# POSTHARVEST PATHOGENIC FUNGI OF WHEAT CIRCULATING IN LAGOS STATE, NIGERIA

**R.M. KOLAWOLE[1], B.T. THOMAS[1], A.A. ADEKUNLE[3] AND AFOLABI OLUWADUN[2]**

1. DEPARTMENT OF CELL BIOLOGY AND GENETICS, UNIVERSITY OF LAGOS, AKOKA, LAGOS STATE, NIGERIA
2. DEPARTMENT OF MEDICAL MICROBIOLOGY AND PARASITOLOGY, OLABISI ONABANJO UNIVERSITY, SAGAMU, OGUN STATE, NIGERIA
3. DEPARTMENT OF BOTANY, UNIVERSITY OF LAGOS, AKOKA, LAGOS STATE, NIGERIA

CORRESPONDING AUTHOR: R.M. KOLAWOLE
PHONE NO: +2348035010696, +2348073660644
EMAIL ADDRESS: rachaelolu@yahoo.com

**ABSTRACT**

This study was carried out, to determine the post-harvest fungi of wheat circulating in Lagos State, Nigeria. A total of 400 wheat samples from eight major market of wheat in Lagos State, were collected randomly from the seller of this agricultural produce. The samples were processed using standard microbiological methods while the relative pathogenic attributes of the isolated mycoflora of wheat were carried out using Koch's postulates. Results from this study, revealed, *Penicillium* spp 90(22.5%) as the most predominant, followed by *Aspergillus flavus* 70(17.5%) while *Trichoderma* spp was the least isolated fungal flora of wheat with a prevalent rate of 14(3.5%). Also, all the isolated mycoflora of wheat were found to be pathogenic, but to varying degree of virulence, as shown by their percentage rate of infection. The order of their pathogenicity are as follows: *Aspergillus niger*, *Aspergillus flavus*, *Aspergillus fumigatus* and *Penicillium* species 50(100%) > *Rhizopus* spp 50(90%) > *Fusarium solani* 50(80%) > *Alternaria* spp and *Trichoderma* spp 50(70%). It can, therefore, be concluded that, wheat circulating in Lagos State, Nigeria are variously contaminated with different xerophilic molds.

**KEYWORDS**: Postharvest fungi, wheat, pathogenicity.

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## INTRODUCTION

Wheat (*Triticum* spp)(order poales) belong to the family poaceae (Kolawole, 2012) and constitute the third most produced cereals after maize and rice (CIMMYT,2001). This grass, which was originally from the fertile crescent region of near east, is now seen as the leading source of vegetable protein (Tanno and Willcox, 2006; Chnapek *et al*.,2013), vitamins and minerals (Grundas, 2003; Tanno and Willcox, 2006; Shewry, 2009) in human foods. In Nigeria, wheat is a major component of many other foods including breads, porridge, cracker and biscuits (Grundas, 2003; Tanno and Willcox, 2006). However, the practices associated with production, processing and post processing handling (Ogiehor and Ikenebomeh,2006) of wheat, may exacerbate microbial contamination. These microbial contaminants, especially fungi causes biochemical deterioration and losses in nutritional quality (Vijaya and Karana,1981; Akano *et al*., 1986). Fungal contaminants, are also responsible for substantial effects in stored food stuffs including discolouration, production of off-odours, deterioration in technological quality (Basilico *et al.*, 2001; Magnoli *et al.*, 2006) and mycotoxin contamination (Smith and Henderson, 1991; Smith *et al*., 1994 ; Jayeola and Oluwadun,2010). In view of this, this study, was designed, to determine, the postharvest fungi of wheat, circulating in Lagos State, Nigeria.

## MATERIALS AND METHODS

### Samples Collection

A total of 400 wheat samples were collected from eight major markets of wheat in Lagos State, Nigeria. These samples were collected separately in presterilized aluminium pan and taken to the laboratory within 24hours of its collection, for processing.

Isolation and Identification of Fungal Flora of Wheat Diseased wheat grains were isolated from the healthy ones using macromophology such as discoloration, weight loss, visible mold growth among other factors. These diseased grains were surface sterilized with 0.1% solution of mercury chloride ($HgCl_2$), rinsed in sterile distilled water before being plated on potato dextrose agar (PDA) in triplicates. The plates were incubated at room temperature ($27+2^0C$) for 48hours. Purification of the isolates, was done, by subsequent subculturing into fresh sterile media until pure cultures were obtained. Identification of fungal isolates were carried out using both macromorphological (Davise, 2002; Marren, 2002) and micromorphological characteristics (Pitt and Hocking, 1997).

### Pathogenecity Test

This was carried out following Koch's experiment (Prescott *et al.*, 1999). Briefly, four hundred healthy grains were surface sterilized with 0.1% mercury Chloride for one minute and then rinsed in distilled water. A batch of 50grains was plated on 7day old pure cultures of each of the test fungus for 24hours and incubated at room temperature ($27\pm 2^0C$).

Statistical Analysis

The prevalence of the isolated mycoflora of wheat was calculated as follows:

$$\text{Prevalence} = \frac{\text{number of isolated organisms} \times 100/1}{\text{Total number of organisms isolated}}$$

while the percentage infection rate in the pathogenecity test was deduced using the formula

$$\% \text{ infection} = \frac{\text{number of seeds infected}}{\text{Number of seeds plated}} \times 100$$

KEY: % = percentage

## RESULTS

**Table 1. Occurrence of fungi found associated with marketed wheat seeds eight different markets in Lagos state, Nigeria**

| Organisms | AG | ID | IK | M12 | MSH | OSH | SOM | YBA |
|---|---|---|---|---|---|---|---|---|
| *Aspergillus flavus* | + | + | + | + | + | + | + | + |
| *Penicillium spp* | + | + | + | + | + | + | + | + |
| *Fusarium solani* | + | - | + | - | - | + | - | - |
| *Aspergillus fumigatus* | + | - | - | + | _ | + | - | - |
| *Aspergillus niger* | + | - | - | - | + | - | + | - |
| *Rhizopus spp* | - | - | + | + | - | - | - | + |
| *Alternaria* spp | - | - | - | - | + | - | - | - |
| *Trichoderma* spp | - | - | - | - | - | - | + | - |

AG = Agege market , ID= Iddo market, IK = Ikorodu market, OSH = Oshodi market, SOM = Somolu market , YBA = Yaba market, + = Present, -= Absent

**Table 2. Prevalence of fungal isolates in wheat circulating in Lagos state, Nigeria**

| Fungal isolated | n | % |
|---|---|---|
| *Aspergillus niger* | 50 | 12.5 |
| *Aspergillus flavus* | 70 | 17.5 |
| *Aspergillus fumigatus* | 48 | 12.0 |
| *Penicillium* spp | 90 | 22.5 |
| *Fusarium solani* | 63 | 15.8 |
| *Rhizopus* spp | 40 | 10.0 |
| *Alternaria* spp | 25 | 6.2 |
| *Trichoderma* spp | 14 | 3.5 |
| Total | (400) | (100%) |

**Table 3. Relative pathogenic attributes of post harvest mycoflora of wheat**

| Fungal isolates | N | n | % |
|---|---|---|---|
| *Aspergillus niger* | 50 | 50 | 100 |
| *Aspergillus flavus* | 50 | 50 | 100 |
| *Aspergillus fumigatus* | 50 | 50 | 100 |
| *Penicillium* spp | 50 | 50 | 100 |
| *Fusarium solani* | 50 | 40 | 80 |
| *Rhizopus* spp | 50 | 45 | 90 |
| *Alternaria* spp | 50 | 35 | 70 |
| *Trichoderma* spp | 50 | 35 | 70 |
| Total | 400 | 355 | 88.75 |

N = number of seeds plated, n = number of seeds infected, % = percentage of infection

Table 1 depict the occurrence of fungi found associated with marketed wheat grains in eight different markets in Lagos State, Nigeria . All the sample investigated harbors *Aspergillus flavus*, and *Penicillium* species while *Fusarium solani*, *Aspergillus fumigatus*, *Aspergillus niger* occur in samples from three different markets, though to varying degree of distribution pattern. Also,

*Alternaria* and *Trichoderma* spp was found in the samples from Mushin and Somolu market respectively. As shown in table 2, *Penicillum* species was the most predominant followed by *Aspergillus flavus* while the least isolated organisms was *Trichoderma* spp. The relative pathogenic attributes of post harvest mycoflora of wheat is represented in table 3. All the isolated organisms were found to be pathogenic to wheat grains but to varying degree of virulence. *Aspergillus and Penicillium* species demonstrated hundred percent of pathogenecity while *Rhizopus* species showed ninety (90%) percent of pathogenic attributes as shown by its ability to infect forty five wheat seeds, of the fifty inoculated. *Alternaria* and *Trichoderma* spp were the least pathogenic in our study, despite being able to infect, 70% of the inoculated wheat grains.

## DISCUSSION

Fungal infection and contamination of stored foods has been well documented (Akano *et al.*, 1986; Vashney, 1990; Bearchell *et al.*, 2005;Thomas *et al.*, 2012).The occurrence of *Penicillium* species was found to be higher than any other species of fungi isolated. This fungal mycoflora has been reported to be a notorious producers of certain mycotoxins including citrinin, patulin and even ochratoxins and are now known to cause tremors, coagulopathy and enteritis (Ojo, 2009). *Aspergillus*, which were isolated in this study, are among the most abundant and widely distributed organisms on earth (Bennet and Klich, 2003). The main impact on agriculture is in saprophytic degradation of products before and after harvesting and in the production of mycotoxins (Domsh *et al.*,1980). *Aspergillus flavus*, which showed the highest proportion in this study has been reported as a major contaminants of peanuts, corns, grains (Cheesborough, 2005) and also the most popular staple foods in Africa (Thomas *et al.*,2012).The occurrence of *Aspergillus niger* on wheat grain, is not surprising, as this organisms has been found to be ubiquitous in soil, plant litter seeds, dried fruits and nuts (Samson *et al.*, 2001). It is one of the most commonly reported fungi from foods and indoor environment (Pitts and Hockings, 1977) with ability to produce Ochratoxin (Klich, 2002). Other fungi species, isolated, in this study has also been linked with different types of nut at one time or the other (Okonkwo *et al.*,2009; Thomas *et al.*, 2013). In terms of pathogenecity, all the isolated fungal mycoflora were found to

be pathogenic but to varied degree of virulency. This observation, further stressed that the isolated mycoflora are capable of causing different diseases to wheat grains (Vijaya and Jarana, 1981;Nanaiah *et al*.,1986;Tanaka *et al*.,1990). It is therefore, very imperative, to determine the survival rate of the isolated organisms in other study, in order to ascertain the most efficacious ways of controlling these post harvest mycoflora of wheat circulating in Lagos State, Nigeria.

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