Journal of
Current Opinion in Crop Science
Journal homepage: www.jcocs.com; ISSN(O):2583-0392

SHORT COMMUNICATION

Primary Screening of Fungi with Aflatoxin-Production Potential in Rotten Tomato sold at Shasha Market Akure

O. A. Ogunoye[1*]., F. O. Sekoni[2]., T. E. Ebunola[3]., & B. E. Ogunoye[4]

[1]Department of Pest Management Technology, Rufus Giwa Polytechnic Owo, Ondo state, Nigeria.
[2]Ritefood Limited, Benin-Shagamu Expressway, Ososa Ijebu, Ogun State, Nigeria.
[3]Crop Improvement Division, Cocoa Research Institute of Nigeria, Ibadan, Nigeria.
[4]Olam Food Ingredients Akure, Ondo state, Nigeria.

Edited by:

V. Prakasam, ICAR-IIRR, Hyderabad, India.

Reviewed by:

Emanuel L. Mulungu, Sokoine University of Agriculture, Morogoro, Tanzania.

Article history:

Received: August 21, 2024
Accepted: September 27, 2024
Published: September 30, 2024

Citation:

Ogunoye, O. A., Sekoni, F. O., Ebunola, T. E., & Ogunoye, B. E. (2024). Primary Screening of Fungi with Aflatoxin-Production Potential in Rotten Tomato sold at Shasha Market Akure. *Journal of Current Opinion in Crop Science, 5*(3), 164-167.
https://doi.org/10.62773/jcocs.v5i3.270

ABSTRACT

The present study aimed to isolate, characterise, and evaluate aflatoxin-producing fungus from rotting tomatoes sold in Shasha market, Akure. Rotten tomato fruits from the Shasha market in Akure were cultured on potato dextrose and malt extract agar that was made selective for fungi by adding chloramphenicol to inhibit bacteria. Results showed that fungal isolates have 1.40 to 3.30 x 10^3 sfu/g of total fungus. *Penicillium* spp., *Rhizopus stolonifer*, *Mucor mucedo*, and *Phytophthora* spp. had the lowest proportion of occurrence (4.76%), followed by *Aspergillus flavus* (33.33%) and *Aspergillus niger* (23.81%). Hepatoma, or liver cancer, and severe hepatitis are caused by aflatoxin, especially in underdeveloped nations like Nigeria. This study informs people that eating rotten tomatoes is harmful. To avoid aflatoxins-producing fungus contamination of tomato fruits, farmers and marketers must implement pre- and post-harvest procedures.

Keywords: *Aflatoxins, Aspergillus flavus,* contamination, tomato.

*Corresponding author e-mail address: ogunoyeolalekan@gmail.com (O. A. Ogunoye)

INTRODUCTION

Aflatoxin represents the most critical category of mycotoxins in agriculture due to its frequent presence in food and various goods. Among the over 20 identified aflatoxins, aflatoxin B1, B2, G1, and G2 are the most prominent (Udomkun et al., 2017; Pickova et al., 2021; El-Sayed et al., 2022; Oner et al., 2022). Aflatoxins are poisonous, carcinogenic, and mutagenic substances generated by fungus species belonging to the genus Aspergillus (Kumar et al., 2021; Salisu et al., 2023). *A. flavus* and *A. parasiticus* are involved in the contamination of agricultural products (Salisu et al., 2023).

The tomato (*Solanum lycopersicum*) is one of the primary crops consumed globally. It provides essential vitamins, minerals, antioxidants, and carbs

(Abraham et al., 2023). As of 2020, Nigeria ranks as the 11th largest tomato producer globally and the second largest in Africa, with a total output of 3,693,722 metric tonnes (FAO, 2020). Despite the extensive production area, tomato farming in Nigeria faces significant obstacles, including diseases and pathogen infestations. Pathogens significantly affect tomato production, leading to reduced output, inferior fruit quality, and postharvest losses. The prevalent consumption of these items by the populace, together with related health ramifications, renders the existence of mycotoxins, especially aflatoxins, a significant public health issue (Haruna, 2023). Studies indicate that 50% of tomatoes cultivated in Nigeria fail to arrive at their designated destinations. This can be ascribed to various sources, including pathogenic assaults such as those induced by fungi that generate AFB1 (Salisu et al., 2023).

Open markets exhibit tomatoes on benches and in baskets for prospective purchasers. Farmers typically obtain tomato fruits from multiple fields and carry them mostly via unpaved rural roads, which may result in harm to the tomatoes. Contaminated containers included many tomato fruits. Typically, individuals displayed tomato fruits in open markets until sold, rendering them susceptible to microbial contamination (Kumar et al., 2021). An examination of most of these markets indicated that numerous tomato fruits had deteriorated. Investigators have identified that *A. flavus, A. fumigatus, P. citrinum, C. fulvum, C. lunata*, and *S. rolfsii* are the pathogens responsible for the deterioration of tomatoes post-harvest in southwestern Nigeria (Kumar et al., 2021). Individuals with low income typically favoured and marketed inferior tomato fruits at a diminished price. Spoilt tomatoes may pose a health risk to customers, in addition to causing financial losses for tomato marketers.

MATERIALS AND METHODS

Diseased (rotten) tomato fruits were collected in new polythene bags from different selling points at Shasha Market Akure. Shasha market is located along the Akure-Benin Expressway between Latitude $7^0$16'44N and Longitude $5^0$13'52E. A total of 50 randomly selected diseased (rotten) tomato fruits were collected from different selling points. This was done to avoid bias during the sample collection process, as some samples were just introduced to the market while others had been there for a considerable amount of time. The diseased (rotten) tomato fruits collected from various selling locations in the Shasha market in Akure were taken to the Crop, Soil, and Pest Management Department laboratory at the Federal University of Technology, Akure (FUTA) for examination. The infected/spoilt tomato fruits were cultured on Potatoe Dextrose and Malt Extract Agar that have been made selective for fungi, by the addition of Chloramphenicol tablets to inhibit bacteria contaminant. The sample was incubated aerotrically at a temperature between 25º-27ºC for about 72 hours (Ahmad et al., 2022). Subcultures were carried out to obtain a pure culture of desired fungi. Thereafter, the pure culture of desired fungi was identified culturally and microscopically by illustrated genera of imperfect fungi by Barnett and Hunter, (1972). The isolate was stored in the refrigerator at a temperature of 4^0 C for further confirmation under microscopical observation. After the fungal isolates were incubated, different colonies were observed and colonies were counted and recorded, this was taken as the total viable count. Fungi isolates were counted using SFU/g (Onuorah and Orji, 2015).

RESULTS AND DISCUSSION

The total fungal counts from the tomato fruit samples vary from 1.40×10^3 to 3.30×10^3 sfu/g, (Table 1) consistent with the findings of Onuorah and Orji (2015). The probable identity of fungal isolates from rotten tomato sold in Shasha market, Akure is presented in Table 2 and includes *A. flavus, A. parasiticus* and *A. niger*, *F. oxysporum*, *Penicillium* spp., *R. stolonifer*, *M. mucedo* and *Phytophthora* spp. The result revealed that *A. flavus* had the highest percentage of occurrence (33.33%) followed by *Aspergillus niger* (23.81%) and the least percentage of occurrence were observed in *Penicillium* spp., *R. stolonifer*, *M. mucedo* and *Phytophthora* spp. (4.76%) as shown in Table 2. This study identified the correlation of six fungal taxa with commercially sold decayed tomato fruits. The findings largely aligned with those of other scholars examining various forms of tomato mycobiota. Tomatoes are inherently susceptible to fungal deterioration because of their elevated moisture and nutrient levels (Salisu et al., 2023). This enhances water activity and provides the essential nutrients for fungal growth and proliferation, thereby elevating the formation and release of secondary metabolites, or mycotoxins (Salisu et al., 2023). The current study shows that three species of fungi, belonging to the genus *Aspergillus*, isolated from decayed tomato samples obtained from the Shasha market in Akure, Ondo State, Nigeria, are capable of creating aflatoxin in tomato fruits. Additional fungal pollutants identified in tomato samples include *Penicillium spp., R. stolonifer, M. mucedo*, and *Phytophthora* spp.

(Muhammad et al., 2004; Ahmad et al., 2022; Salisu et al., 2023). Salisu et al. (2023) identified *A. flavus* as the predominant fungal isolate in decayed tomatoes in Nigeria, among the *Aspergillus* species known to produce hazardous Aflatoxins, a conclusion corroborated by its highest percentage occurrence in our study. The genus *Aspergillus parasiticus* exhibits the lowest percentage incidence among fungal genera. The limitation in the sample size of the current study may have influenced the variation in fungal diversity observed in tomatoes and other fruits, while additional factors such as geographic location and climate may also affect fungal diversity (Ahmad et al., 2022; Salisu et al., 2023).

Table 1. Total fungi count for fungal isolates

Isolation	Total Fungi Count (TFC) (sfu/g)
First	2.00×10^3
Second	2.50×10^3
Third	3.30×10^3
Fourth	1.40×10^3

Note: sfu/g_ Spore forming unit per gram of the sample 10^{3}- Dilution factors.

Table 2. Frequency of occurrence of fungi isolated from rotten tomato

Fungal Isolates	Occurrence	Percentage (%)
Aspergillus flavus	7	33.33
Aspergillus parasiticus	3	14.29
Aspergillus niger	5	23.81
Penicillium spp.	1	4.76
Fusarium oxysporum	2	9.52
Rhizopus stolonifer	1	4.76
Mucor mucedo	1	4.76
Phytophthora spp.	1	4.76
Total	21	100

CONCLUSION

This study aims to raise awareness about the significant health risks associated with consuming rotten tomatoes. Consequently, tomato cultivators and distributors must implement suitable pre- and post-harvest strategies to prevent contamination of tomato fruits by aflatoxin-producing fungus. This will reduce the likelihood of contamination and, therefore, diminish the risk of aflatoxin and other mycotoxins detrimental to human health.

ACKNOWLEDGMENT

Not applicable

FUNDING

No funds were obtained for this study.

AUTHORS CONTRIBUTION STATEMENT

Ogunoye, O. A., formulated the concept. Ogunoye, O. A., Sekoni, F., Ebunola, T. E., and Ogunoye, B. E. conducted a literature review, formulated methodology, analysed results, and drafted the manuscript. All authors meticulously proofread, reviewed, and approved the final version of the article.

CONFLICT OF INTERESTS

The authors declare no conflict of interest.

REFERENCES

Abraham, P., Banwo, O. O., Kashina, B. D., & Alegbejo, M. D. (2023). "Status of tomato viruses in Nigeria." *FUDMA Journal of Sciences*, *3*(3), 482 – 494.

Ahmad, A., Keta, J. N., & Singh, D. (2022). Determination of aflatoxin levels and prevalence of fungal flora of cwande condiments sold in zuru local government area, Kebbi state, Nigeria. *Journal of Sustainability and Environmental Management*, *1*(4), 371 - 375.

Barnett, H. L., & Hunter, B. B. (1972). Illustrated Genera of Imperfect Fungi. 3rd Edition, Burgress Publishing Company, Minneapolis, MN. p241.

El-Sayed, R. A., Kang, A. B., & El-Demerdash, F. M. (2022). "An overview on the major mycotoxins in food products: Characteristics, toxicity, and analysis." *Journal of Future Foods*, *2*(2), 91-102.

FAO, (2020). Food and Agriculture Organization of United Nations. Tomato Production Statistics. https://www.fao.org/land-water/databases-and-software/crop-information/tomato/en/ (accessed on 17 June 2023).

Haruna, S. G. (2023). Effect of soil amendments with bio-fumigant crops and animal manure on growth and yield of tomatoes infected with *Fusarium* Wit. *Ife Journal of Agriculture*, *35*(2), 119-131.

Kumar, A., Pathak, H., Bhadauria, S. and Sudan, J. (2021). Aflatoxin contamination in food crops: causes, detection, and management: a review. *Food Production, Processing and Nutrition*, *3*, 17 (1-9).

Onuorah S. and Orji, M. U. (2015). Fungi Associated with the Spoilage of Post-harvest Tomato Fruits Sold in Major Markets in Awka, Nigeria.

Universal Journal of Microbiology Research (CEASE PUBLICATION), *3*(2), 11 - 16. https://doi.org/10.13189/ujmr.2015.03020

Oner, L., Yilmaz, D. E., Demirci, H., Ozbek, T. and Celik, S. (2022). Detection of aflatoxins in tomato and pepper pastes sold in market places of Istanbul, Turkey. *European Journal of Science and Technology*, *35*, 221-226.

Pickova, D., Ostry, V., & Malir, F. A (2021). Recent overview of producers and important dietary sources of aflatoxins. *Toxins*, *13*, 186. https://doi.org/10.3390/toxins13030186

Udomkun, P., Wiredu, A. N., Nagle, M., Bandyopadhyay, R., Müller, J., & Vanlauwe, B. (2017). Mycotoxins in Sub-Saharan Africa: Present situation, socio-economic impact, awareness, and outlook. *Food Control, 72*, 110–122. https://doi.org/10.1016/j.foodcont.2016.07.039

Salisu, N., Ukwaja, V. C., & Sakariyau, W. A. (2023). Molecular identification of fungi and determination of aflatoxin b1 in dried tomatoes. *International Journal of Scientific Research in Biological Sciences*, *10*(3), 65-69.