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Original Article

PREVALENCE OF FUNGI IN CENTRAL MARKET OF LAPAI, NIGER STATE, NIGERIA

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ABSTRACT

The study was conducted to determine the prevalence of molds in soil samples collected from four different locations (yam, sugar cane, vegetables and plastic marketing areas) in Lapai central market. The soil samples collected were serially diluted, inoculated on PDA and incubated at 28^{o}C $\pm$ 2^{o}C for 72 hours. Fungi associated with the samples were isolated and identified. In all the sampled areas, a total of twelve(12) fungi species from seven (7)genera viz. *Aspergillus niger, A. flavus, Afumigatus, A. clavatus, Alternaria alternata, Cladosporium herbarium, Trichoderma herzianum, Fusarium oxysporium, Fusarium solani, Penicillium italicum, Penicillium chrysogenum and Rhizopus stolonifer* were isolated. From sugar cane marketing area, *A. flavus* has the highest significant percentage frequency of occurrence (25.8%) at P<0.05while *Alternaria alternata, C. herbarium, T. herzianum* and *P. chrysogenum* were not isolated. *R. stolonifer* has the highest significant percentage frequency of occurrence at P<0.05 in yam, plastic and control areas with 18.00%, 60.00% and 15.73% respectively. The results revealed that the most prevalent fungi in Lapai central market was *R. stolonifer* with the highest mean percentage of occurrences of 26.5% followed by *A. flavus* (15.45%), and *C. herbarium* was the least(0.25%). All others fungal species were moderately present. This study revealed high abundance of fungal species in the main market in Lapai especially where farm produce are offered for sale. Therefore, total cleaning of farm produce brought directly from the farms to the market and possibly, periodic

fumigation of the Market area to bring down the level of fungal build up are suggested.

Key word: Fungi, Yam, Sugar cane, Vegetable, Plastic

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INTRODUCTION

Soil is a rich habitat containing all major groups of microorganisms like bacteria, protists and fungi (Puangsombat *et al*., 2010). It is an oligotrophic medium for the growth of fungi that are virtually present in every type of soil. Fungi species reportedly isolated from different types of soil include: *Mucor* species *, Aspergillus niger, Cryptococcus , Byssochlamys fulva, Aspergillus wentii, Aspergillus terreus, Penicillium brevicompactium, P. cyclopium, P.raistrictii, Fusarium, Trichoderma* species *, Curvularia* species*, Collectrichum* species*, Helminthoorium* species *and Penicillium* species (Etukudoh *et al*., 2011; Ewekeye *et al*., 2012; Gaddeyya *et al*., 2012 and Rohilla and Salar, 2012). Fungi are eukaryotic microorganisms important to humans in several ways. They are among the most important microorganisms associated with food poisoning and causes infections that coul lead to death. Pathogenic fungi such as *Aspergillus* species*, Fusarium* species*, Pythium* species, *Phytophtora* and *Penicillium* isolated from soils are known to produce mycotoxin that causes food poisoning (Adebanjo and Bankole, 2003). Aflatoxins contaminated diet is immunotoxic to both livestock and man. Some of the commodities that are easily disposed to aflatoxins are cereals, tubers, legumes, milk etc.

Occupational exposure to aflatoxins in agricultural workers, people working in oil mills, markets and granaries have been reported (Sorenson et *al*., 1994). A significant correlation among the aflatoxins exposure and stunted growth in children who are exposed to aflatoxin right from neotal stages was reported by Gong *et al*. (2002). Fumonisins, are important field mycotoxin caused by *Fusarium* causing adverse effect to human and animal health (Visconti, 2001). *Fusarium* species has been reported to be the most frequently isolated fungi in pre- harvest and stored food crop such as maize (Ekpo and Banjoko, 1994; Essien, 2000). Ochratoxin a is a mycotoxin produced by different species of *Aspergillus* and *Penicillium* and found as natural contaminants in many foodstuff including cereals, dried fruits, cocoa, wine, poultry eggs and milk. These mycotoxins are immunosuppressive, teratogenic, genotoxic and mutagenic (Adebanjo, 1993; IARC, 1993; Kpodo, 1996).

The post harvest handling of farm produce in our chime is very poor and contamination rate is alarming. Some of these food items are contaminated either from the farm, during transportation or processing

and brought to the market, leading to build- up of innoculum density of fungi in the market environment. On this note, this study was therefore aimed at isolating, identifying and enumerating the frequency of occurrence of different fungi species present in different sites where farm produce are sold in the main market in Lapai Niger State of Nigeria.

MATERIALS AND METHODS

Study area

This study was carried out in the Main Market Lapai, in Lapai, Niger State, Nigeria. The market holds on every Tuesday of the week. Farm produce sold in the market include, but not limited to, yam, sugarcane, vegetables, grains, beans, meat, fish, domestic utensils, cloth and finished goods. Four areas were sampled and categorized into areas I,II, II and IV. Area I: where different species of yams are sold; Area II: where sugar cane is sold; Area III: where vegetables (Spinach, onions, tomatoes and pepper) are sold; Area IV: where finished goods such as plastic and clothing materials are sold.

Collection of soil samples

Soil samples from the selected sample areas were carefully collected using sterile augers, hand trowels and sterile polythene bags. Auger was used to dig the soil from 0-20cm, then hand trowel used to scoop the soil into a polythene bag for laboratory analysis. Another sample of soil was collected 500metres away and as the control designated as area V.

Preparation of culture media and isolation of fungi

Potatoes Dextrose Agar (PDA) was prepared according to manufacturer's instruction. Serial dilution was performed for the isolation of fungi as follows: One gram of soil sample was aseptically transferred into 9ml of sterile distilled water in test tubes and shaken properly to allow even distribution of microorganism present in the sample. One ml of dilution 10^{-1} and 10^{-2} were aseptically taken from the suspension and transferred into sterile Petri dishes. The PDA containing chloraphenicol (30mg/l), and the plates were swirled gently allowed to gel and were incubated at ambient temperatures ($28 \pm 2^{o}C$) for 72 hours. Sub-cultures were made from initial culture for pure isolate of each fungus. Fungal isolates were identified using cultural, microscopic and characterization as outlined by Cannon and Kirk, (2007). Stock cultures were preserved in PDA and refrigerated at $4^{o}C$.

Determination of percentage frequency

The percentage frequency of each species of fungus isolated was determined by the formula C/D x100; where C = Number of plates in which the species appeared, and D = Total number of plates incubated for sample area (Sampol *et al.*, 1997).

Statistical Analysis

All data collected were analysed using Analysis of variance (ANOVA). The test statistic follows Snedecor's F distribution.

RESULTS

A total of twelve different moulds from seven genera were isolated from all the areas sampled in Main Market, Lapai (Table 1).

Eight moulds from four genera viz: *Aspergillus niger*, *A. flavus, A. fumigatus, A. clavatus, Fusarium oxysporium, Fusarium solani, Penicillium italicum* and *Rhizopus stolonifer* were isolated from area II. *A. flavus* had the highest percentage frequency of 25.80% followed by *Fusarium oxysporium* with 15.80%, *A. clavatus and A. fumigatus* had the same frequency of 3.20%. *A. alternata, C.herbarium, T. herzanium* and *P. chrysogenum* were not isolated (Table 1).

In area III (Table1), all the twelve (12) fungal species from seven genera were isolated viz: *Aspergillus niger, A. flavus, A. fumigatus, A. clavatus, Alternaria alternata, C. herbarium, T. herzanium, F. oxysporium, F. solani, P. italicum* and *R. stolonifer. A. niger* had the highest frequency of 19.35%, followed by *A. flavus* and *F. oxysporium* with 14.00% each while *A. fumigatus* and *A. clavatus* had the same percentage occurrence of 3.2% *C. herbarium* had the least frequency of 3.23 %.

A total of ten (10) species from six (6) genera; *A. niger, A. flavus, A. fumigatus. T. harzanium, F. solani, P. italicum, P. chrysogenum, R. stolonifer and A. alternata* were isolated from area I (Table1). *R. stolonifer* had the highest percentage occurrence of 18.0% and was followed by *P. chrysogenum* with 16.0%, while the least isolated species were *T. harzanium* and *F. oxysporium* with 3.0% each. *A. clavatus* and *C. herbarium* were not isolated.

From area IV (Table 1), only nine fungal species from six genera were isolated viz: *A. niger, A. flavus*, *A. fumigatus, P. chrysogenum,* P*. italicum T. harzanium, F. solani, R. stolonifer* and A*. alternata. R. stolonifer* had the highest frequency of occurrence of 60.0%, while *T. harzanium* had the least percentage of occurrence of 1%

From the control area V, only *A. clavatus* was not isolated. *R. stolonifer* had the highest percentage of occurrence of 15.73% (Table 1) followed by *F. solani* 13.39% while *A. alternata* was the least (6.20%).

Isolation from the soil (Table1) taken from adjacent area to the market served as the control. *R. stolonnifer* has the highest percentage of occurrence (15.73%) followed by *Fusariun solani* (13.39%), *A niger* (10.36%), *P. chrysogenum* (10.13%). However, A. clavatus wasnot isolated from the area.

Table 1: Percentage frequency (%)of occurrence of fungal isolates in the four sampled areas in Lapai central market.

Isolated fungi	Area I	Area II	Area III	Area IV	Mean total
Aspergillus niger	12.9^{d}	16.0^{c}	15.0^{c}	12.0^{b}	13.93
Aspergillus flavus	25.8^{f}	14.0^{b}	14.0^{c}	8.0^{b}	15.45
Aspergillus fumigatus	3.2^{b}	2.0^{a}	4.0^{a}	6.0^{b}	3.80
Alternaria alternate	0.0^{a}	3.0^{a}	4.0^{a}	4.0^{a}	2.75
Aspergillus clavatus	3.2^{b}	12.0^{b}	0.0^{a}	0.0^{a}	3.80
Cladosporium herbarium	0.0^{a}	1.0^{a}	0.0^{a}	0.0^{a}	0.25
Trichoderma harzanium	0.0^{a}	5.0^{a}	3.0^{a}	1.0^{a}	2.25
Fusarium oxysporium	15.8^{e}	14.0^{b}	3.0^{a}	0.0^{a}	8.20
Fusarium solani	14.0^{e}	12.0^{b}	10.0^{b}	2.0^{a}	9.50
Penicillium italicum	9.0^{c}	6.0^{a}	13.0^{c}	3.0^{a}	7.75
Penicillium chrysogenum	0.0^{a}	3.0^{a}	16.0^{cd}	4.0^{a}	5.75
Rhizopus stolonifer	16.0^{e}	12.0^{b}	18.0^{d}	60.0^{c}	26.50

Percentage fungi occurrence in a column that bears the same letters are not significantly different ($P < 0.05$) SCA= Sugar cane Area; VG = Vegetable Area; YMA= Yam Area; PLA= Plastic Area

Table 2: Percentage frequency (%)of occurrence of fungal isolates in the control sampled area adjacent to Lapai central market.

Isolated fungi	Percentage frequency(%)
Aspergillus niger	10.36b
Aspergillus flavus	9.16bc
Aspergillus fumigatus	7.40c
Alternaria alternata	6.20c
Aspergillus clavatus	0.00e
Cladosporium herbarium	4.30d
Trichoderma harzanium	7.22c
Fusarium oxysporium	6.31c
Fusarium solani	13.39a
Penicillium italicum	9.84bc
Penicilliumchrysogenum	10.13b
Rhizopus stolonifer	15.73a

Percentage fungi occurrence in a column that bears the same letters are not significantly different ($P < 0.05$)

DISCUSSION

The results in this study indicated a high prevalence of fungi in various proportions in central Market, Lapai, Niger State. The isolated fungi species from areas where farm produce were being sold were higher compared to those isolated from the plastic selling area. The occurrence of *Aspergillus* sp. was found to be the highest confirming their cosmopolitan nature and possibly because they sporulate profusely, releasing enormous number of spores as earlier reported by Durowade *et. al.*, (2008). It was also revealed that the total number of fungi isolates was more in Yam marketing areas than in other areas. This could be because yam is exhumed from the ground and most of the fungi isolated are soil borne. Of all the marketing areas sampled, plastics area (area IV) had the least fungal isolates, probably because only synthetic products are sold in the areas as compared to other areas where farm produce are marketed. *Aspergillus flavus* and *A. niger* were observed to have the highest frequency. Their dominance was also reported in the works of Ewekeye *et.al. (*2012).This could be dangerous as they are known to produce aflatoxins (Nilimal *et.al.,* 2011 and Gaddeyyah *et.al.,* 2012). *Fusarium* species which are also notorious in the production of lethal toxins called Fumonisins (Latiffah *et.al.,* 2011)were abundantly isolated in this study. The prevalence of *Rhizopus stolonifer* in high frequency in yam marketing area(areaI) may possibly be due to the role they perform in decomposition of plant structural polymers, such a cellulose, hemicelluloses and lignin.

The wide spread occurrence of these fungi in the main market at Lapai has serious implications as some of them are known to produce mycotoxin. The prevalence is encouraged by the rate at which food crops and other farm produces known to harbour soil microorganisms are taken to the markets from different sources. Some of these food crops were contaminated either from the farm, during transportation or handling and brought to the market. As more farm produce is brought to the market, fungi density tends to rise. Therefore, this study suggests total cleaning of farm produce brought directly from the farms to the market and possibly, periodic fumigation of the Market area to bring down the level of fungal build up.

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