



DETECTION OF FUNGI ASSOCIATED WITH THE SPOILAGE OF *Psidium guajava*, *Malus domestica* AND *Persia americana* FROM SELECTED MARKETS WITHIN KADUNA METROPOLIS.

Jere, S.A., Obajemu, O. and Keziah Y.

Department of Applied Science, College of Science and Technology, Kaduna Polytechnic, Kaduna - Nigeria.

saudatujere@gmail.com

ABSTRACT

Ten samples each of *Psidium guajava*, *Malus domestica* and *Persea americana* were collected from Sabo Market, Station and Bakin Dogo Market all within Kaduna State. These fruits were Mycollogically analyzed using the Spread plate techniques for isolation and enumeration of Microorganisms. Five fungi genera were found as major contaminant present in most of the samples from the various markets which include *Penicillium* species, *Mucor* species, *Rhizopus* species, *Aspergillus* species and Yeast. *Aspergillus* was found as the major contaminant present in most of the samples from the various markets while *Mucor* species was the lowest contaminant fungi. The high prevalence of these fungi demand appropriate control major against infection should be employed if farmers expect good performance of their produce. Proper storage facilities should be employed as improved means of transportation, should be achieved by proper loading of fruits to areas they are sold.

Key words: Fungi, Fruits and Microscopic Analysis.

INTRODUCTION

Fruits play a vital role in human nutrition by supplying the necessary growth factors such as vitamins and essential minerals in human daily diet and that can help to keep a good health (Bankole, 2004). Fruits are widely distributed in nature. One of the limiting criteria is the relatively short- shelf life period caused by pathogens attack. It is estimated that about 20 - 25% of the harvested fruits are decayed by pathogens during post-harvest handling even in developed Countries. It has been known that fruits constitute commercially and nutritionally important indispensable food commodity (Al-Hindi *et al.*, 2011). Pathogenic organisms can enter fruits through damaged surfaces, such as punctures, wounds, cuts and splits that occur during growing or harvesting (Durgesh *et al.*, 2011). One of the factors influencing virulence of pathogens is their ability to produce enzymes capable of degrading their hosts' tissue. Microorganisms especially bacteria and fungi have been identified as major organisms causing deterioration of various fruits by the secretion of extracellular cell wall degrading enzymes (Ayanda *et al.*, 2013). Fruits contain high levels of sugars, nutrient and their low pH values makes them particularly desirable to fungal decay (Singh *et al.*, 2007). Generally, spoiling fungi are considered toxigenic or pathogenic. Toxigenic fungi have been isolated

from spoilt fruits (Stinson *et al.*, 1981). Use of untreated waste water and manure as fertilizers for the production of fruits is a major contributing factor to contamination. In developing Countries, food borne illnesses caused by contaminated fruits are frequent and in some areas they cause a large proportion of illness (Meher *et al.*, 2011).

Psidium guajawa (Guava) is one of the well-known commercial fruit crops from family Mytaceae and genus *Psidium*. *Malus domestica* (Apple) (Milleri, 1968) is one of the most widely cultivated fruit that is originated from Rosaceae family and genus *Malus* (Barry, 2001). *Persea americana* commonly called Avocado (Royal Botanical Garden, 2010) is a member of the family Lauracea, which are mainly shrubs and trees that yield resinous aromatic gum from their cut bark. The poor shelf-life of the fruit has led to its high perishability, huge losses and market glut during harvest as noticed by large heaps of unsold rotten fruits in the refuse dumps of village and Urban Markets. The Avocado fruit is vulnerable to bacterial, viral and fungi diseases which lead to its spoilage (Samson and Van Reenen - Hoekstra, 1988).

The major source of fruits contamination includes pre-harvest process, plant growth, environment and cultivation soil, organic fertilizer and harvest and post-harvest process. This study is therefore, undertaken to isolate and identify the various microorganisms

Special Conference Edition, November, 2018

associated with the spoilage of *Psidium guajava*, *Malus domestica* and *Persia americana* fruits obtained from selected markets within Kaduna metropolis.

MATERIALS AND METHODS

Sample Collection

Ten (10) samples each of *Psidium guajava*, *Malus domestica* and *Persea americana* fruits were collected from three selected markets within Kaduna metropolis. These markets are Sabo markets, Station market and Bakin Dogo market. Of these selected fruits each of the decaying portion were subjected for fungal identification.

Isolation and Identification of Fungi

Sabouraud dextrose agar was prepared according to the manufacturers instruction. The preparations were sterilized in an autoclave at 121⁰C for 15 minutes, cooled at about 45⁰C and dispersed aseptically into sterile petri dishes. Fifteen millimeter (15ml) was used for fungal isolation. The plates were inoculated with the spilt fruits, incubated at room temperature (25⁰C) for four days (Jolt *et al.*, 2004).

The identification of fungal was based on the macroscopic and microscopic appearance which comprises of the pigmentation, area colours and substrate hyphae. Reference was made to the standard identification key and atlas (Fawole and Oso, 1986).

RESULTS AND DISCUSSION

The fungi isolated are *Aspergillus* species, *Rhizopus* species, *Mucor* species, *Penicillium* species and Yeast (Table 1). Most of the organism are storage fungi that have been variously implicated in the spoilage of fruits

and vegetable (Amadi, 2005 and Lima, 2009). Some of the fungi isolated e.g. *Aspergillus* species and *Penicillium* species are known to be producers of Mycotoxin which are secondary metabolites that are known to cause a lot of deteriorious effect when consumed in food by man (Okigbo, 2009). Factors affecting Mycotoxin production include the fruit or vegetable and cultivar, geographical location, climate, pre-harvest treatment and method of harvest (Ehsani, 2007). Fruits are susceptible to pathogenic attack due to their low pH, high moisture content and nutrient composition, these make them unfit for consumption. The high rate of isolation of fungi species from selected fruits in this study have been previously isolated in decayed fruits and vegetable in other studies in Nigeria (Walker, 2007 and Uzeh *et al.*, 2010).

Aspergillus spp and Yeast have the highest occurrence of 5(55.55%), while the least is *Mucor* spp with 1 (11.11%) occurrence (Table 2). Samuel Mailafia *et al.* (2017) identified fungal organisms associated with spoilt fruits in the Gwagwalada area include *A. niger* with 70% occurrence and yeast (40%) suggesting that these fungal organisms could be responsible for the fruit spoilage.

The highest contamination of the fruits based on the markets is attributed to Station market with 7 fungi isolated from all the fruits, while the least fruit contamination was observed in Sabo market with 3 fungi isolated from all the fruits sampled (Table 3). The highest contamination in Station market might be attributed to the large volume of human activities going on in the market (Samuel Mailafia *et al.*, 2017).

Special Conference Edition, November, 2018

Table 1: Macroscopic and Microscopic Characteristics of Organisms Isolated from the Three Different Fruit Sold in the Three Markets within Kaduna Metropolis.

Sample area	Fruit	Macroscopic characteristics	Microscopic characteristics	Inference
Sabo Market	<i>Psidium guajava</i>	Deep brown	Hyphae is septate	<i>Aspergillus</i> species
	<i>Malus domestica</i>	Green colony	Conidiophores are Branched it terminates in one or few phalid.	<i>Penicillium</i> species
	<i>Persea americana</i>	white to creamy colonies	Pseudohyphae smooth globose and yeast like blasto conidia	Yeast species
Station Market	<i>Psidium guajava</i>	white to creamy colonies	Pseudohyphae smooth-yeast like globose blasto conidia	Yeast species
	<i>Malus domestica</i>	Deep brown Powdery colony white to creamy colonies	Hyphae is Septate Pseudohyphae Smooth yeast like globose blasto canidia	<i>Aspergillus</i> species. Yeast species
	<i>Persea americana</i>	White colour turns Greyish as it aged, Fluffy appearance Resemble cotton Deep brown Powdery colony	Non - septate broad hyphae sporengiophores sporangi lack rhisoids Hypuae is septate	<i>Mucor</i> species <i>Aspergillus</i> species.
Bakin Dogo Market	<i>Psidium guajava</i>	Colony appeared pure white with Cotton like bearing black spore	Non- septate mycelium, and the sporengiophores formed were smooth well erect end pale brown. Hyphae is septate	<i>Rhizopus</i> species. <i>Aspergillus</i> species.
	<i>Malus domestica</i>	Deep brown mycelium Green colony	Conidiophores are branched it Terminates in one or few phalides	<i>Penicillium</i> species
		White to creamy colonies	Pseudo hyphae smooth Yeast - like globose bistro conidia	Yeast species
	<i>Persea americana</i>	Deep brown Powdery colony Colony appeared Pure whitish Cotton like Mycelium, bearing black spore	Hyphae is Septate Non - septate Pscelium and the sporangiophores formed were smooth, well erect end pale brown	<i>Aspergillus</i> species <i>Rhizopus</i> species

Table 2: Occurrence of fungi isolated from *Psidium guajava*, *Malus domestica* and *Persia americana* obtained from three markets within Kaduna Metropolis.

Sample	Market	A	B	C	D	E	Total (%)
<i>Psidium guajava</i>	Sabo Market	+	-	-	-	-	1(20)
	Station Market	-	-	-	+	+	2(40)
	Bakin Dogo Market	+	-	+	-	-	2(40)
<i>Malus domestica</i>	Sabo Market	-	-	-	+	-	1(20)
	Station Market	+	-	-	-	+	2(40)
	Bakin Dogo Market	-	-	-	+	+	2(40)
<i>Persea americana</i>	Sabo Market	-	-	-	-	+	1(20)
	Station Market	+	+	-	-	+	3(60)
	Bakin Dogo Market	+	-	+	-	-	2(40)
		5(55.55)	1(11.11)	2(22.22)	3(33.33)	5(55.55)	

Key words: (+) present (-) not present
A = *Aspergillus* B = *Mucor* C = *Rhizopus* D = *Penicillium* and E = Yeast.

CONCLUSION AND RECOMMENDATIONS

The fungi isolated at the course of this research include *Aspergillus* species, *Rhizopus* species, *Mucor* species, *Penicillin* species and Yeast. The presence of these organism indicated poor sanitary measures employed by farmers, sellers and consumers of these fruits and could be responsible for food borne diseases. Therefore it is necessary and important for both farmers, marketer and consumers to take precaution in

preventing contamination of these fruits to reduce the risk of Mycotoxin associated with fungal contamination.

Proper sanitary measures are necessary from the packing bags, points of harvest to store rooms and handlers must be observed so as to reduce the microbial load. Also fruits should be properly washed before consumption to reduce the rate of the infection.

REFERENCES

- Al-Hindi, R.R., Al-Najada, A.R., Mohammed, S.A. (2011). Isolation and Identification of some Fruit spoilage Fungi: Screening of Plant cell Wall Degrading Enzymes. *African Journal of Microbiology Research*, 5(4): 443 - 448.
- Amadi, J.E and Oso, B.A (1996). Microflora of cowpea seeds (*Vigna unguiculata* L) and their effect on seeds nutrient contents and germination. *Nigeria Journal of Science* 30:63 - 69 (Published by Science Association of Nigeria SAN)
- Ayanda, O.I., Ajayi, A.A., Olasehinde, G.I. (2013). Isolation, characterization and Extracellular Enzyme Detection of Microbial Isolates: *Int. J. Biol. Chem. Sci.* 7(2): 641 - 648, April, 2013 ISSN 1991 - 8631.
- Bankole, S. A. and joda, A. O. (2004). Associated with spoilage of edible fruits *Africa Journal of Biotechnology* 3(1):52 - 59.
- Barry, P. C. (2001). Avocado; The Early Roots of avocado History Canku Ota. Available at: <http://web.archive.org/web/> (Accessed 5 May, 2013).
- Durgesh, P.M., Ranjana, G.K., Varsha, K.V. (2008). Microbiological Analysis of Street vended Fruit juices from Mumbai City, India. *International Journal of Food Safety*, 10:31 - 34.
- Ehasani, R. (2007). "in-sit Measurement of actual Detachment Force of Oranges harvested by a Canopy Shaker harvesting Machine. Abstract for the 2007 Joint Annual Meeting of Florida State horticulture Society.
- Fawole, M. O. and Oso, B.A. (1986). Laboratory Manual of Microbiology Spectrum book Ltd. Nigeria. 1 - 35 pp.
- Joit, J.G, Krieg N.R, Sneath P.H.A, Strangles J.T, Williams S.T, (1994). Bergeys manual of Systematic Bacteriology 9th Edition Williams & Co. Baltimos' Meryland 78 - 789.
- Lima, *et al.*, (2009). Moulds and Teast in Fruits Salads and Fruitsjuice *Journal of Food Microbiology* 23(7).
- Meher, Nigad Npa, Reaz, Mohammad (2011). Prevalence of multi Drug Resistant Bacteria, Middle-East. *Journal of Scientific Research* 10(1): 70 - 77, ISSN 1990 - 9233.
- Okigbo, RN. (2009). Mycoflora and Production of Wine from Fruit of Soursops. *Int. Journal Wine Res.*, 1:1 - 9.
- Samuel Mailafia, God'spower Richard Okoh, Hamza Olatunde K. Olabode, and Ramatu Osanupin (2017). Isolation and identification of fungi associated with spoilt fruits vended in Gwagwalada market, Abuja, Nigeria. *Vet World*. 2017 Apr; 10(4): 393-397.
- Samson, R. A. and Van Reenen-Hoekstra, E. S. (1988). Quality measurement of fruits and vegetable. *Post Harvest Biology and Technology*, 15:207-225
- Stinson, E.E., Osman, S.F., Heister, E.G., Siciliano, J., Bills D.D. (1981). Mycototin Production in whole Tomatoes, *Malus domestica* Orange and Lemons. *J. Agric. Food Chem.*, 29: 790 - 792.
- Uzeh, R.E., Alade, F.A and Bankole, M. (2009). The microbial quality of pre - packed mixed vegetables salad in some retail outlets in Lagos, Nigeria. *African Journal of Food Science*, 3(9): 270 - 272
- Walker, M. and Phillips. C. A. (2007). The Growth of Propioni bacterium Cyclohexani cum in Fruits Juice and its Survival Following Eleaved Temperature Treatment *journal of Food Microbiology*, 24(4) 313 - 318.