

Public Health Implications of Fungal Associated with Post-Harvest Spoilage of Vegetables in Osogbo Metropolis

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ABSTRACT:

Study of fungi responsible for the post-harvest spoilage of *Amaranthus hybridus*, *Celosia argentea*, *Talinum triangulare* and *Solanum macrocarpon* from four different markets within Osogbo metropolis, Osun state, Nigeria was carried out. Healthy vegetable samples were collected from the selected markets. Fungal species found associated with the deterioration of the various vegetables tested included *Aspergillus niger*, *Aspergillus flavus*, *Aspergillus fumigatus*, *Penicillium maniffei*, *Trichoderma harzianum*, *Microsporum specie*, *Fusarium oxysporum*, *Trichophyton terrestre*, *Bipolaris hawaiiensis*, *Geotrichum candidum*, *Rhizopus specie* and *Rhizopus stolonifer*. All isolated fungi were pathogenic to the different vegetables from the result of pathogenicity tests that were carried out.

Keyword: Fungi, Spoilage, Infection, Pathogen, Vegetables

INTRODUCTION

Generally, vegetables are considered as the leafy outgrowth of plants or plants shoot used as food [1]. Vegetables are important protective food and highly beneficial for the maintenance of health and prevention of diseases. They contain valuable food ingredients which are essential for the proper function of the body. The incidence of fungi and other microbes in vegetables may be expected to reflect the sanitary quality of the processing steps and the microbiological condition of the raw product at the time of processing [2]. Fruits and vegetables supply some necessary nutritional substances such as vitamins and essential minerals in human daily diet; this keeps the body in a good and healthy condition [3]. Consumption of fruit and vegetable products has dramatically increased in Nigeria by more than 40% during the past few decades. It is also estimated that about 30% of all fruits and vegetables produced is lost each year due to spoilage [3, 4]. The occurrence of fungi as the spoilage organism of some edible fruits and vegetables abound in different locations in Nigeria. Fruits and vegetables are exposed to contamination by microorganisms especially fungi, through direct contact with soil, dust, water and by handling at harvest or during postharvest processing. This makes them to harbour a wide range of microorganisms including plant and human pathogens [4, 7].

Fungi are increasingly implicated as the spoilage agents of economically important fruits and vegetables, because they produce an abundance of extracellular pectinases and hemicellulases that are important factors for fungal spoilage [5]. Some spoilage microbes are capable of colonizing and creating lesions on healthy, undamaged plant tissue [6]. Improper pre-harvest processes including fungicide application, poor washing, and/or inadequate culling of fruits and vegetables usually lead to expanding infestation of spoilage microorganisms which can destroy a substantial portion of a stored lot of fruits [4, 6]. The aims of this present study was to investigate and document the prevalence of fungi responsible for the spoilage of some fruits and vegetables within Osogbo metropolis, Osun State, Nigeria and to

create awareness on the public health implications.

MATERIALS AND METHOD

Sample collection

The vegetable samples used in this study were obtained from four different markets within Osogbo metropolis, these are Orisumbare market, Alekuwodo market, Igbona market and Olu-ode market. These samples were placed in separate sterile plastic bags and transported to the laboratory for microbial analysis. The different samples were held in separate aerated places and was allowed to decay.

Fungal Isolation

Decayed vegetable samples cut into 2 mm² pieces with a flamed surgical blade, surface sterilized with 1% NaOCl and rinsed three times with sterile distilled water. The excised decayed portions were then plated on to Potato dextrose agar (PDA) supplemented with 50 mg chloramphenicol. Inoculated plates were incubated at room temperature (28±2°C) for 5 - 7 days and was observed daily. The identity of these fungi was certified using cultural and morphological characteristics. The pathogenicity tests was carried out to confirm the pathogenicity of the isolated fungi, this was done according to modified method of Ewekeye *et al* [3]

RESULTS

A total of twelve fungi were found in association with post-harvest spoilage of some selected vegetable samples in this study. The fungi were *Aspergillus niger*, *Aspergillus flavus*, *Aspergillus fumigatus*, *Penicillium maniffei*, *Trichoderma harzianum*, *Microsporum specie*, *Fusarium oxysporum*, *Trichophyton terrestre*, *Bipolaris hawaiiensis*, *Geotrichum candidum*, *Rhizopus specie* and *Rhizopus stolonifer*. The distribution of these fungi among the various vegetable samples were equal, such that no two fungi appeared in a particular vegetable sample (Table 2). *Celosia argentea* shows highest occurrence of fungal isolates among other vegetable samples. Six out of twelve fungal isolates were isolated from *Celosia argentea* while three isolates were gotten from

Amaranthus hybridus (Table 1). The rate of fungi isolated from the various vegetable samples were as follows; *Amaranthus hybridus* (25%), *Celosia argentea* (50%), *Talinum triangulare* (8.3%) and *Solanum macrocarpon* (16.7) (Table 1). The pathogenicity test carried out indicated that the fungi were actually capable of post-harvest spoilage of these selected vegetable

samples. Figure 1 to 4 shows the results of pathogenicity test carried out where all the four vegetable samples present disease condition after fungal inoculation of healthy vegetables. Figure 1-4A presented the healthy vegetable samples while Figure 1-4B shows the disease vegetable samples inoculated with fungi observed at ten days.

Table 1: Rate of fungi isolated from the various vegetable sample

Vegetables	No of fungal isolates	Rate of fungal isolates (%)
<i>Amarantus hybridus</i>	3	25
<i>Celosia argentea</i>	6	50
<i>Talinum triangulare</i>	1	8.3
<i>Solanum macrocarpon</i>	2	16.7

Table 2: Percentage distribution of fungi from the various vegetable sample

Fungi	<i>Amarantus hybridus</i>	<i>Celosia argentea</i>	<i>Talinum triangulare</i>	<i>Solanum macrocarpon</i>
<i>Aspergillus niger</i>	0	0	25	0
<i>Penicillium maneffei</i>	0	25	0	0
<i>Aspergillus flavus</i>	0	25	0	0
<i>Trichoderma harzianum</i>	0	0	0	25
<i>Microsporum specie</i>	0	25	0	0
<i>Fusarium oxysporum</i>	25	0	0	0
<i>Trichophyton terrestre</i>	25	0	0	0
<i>Aspergillus fumigatus</i>	0	25	0	0
<i>Bipolaris hawaiiensis</i>	0	25	0	0
<i>Geotricum candidum</i>	0	0	0	25
<i>Rhizopus specie</i>	0	25	0	0
<i>Rhizopus stolonifer</i>	25	0	0	0



Figure 1A: *Amaranthus hybridus* (Healthy)



Figure 1B: *A. hybridus* inoculated with fungi



Figure 2A: *Celosia argentea* (Healthy), Figure 2B: *C. argentea* inoculated with fungi





Figure 3A: *Talinum triangulare* (Healthy), Fig. 3B: *T. triangulare* inoculated with fungi



Figure 4A: *Solanum macrocarpon* (Healthy), Fig. 4B: *S. macrocarpon* inoculated with fungi

DISCUSSION

The high rate of isolation of fungi species from vegetables in this study showed that fungi are responsible for post-harvest deterioration of some vegetables. This is in line with the work of Akinmusire [8], who in his studies in Maiduguri, Northern Eastern Nigeria reported the prevalence of fungi as the spoilage organism of some edible fruits and vegetables *Fusarium oxysporum* and *Fusarium moniliforme* were among other fungi isolated. Spoiling fungi are considered toxigenic or pathogenic, whereby toxigenic fungi have been isolated from spoiling fruits [9]. Pathogenic fungi, on the other hand, are known to produce several toxic metabolites, such as malformins, naphthopyrones [9, 10] and they can produce Ochratoxins (OTA), a mycotoxin which is a very important toxin worldwide because of the hazard it poses to human and animal health.

All the thirteen fungi isolated were confirmed to be pathogenic on vegetables but in varying degrees. It showed that all the isolated fungi were pathogenic leading to disintegration of vegetables in 3-10 days. These thirteen fungi isolates (*Aspergillus flavus*, *Penicillium maneffei*, *Aspergillus niger*, *Aspergillus fumigatus*, *Fusarium oxysporum*, *Bipolaris hawaiiensis*, *Trichoderma species*, *Geotrichum candidum*, *Microsporium species*, *Rhizopus species*, *Trichoderma harizanium*, *Trychophyton terrestre*) were successfully taking part in the vegetable decay and are thus confirmed as the spoilage organisms as reported by [11, 12]. The contamination of vegetables by pathogenic fungi could also be as a result of poor handling practices in food supply chain, storage

conditions, distribution, marketing practices and transportation [8, 13, 14]. Vegetables with bruises portends a great risk of aflatoxin and other mycotoxins to the consumers [11, 13].

CONCLUSION

In this study, thirteen fungi isolates were successfully isolated from four vegetable samples. The isolated fungi species were inoculated into fresh vegetable samples used in this study. The inoculated fungi were capable of inducing spoilage in the fresh vegetable samples as it was observed in this study. From public health viewpoints, there is the need for microbial assessment of vegetables to reduce possible contamination, through poor handling and poor agricultural practises such as irrigation.

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