks, meat, vegetables, etc. (Dor et al., 2011). *Irvingia gabonensis* (Bush mango), also known as wild mango, African mango is commonly called ‘Ogbono’ in Igbo and ‘Apon’ in Yoruba (Okafor, 1978). It produces edible fruits and seeds. The dried seeds of *Irvingia gabonensis* is widely consumed by humans in Nigeria as a good thickener for soup. Dried *Irvingia. gabonensis* seeds has low water activity however, poor handling and storage, combination of environmental factors and continual exposure in the market...
could predispose aflatoxigenic contaminants to it (Shaltout et al., 1999).

One of the most important mycotoxins of health significance is aflatoxin. The toxins are primarily produced by *Aspergillus flavus*, *Aspergillus parasiticus* and *Aspergillus nomius*. Contamination of *I. gabonensis* seeds with these aflatoxigenic mould will pose a very serious health hazard because of its wide occurrence in contaminated commodities purchased from hawkers and stationary sellers in the major markets within Jos metropolis. The markets include Faringada, Angwa rukuba, Terminus and Satelite markets. Successfully, 12 samples each were obtained in clean polythene bags at different sales points in the markets during the rainy season at four weeks interval, and transported to National veterinary Research Institute Microbiology laboratory Vom for appropriate analysis.

2.2. Mycological Analysis

The mycological analysis of the collected sample was carried out following standard method of Samson (2000). 10g of the pulvarised dried *I. gabonensis* seeds was weighed and homogenously mixed in 90ml of sterile distilled water. It was then serially diluted to 5folds and 0.1ml of the resultant solution was spread plated on Sabaroud Dextrose Agar (SDA) incorporated with 40µg/ml chloramphenicol to prevent the growth of bacterial contaminants if present. Enumeration of colonies (cfu/g) was done after 7days of incubation at 27°C. Distinct colonies were then subcultured on fresh SDA media to obtain pure isolates for further examination.

The fungal isolates were identified using cultured, macroscopic and microscopic morphologies, and comparison with standard representative of species in relevant fungal atlas (Samson, 2000; Barnett et al., 1998).

2.3. Screening for Aflatoxigenic Fungi

Screening for aflatoxin production potentials was carried on coconut extract agar (CEA) with 40µg/ml chloramphenicol to suppress bacterial growth, following standard methods (Davis et al., 1987). All the pure fungal isolates were inoculated on CEA and incubated at 27°C for 5days. The aflatoxin producing potential of the isolates was determined by observing reversed side of plates under 365nm ultraviolet lamb. Using non-inoculated CEA medium as control, the emission of a characteristic blue fluorescence confirmed the presence of aflatoxin producing potentials of the isolates.

3. Results

The result showed fungal contamination of *Irvingia gabonensis* seeds which result in a significant total fungal load which ranges from 0.00 to 6.8×10⁶ cfu/g. (Table 1). The result also showed that the *I. gabonensis* seed obtained from Terminus and Gadabiyu had the highest mean fungal load of 4.0×10⁶cfu/g, while samples from Angwa Rukuba had the lowest mean fungal load.

Nine fungal species were isolated from the *I. gabonensis* seeds which included *A. flavus*, *A. fumigatus*, *A. parasiticus* and *A. niger*. Other fungal genera isolated were *Penicillium chrisogenu*, *Verticelium leceanii*, *Rhizopus oryzea*, *Fusarium sporotrichoides* and yeast.

The result also showed that out of 39 Aspergillus species isolated, 17 were *A. flavus*, 9 were *A. fumigatus*, 5 were *A. parasiticus* and 8 were *A. niger* (Table 3). Only 2 *A. flavus* strains exhibited aflatoxin producing potential while one each

2. Materials and Methods

2.1. Sample Collection

A total of 48 *I. gabonensis* seed samples were randomly purchased from hawkers and stationary sellers in the major markets within Jos metropolis. The markets include
for A. fumigatus and A. niger respectively. None of the 5 A. parasiticus strains showed aflatoxin producing potential.

### Table 1. Mean Fungal Load of Irvingia gabonensis (Bush Mango).

| Sample No. | Terminus | Faringada | Angwa Rukuba | Gadabiyu |
|------------|----------|-----------|--------------|----------|
| 1          | 6.1×10⁵  | 1.6×10⁵   | 1.2×10⁵      | 1.5×10⁵  |
| 2          | 1.9×10⁶  | 3.0×10⁵   | 3.0×10⁵      | 5.3×10⁵  |
| 3          | 6.4×10⁵  | 6.0×10⁵   | 5.2×10⁵      | 5.3×10⁵  |
| 4          | 4.4×10⁵  | 1.0×10⁵   | 4.1×10⁵      | 4.2×10⁵  |
| 5          | 3.0×10⁵  | 3.4×10⁵   | 2.0×10⁵      | 2.2×10⁵  |
| 6          | 2.9×10⁵  | 4.6×10⁵   | 1.7×10⁵      | 1.5×10⁵  |
| 7          | 3.1×10⁵  | 3.8×10⁵   | 1.3×10⁵      | 3.6×10⁵  |
| 8          | 6.2×10⁵  | 6.8×10⁵   | 6.8×10⁵      | 6.7×10⁵  |
| 9          | 1.5×10⁶  | 4.7×10⁵   | 2.2×10⁵      | 6.8×10⁵  |
| 10         | 3.2×10⁵  | 2.8×10⁵   | 3.7×10⁵      | 1.5×10⁵  |
| 11         | 5.0×10⁵  | 5.6×10⁵   | 6.0×10⁵      | 2.7×10⁵  |
| 12         | 4.5×10⁵  | 2.3×10⁵   | 1.0×10⁵      | 6.7×10⁵  |
| Mean       | 4.0×10⁵  | 3.8×10⁵   | 3.2×10⁵      | 4.0×10⁵  |

### Table 2. Frequency of Occurrence of the Fungal Isolates.

| Fungal Isolate         | Place of sample collection |
|------------------------|---------------------------|
| Total of species       | Terminus | Faringada | Angwa Rukuba | Gadabiyu |
| A. flavus (%)          | 3(25.0)  | 7(58.3)   | 5(41.7)      | 2(16.6)   |
| A. fumigatus (%)       | 1(8.3)   | 2(16.7)   | 4(33.3)      | 2(16.6)   |
| A. parasiticus (%)     | -        | 2(16.7)   | 2(16.7)      | 1(8.3)    |
| A. niger (%)           | 2(16.7)  | 1(8.3)    | 4(33.3)      | 1(8.3)    |
| P. chrisogenu (%)      | 2(16.7)  | 4(33.3)   | 4(33.3)      | 1(8.3)    |
| V. lecanii (%)         | 1(8.3)   | 5(41.7)   | 7(58.3)      | 10(83.3)  |
| R. oryzae (%)          | -        | 7(58.3)   | 1(8.3)       | 2(16.7)   |
| F. sporotrichoides (%) | 1(8.3)   | 1(8.3)    | 2(16.7)      | -         |
| Yeast (%)              | 6(50.0)  | 3(25.0)   | 1(8.3)       | 8(66.7)   |
| Total                  | 16       | 32        | 37           | 27        |

### Table 3. Screening for Aflatoxicogenic Fungi.

| Fungal Isolates | No. of Isolates | No. of + ve Samples (%) | No. of – ve Samples (%) |
|-----------------|-----------------|-------------------------|-------------------------|
| A. flavus       | 17              | 2(11.8)                 | 15(88.2)                |
| A. fumigatus    | 9               | 1(11.1)                 | 8(88.9)                 |
| A. parasiticus  | 5               | 0(0.00)                 | 5(100)                  |
| A. niger        | 8               | 1(12.5)                 | 7(87.5)                 |

### 4. Discussion

This study revealed that the Bush mango seed (I. gabonensis) sold in the market in Jos metropolis are contaminated with fungal species at significant total fungal load. This could be attributed to poor handling during harvest and transportation, poor storage, and exposure in the market as observed from the sellers (Shaltout et al., 1999). Bosco F. and Mollea C. (2002) have also reported that raw materials, food and feeds are naturally susceptible to aflatoxicogenic contaminants.

The study also showed contamination of Bush mango seeds sold with Jos metropolis with more than one genus of fungi. The genera implicated are Aspergillus species, Rhizopus species, Penecillium species, Fusarium species and Yeast. Most of these species have been reported to be pathogenic (Shanthini et al., 2003). Aspergillus species such as A. flavus, A. parasiticus, A. niger and A. fumigatus which were also isolated in this research are the most dangerous of all the isolates. This is due to their high aflatoxin producing potentials and other mycotoxins of high health significance (Adebajo, 1992; Olayemi et al., 2012).

Fungal contaminants might be killed by heat during processing but the mycotoxins can remain undestroyed in the final product thereby posing health hazard to consumers (Smith et al., 1994). The study confirmed the presence of 4 strain with aflatoxin producing potential. Subsequent exposure and as time goes on, more of the aflatoxicogenic mould will proliferate on the I. gabonensis seeds and will cause more harm to consumers. Incidentally, bush mango seeds are highly consumed in plateau state. Therefore nonchalant attitude of government, non-governmental organizations and the masses toward handing practices of food and ingredients sold in open market is a pointer to severe outbreak of food diseases and poisoning in the future.

### 5. Conclusion

The Irvingia gabonensis (Bush Mango) seeds sold within Jos metropolis market were contaminated with varying levels of fungal loads from 1.0×10⁶cfu/g to 6.8×10⁶cfu/g which is alarming. A. flavus, A. fumigatus and A. niger isolated exhibited aflatoxin producing potentials. Other fungi isolated include Penecillium chrisogenu, Verticelium leceanii, Rhizopus oryzae, Fusarium sporotrichoids and yeast. This study therefore suggest that I. gabonensis (Bush Mango) seeds are susceptible to contamination by aflatoxicogenic mould.
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