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Isolation and Identification of Fungi Responsible for the Spoilage of Apple in Gaskiya, Zaria Market, Kaduna State, Nigeria

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ABSTRACT
Fruits are the comestible part of mature ovary of flowering plants which are normally eaten raw. Fruit also includes many structures that are not commonly called fruits such as bean pods, corn kernels, tomatoes, and wheat grains. The importance of fruit in human nutrition cannot be overestimated as it provides essential growth factors such as vitamins and minerals necessary for proper body metabolism. The Study used fourteen samples of fruits of Apple. Microscopic Method was employed the result revealed the fungi responsible for spoilage of these fruits are Aspergellus Niger, 119(51.3%), Fusarium spp 28 (25%) and Penicillium spp,55(23.7%). The study recommended an aggressivity/pathogenicity assessment of the fungi as well as their biomolecular characterization is also essential to confirm their identity and pathogenic importance.

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INTRODUCTION

Apples *(Malus domestica)* are one of the most widely consumed fruits worldwide and earlier studies have shown that it not only has a higher fiber content than other fresh fruits (cellulose, hemicelluloses, pectin and lignin content) but also that its consumption have a statistically significant impact on weight reduction and hence widely used as part of diet in controlling obesity. Furthermore, the consumption of apple juices mainly for their antioxidant properties with contributions from ascorbic acid reduce outset of cardiac diseases, cancer, ageing processes, and interferes with the oxidation of lipoproteins of low density.

Studies conducted (Ammon,et al;2018) have showed that the presence of antioxidants such as ascorbic acid effect some contribution to the biochemical efficiency of apples and corresponding fruit products. However, it was concluded that vitamin C only account for a small percent of the total antioxidant activity of apple juices and that polyphenols are higher in terms of contributions to the overall total antioxidant activity. The chemical characteristics of apple juice are well balanced and may vary depending on variety, production region and production system adopted. Juices obtained from apples provide a good composition in terms of sugar and acid content, presenting a taste that is mostly appreciated by consumers. With respect to calorie intake, they are moderately energetic. Armijo, *et al.,* (2018) reported that the water composition of apple fruits is over 85% and this is where minerals such as potassium, magnesium, calcium and sodium as well as some trace elements are dissolved in. The most abundant vitamins in apple juices are the water-soluble vitamins, although it is evident that a large diversity of vitamin activity is present.

The aim of the study is to access, isolate and identify the microorganisms responsible for the contamination of Apple, Mango and Banana. The specific objectives are

1. To isolate and identify the fungal organisms responsible for the spoilage of fruits.
2. To determine the fungi with high frequency occurrence of the spoilage.

Preparation of the Media

14 gram of potato dextrose agar (PDA) weighed and transferred into the conical flask, 400

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mls of distilled water will be measured in a measuring cylinder and will transfer into the conical flask containing PDA and will be shake vigorously and small amount of streptomycin will be applied, the media will be covered with cotton wool and blotting paper was sealed with masking tape. The media was heated on the Bunsen burner for 3 times and poured on a petri dish and allowed to solidified.

Procedure for the Experiment

A small portion of fungal growth inoculated with a sterile wire loop into the petri dishes, the plates will be labeled and inverted into the incubator for a period of 5 – 7 days. After incubation period, a well separated colony along streak lines of PDA plates will be observed, a little of the colony will be scrapped from the center of another PDA plate. Pure colonies in final plates were microscopically was examined.

Preparation for Microscopic Examination

A small portion of each sub-cultured colony scraped out using sterile wire loop was placed on a center of new sterile glass slide, the slide was left on a bench ad allowed the air dry, the slide was picked carefully and respectively with forceps and dropped on the container that containing lactophenol and was rinse with water and allowed to air dry. The slide will be prepared covered carefully with coverslip slide of each colony was made and will observed under low power objective (XI0) and high-power objective (X40) lens of the compound microscope

RESULTS

Table 1: Frequency of occurrence of isolation found in Apple

S/N	Isolate	Frequency of Occurrence	%
1	Penicillium	55	23.7
2	Fusarium	58	25
3	Aspargillus	119	51.3
		232	**100%**

This study isolated three fungi responsible for the spoilage of Apple they are *Aspergillums Niger, Fusarium sp and Penicillium sp*. The *Aspergellus Nige*r is the common fungus responsible for these fruits. *Aspergellus Niger*, 119(51.3%), Fusarium *spp 28* (25%) and *Penicillium spp,55(23.7%)*. This finding is in line of study carried out in Anambra State by Arya, *et al.* (2021) examined fungi associated with the post-harvest loss of fruits obtained from Eke-Awka market, Awka South Local Government Area, Anambra State. The spoilage molds they identified were three species: *Aspergillus fumigatus, Aspergillus niger* and *Rhizopus stolonifer.* Though Anambra and Ebonyi States are both in South East of Nigeria, the reason for the variation in occurrence of up to seven different species of fungi in the present study and those (3 species) of Arya, *et al* (2021) may be due to several factors such as sample size and sampling location. A different report contradicted the present study is the findings of Amienyo and Ataga (2007) who analyzed fruits samples collected from different markets Port Harcourt and identified six fungi comprising four of the fungi genera (*Fusarium*, *Rhizopus*, *Aspergillus* and *Botryodiplodea*) and species (*Aspergillus flavus, Aspergillus niger, Botryodiplodia theobromae, Fusarium solani*).

Table: 2: The Isolated Fungi Responsible for the Spoilage of Apple

S/N	Macroscopic	Microscopic	Isolate
1.	Growth is recognizable within few days, from velvety to glacy surface due to sporulation and appears to be black in colour	The hypae are septate. Consisting of a compact white or yellow basal felt with a dense layer of dark brown to black conidiophores. Conidial heads radiate, tending to	Aspargillus Niger

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S/N	Macroscopic	Microscopic	Isolate
		split into loose column with age.	
2.	Growth is recognized within three days and it consists of dense felt of dark green colouration	Consisting of dense felt of dark green conidiophores intermixed with aerial hyphae bearing conidiophores. Conidial heads typically columnar. Conidiophores short, smooth, particularly in the upper part.	Aspargillus Fumigation
3.	Growth is recognized within three days consisting of dense felt or yellow-green colouration	Consisting of septate hyphae. Consisting of dense felt or yellow green coniosphores conidial heads typically radiate, later splitting into several loose column, yellow green becoming dark yellow green	Aspargillus flavus
4.	The fungi is the mainly biospheres and produce filamentous flat radially suleade colonies and 25^0c these colonies are blushing gray-green at center and white at pipriptery there dirapiditly diffusion isolate pigment observed.	Penicillium sp were initially white and become blue-green, gray-green, olive-gray yellow or pinish with time multi cellular fungi are composed of fitament called hyphae.	Penicillium

DISCUSSION OF FINDNGS

This study isolated three fungi responsible for the spoilage of Apple, Banana and Mango they are *Aspergillums Niger, Fusarium sp and Penicillium sp*. The *Aspergellus Niger* is the common fungus responsible for these fruits. *Aspergellus Niger*, 119(51.3%), Fusarium *spp 28* (25%) and *Penicillium spp,55(23.7%).* This finding is in line of study carried out in Anambra State by Arya, *al.* (2021) examined fungi associated with the post-harvest loss of fruits obtained from Eke-Awka market, Awka South Local Government Area, Anambra State.

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CONCLUSION

From this study, three pathogenic fungi were revealed to be associated with Apple, Mango

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and BananNamely. *Aspergillums Niger, Fusarium sp and Penicillium sp* Results also show a variability of types of infection on relative abundance of the pathogenic fungi.

RECOMMENDATION

The Study recommended the appropriate in perspective to realize a more elaborate study to determine the prevalence of these pathogens in relation to pertinent factors. An aggressivity/pathogenicity assessment of the fungi as well as their biomolecular characterization is also essential to confirm their identity and pathogenic importance.

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