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Journal of Botanical Research
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ARTICLE

Storage Mycoflora in Sesame Seed Production in Benue State, Nigeria

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ARTICLE INFO

Article history
Received: 26 July 2021
Accepted: 16 August 2021
Published Online: 7 September 2021

Keywords:
Storage fungi
Mycoflora
Storage sesame
Benue state

ABSTRACT

Sesame (*Sesamum indicum*) is usually contaminated with many fungi where some of them are mycotoxigenic causing economic and health problems. This study investigated the percentage composition of fungi contamination of sesame seeds in Benue state Nigeria. Using direct plating technique; the study revealed twelve species of fungi contamination in sesame seed obtained in Benue State. The percentage occurrence of fungal isolates shows that *Aspergillus flavus* and *A. niger* were found in all the locations and their occurrence was significantly different (P≤0.05). The percentage contamination of Sesame samples collected from Otukpo LGA has the highest fungal (23.35%) contamination and was significantly higher (P≤0.05) from samples of other places whereas Sesame contamination from Gboko was the least with total percentage of (12.05%). In conclusion, considering the benefits of sesame, it is recommended that several treatments should be applied to reduce the levels of contamination in sesame seeds before consumption utilization such as environmental conditions leading to fungal proliferation (a high temperature, humidity, poor soil fertility, drought and insect damage). Also poor harvesting practices, unsuitable storage conditions, improper transportation, marketing and processing should be discouraged.

1. Introduction

Sesame seeds (*Sesamum indicum* L.), otherwise known as beniseed, grouped under the family pedaliaceae is one of the oldest and most traditional oilseed crops known to mankind [1]. It is called 'Queen of oil seeds' due to its high quality polyunsaturated stable fatty acid, which restrains oxidative rancidity [2-4]. Sesame production in Nigeria probably began in the Middle Belt (North –Central) region of the country and later spread out between latitudes 60ºN and 100ºN. Sesame is commonly grown by small holder farmers in Nigeria. The major producing areas in order of priority are Nasarawa, Jigawa and Benue States [5].

Sesame (Beniseed) is one of the major cash crops that are popularly cultivated in Benue State. It was in this regards that OLAM Nigeria Limited distributed Sesame seedlings to 7,000 farmers in Benue and Nasarawa States to improve productivity of the cash crop in 2007 [6]. The prominent sesame producing local government areas of the state are: Makurdi, Gwer-West, Gwer-East, Logo, Katsina-

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DOI: https://doi.org/10.30564/jbr.v3i4.3482

Ala, Ukum, Agatu, Oju, Obi, Gboko, Ogbadibo, Ohimini, Guma and konshisha, Vandeikya and Otukpo [7]. There are three major varieties of sesame cultivated in Benue state: Yandev 55 characterized by smaller seeds and brighter in colour, E7 is with dull colour medium seeds and medium yield and E8 is having bigger seeds, high yielding and more oil [7]. Sesame production, and post-harvest handling business, producers, mainly smallholder farmers in Benue state are facing strong constraints and challenges to achieve significant increases in their incomes. Among many constraints is the risk of contamination during storage by mycotoxins especially the unbiquitous and hepatotoxic aflatoxins which are produced when seeds are kept under conditions that favour the development of these fungi [8]. The most vital mycotoxins are produced by fungi such as: *Fusarium* spp, *Aspergillus* spp, *Penicillum* spp, *Alternaria* spp, *Emericella* spp. These organisms thrive in moist and environments with moderate rainfall. They are regularly found in improperly stored staple commodities such as cassava, chili peppers, corn, cotton seed, millet, peanuts, rice, sesame seeds, sorghum, sunflower seeds, tree nuts, wheat, and a variety of species [9]. However, there is dearth of information on fungi contamination with Sesame in Benue state. The objective of this study is to evaluate storage mycoflora contamination in sesame sold in Benue state North central Nigeria.

2. Materials and Methods

Benue state is located in the Southern Guinea Savanna which is a transition belt between the grassland savanna in the North and the rainforest in the South. Benue State, Nigeria is designated with (latitude 6°21′ - 8°10′ N and longitude 7°44′ E - 9°55′ E).

Sampling collection

The State has three agricultural zones namely: North which comprises (Buruku, Guma, Gboko, Tarka, Makurdi, Gwer-West and Gwer) Local government Areas, East (Konshisha, Vandeikya, Kwande, Ushongo, Katsina-Ala, Ukum and Logo), and South (Apa, Ado, Agatu, Otukpo, Ohimimi, Okpokwu, Ogbadibo, Obi and Oju). For the purpose of this study, two (2) zones were purposively selected; North and South which are known as the belt of sesame production in the State [7]. Of these zones, a total of six LGAs including Guma, Gboko and Makurdi (Benue North) and Otukpo, Obi and Ogbadibo (Benue South) was included in the survey. Four samples were collected each from four different markets within each of the six surveyed LGA resulting in a total of 96 samples. Markets from selected local government areas were identified through local government departments' of agriculture and traditional authorities.

Determination of Representative Sample Size (DRSS)

Research work in this area of study is scanty, as such this research work will served as basis for the estimation of the representative sample size and it was calculated using the formula below:

$$S = \frac{x^2 PQ}{l^2}$$

S = Number of markets/ Centers

x = the x score for a given confidence interval

P = Estimated prevalence

Q = 1-p

l = allowable error of estimation

In this research the desired confidence interval was 95% with an allowable error of estimation 0.05 the estimated prevalence that was considered as 47% according to Ezekiel and Sombie [10].

Isolation of Fungi by direct plating method

Sabouroud Dextrose Agar (SDA) was used throughout the study. The method described by Jha [11] Agar plate method was used for the isolation of fungi.

Fungal Identification

The Sub cultured fungi were primarily identified using cultural and morphological (colony colour, surface texture) features and microscopic characteristics (Nature of spore, conidiophores, sporangiophore, and vesicles) using identification keys by Davis [12] and Clich [13].

Statistical analysis

Means for the distribution of concentrations of Aflatoxin were calculated and tested for significance by DMRT at 95 percent confidence level by one-way ANOVA.

3. Results and Discussion

The study revealed that twelve (12) fungal species were isolated from different samples of sesame collected from six different Local Government Areas of Benue State. The fungal species identified were: *A. flavus, A. fumigatus, A. nidulans, A. niger, A. parasiticus, A. tamarrii, A. terreus, A. versicolor, Fusarium oxysporium, Mucor mucedo, Penicillium digitatum, Rhizopus stolonifer.*

DOI: https://doi.org/10.30564/jbr.v3i4.3482

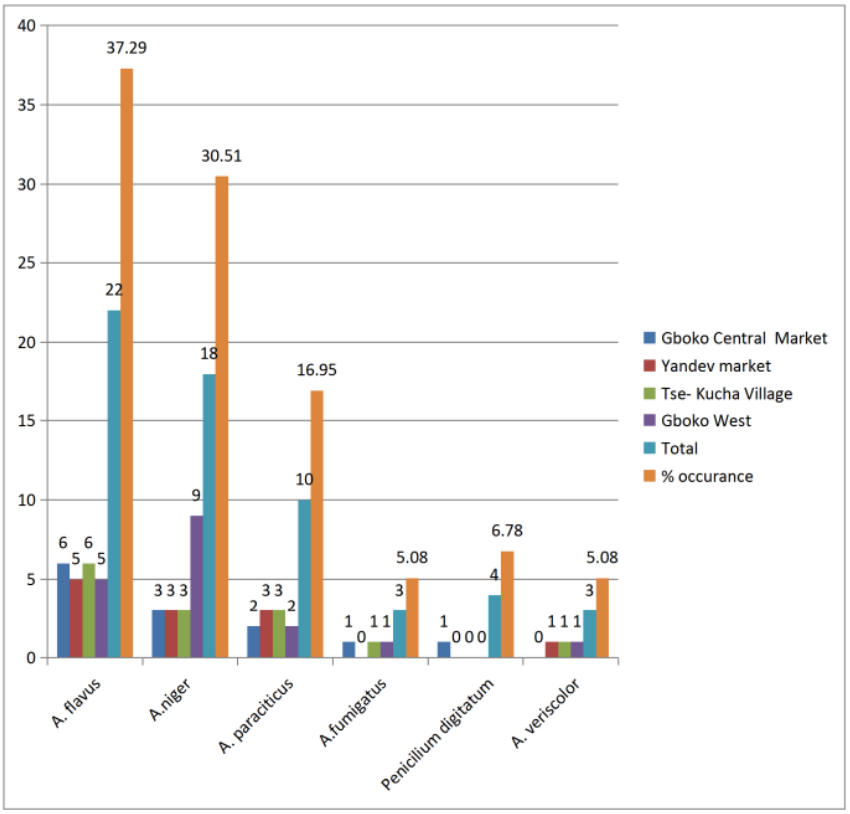

Figure 1. Occurrence (%) of fungi isolated from samples obtained from Gboko LGA

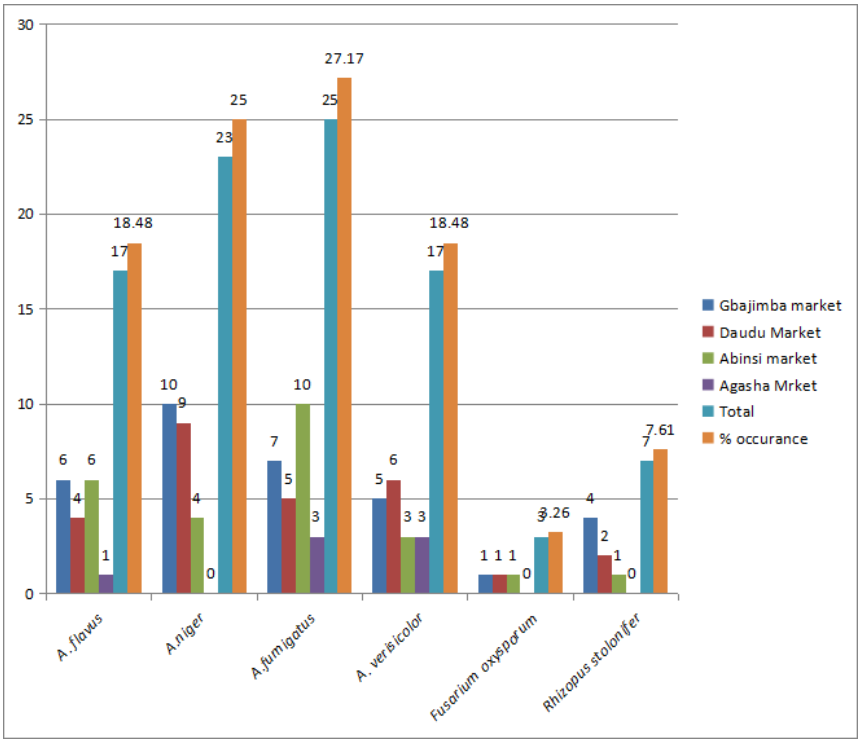

Figure 2. Occurrence (%) of fungi isolated from samples obtained from Guma

DOI: https://doi.org/10.30564/jbr.v3i4.3482

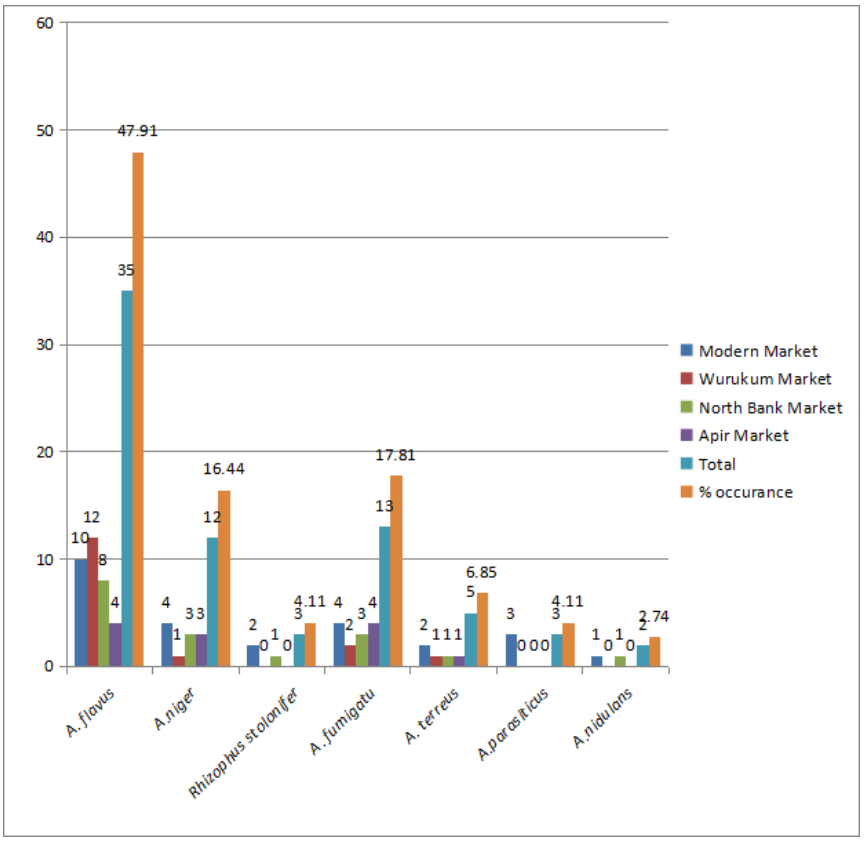

Figure 3. Occurrence (%) of fungi isolated from samples obtained from Makurdi

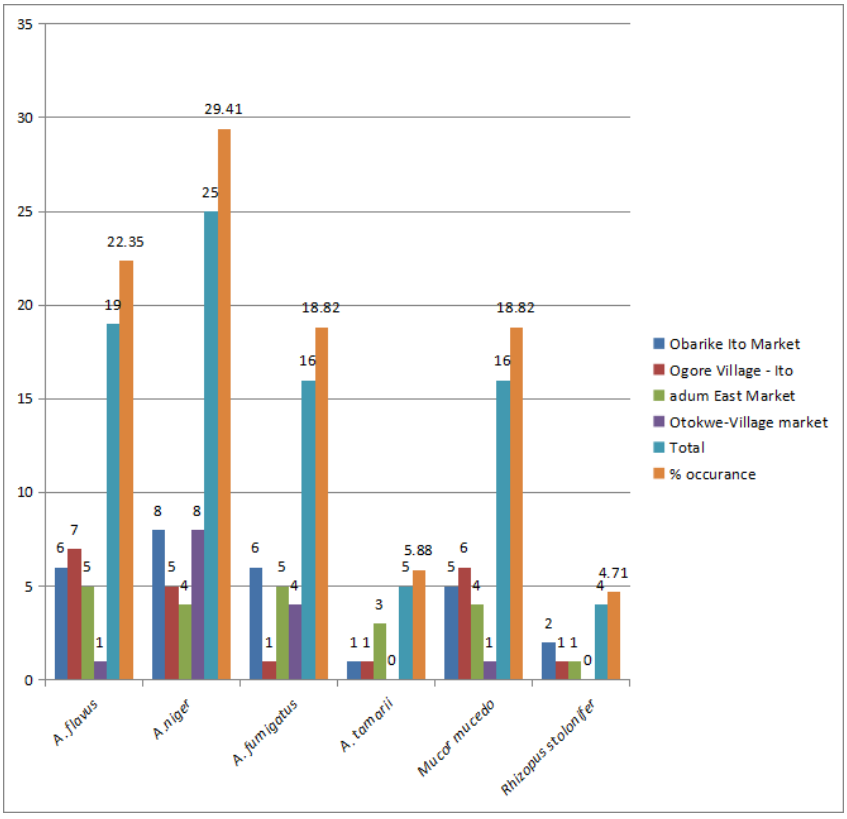

Figure 4. Occurrence (%) of fungi isolated from samples obtained from Obi LGA

 DOI: https://doi.org/10.30564/jbr.v3i4.3482

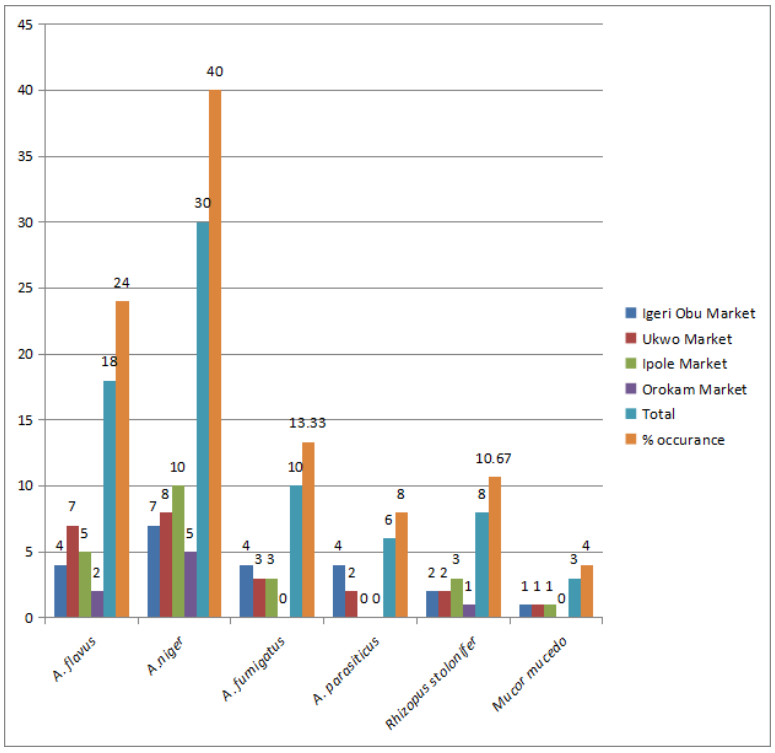

Figure 5. Occurrence (%) of fungi isolated from samples obtained from Ogbadibo LGA

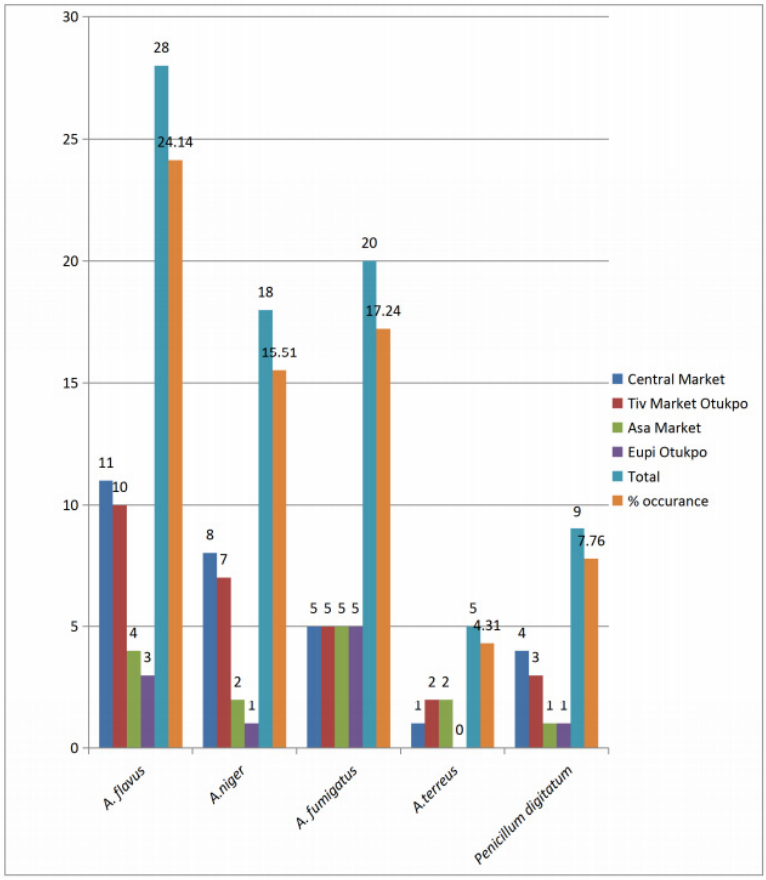

Figure 6. Occurrence (%) of fungi isolated from samples obtained from Otukpo LGA

DOI: https://doi.org/10.30564/jbr.v3i4.3482

Table 1. Occurrence (%) of the isolated fungi from six local government areas.

Fungal Isolates	Occurrence (%) of the isolated fungi from						Total	Mean No: of Colonies ±S.E
	Gboko	Guma	Makurdi	Obi	Ogbadib	Otukpo		
A.flavus	22(36.67)	17(18.45)	35(5.00)	19(22.35)	18(24.00)	28(24.14)	139(27.91	23.2±2.9[a]
A.fumigatus	3(5.00)	25(27.17)	13(18.57)	16(18.82)	10(13.33)	20(17.24)	87(17.47)	14.5±3.2[a]
A.nidulans	0(0.00)	0.(0.00)	2(2.86)	0(0.00)	0(0.00)	0(0.00)	2(0.40)	0.33±0.3[b]
A.niger	18(30.00)	23(25.00)	12(17.14)	25(29.41)	30(40.00)	18(15.52)	126(25.30)	21.0±2.6[a]
A.Parasiticus	10(16.67)	0.(0.00)	0.(0.00)	0.(0.00)	6(8.00)	36(31.03)	52(10.44)	3.2±1.7[b]
A.tamarii	0(0.00)	0.(0.00)	0(0.00)	5(6.01)	0(0.00)	0(0.00)	5(1.00)	0.83±0.8[b]
A.terreus	0(0.00)	0(0.00)	5(7.14)	0(0.00)	0(0.00)	5(4.31)	10(2.01)	1.7±1.11[b]
A.versicolor	3(3.00)	17(18.48)	0(0.00)	0(0.00)	0(0.00)	0(0.00)	20(4.02)	3.33±2.8[b]
Fusarium Oxysporum	0(0.00)	3(3.26)	0(0.00)	0(0.00)	0(0.00)	0(0.00)	3(0.62	0.5±0.5[b]
Mucor mucedo	0(0.00)	0.(0.00)	0(0.00)	16(18.82)	3(4.00)	0(0.00)	19(3.82)	3.2±2.6[b]
Penicillium digitatum	4(6.67)	0.(0.00)	0(0.00)	4(4.71)	0(0.00)	9(7.76)	17(3.41)	3.0±1.5[b]
Rhizopus stolonifer	0(0.00)	7(7.61)	3(4.29)	0(0.00)	8(10.67)	0(0.00)	18(3.61)	3.0±1.5[b]
Total	60(12.05)	92(18.47)	70(14.06)	85.(17.00)	75(15.06)	116(23.29)	498	
Mean No: of colonies±S.E	5 ±2.21[a]	7.7±2.87[a]	5.8±2.9[a]	7.1±2.6[a]	6.3±2.7[a]	9.7±3.7[a]		

P value

Fungal Isolates: 0.000**

4. Discussion

Sesame has been reported to be contaminated with different genera of fungi including *Alternaria, Aspergillus, Fusarium, penicillium* and *Cladosporium* whereas *Aspergillus* was the dominant genera [14]. Sesame from Otukpo (23.29%) and Guma (18.47%) contained more fungi than those obtained from Ogbadibo (15.06%), Makurdi (14.06%) and Obi (17.00%). The variation might be due to the differences in ecological zone and probably of differences in environmental conditions of the area because warm, humidity and climatic conditions favoring fungal growth [14]. Another reason for their high incidence might be due to their cosmopolitan nature and they are known to be obligate saprophytes so can survive in the environment with a wide range of temperatures varying from 18-32°c [15]. Apeh *et al.* [16] reported that fungi and aflatoxin levels were higher in sesame than millet and sorghum and that Fungi load in sesame seeds increased with latitude.

The Occurrences of different fungal species revealed that *Aspergillus* species had the highest frequency of occurrence in all sesame obtained from different local government areas.. This result is in agreement with the previous studies that *Aspergillus flavus* members are common colonizers of all types of millet and sesame during post-harvest storage [17-19], whereas *A. parasiticus* was the dominant one fungi among the *Aspergillus* genera [14]. In another research conducted by Elewaa [20] and Elaigwu *et al*. [21] showed that sesame has been heavily attacked by many fungi such as *F. oxysporum, F. sesame* and *Macrophomina phaseolina.* Among the *Aspergillus* species obtained *A. flavus* and *A. niger* were the most prevalent and this following the pattern of the findings of Amienyo, *et al*. [22] that *Aspergillus niger* showed the highest percentage occurrence of 10.3% in *Sesamum indicum* from Faringada market in Nigeria. This might be due to their ability to survive in the range of varying environmental factors (temperature and humidity) as compared to other species isolated. Recently, different species of *Alternaria, Aspergillus* and *Penicillium* were isolated from sesame in varying proportions [10].

5. Conclusions

The present report is a major investigation into the incidence of fungi in Sesame production in Makurdi Benue state Nigeria. Mycoflora contamination constitutes a major setback to export trade in grains and cereals proceeding from Africa. As a result it poses a challenge to food security in areas that are dependent on these staples. The work necessitates implementation of management and intervention strategies by concerned stakeholders and regulatory bodies. Considering their health and economic implications, there is therefore the need to elucidate the mycotoxin profile of these crops within regions where they are produced and marketed, with a view to generating incidence data which can be used to proffer intervention strategies. In view of the above, there is need for proper orientation and awareness campaign on the impending

 DOI: https://doi.org/10.30564/jbr.v3i4.3482

danger of overdependence on sesame in the area sampled.

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DOI: https://doi.org/10.30564/jbr.v3i4.3482