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FUNGAL ROT OF WHITE YAM (DIOSCOREA ROTUNDATA) SOLD IN WARRI MARKETS, NIGERIA.

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Abstract

Observations have shown that one of the problems affecting yams in storage in Warri is fungal rot leading to large economic losses. Hence the need to investigate the fungi associated with yam rot in the metropolis. Fungal decay of white yam (*Dioscorea rotundata*) sold in Warri markets was investigated. A total of seven fungi namely, *Aspergillus niger, Fusarium* sp, *Fusarium sp*^{a}*, Botyodiplodia theobromae, Penicillium* sp and *Sclerotium* sp were isolated and the fungi belonged to three different classes: Ascomycetes, Zygomycetes and Deuteromycetes. The frequency and the nature of the rot produced were recorded and *B. theobromae* was the most frequently isolated fungus and pathogenic followed by *A. niger* and *Fusarium* sp which was the least. Pathogenicity was proved for all the fungal isolates and thus each of the fungus isolated was associated with the decay. Inoculated tubers were examined and the nature of rot recorded.

Key words : Yam cultivars, pathogenicity, isolates, fungi, rot.

Introduction

Yam the tuber of various species of the genus Dioscorea are an important food in many tropical countries notably in West Africa, South East Asia, South America and regions of the Pacific and Caribbean. Historically this crop was introduced into Nigeria from South East Asia where it is believed to have originated. Yam is grown in all states of Nigeria but the greatest production is in the Northern part of the country particularly Idah in Benue State from where the vast majority of tubers are

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brought southwards. Yam production is still high in the South East where it is associated with traditional festivals.

The yam cultivar Dioscorea rotundata is mainly grown in the riverine areas especially on alluvial soils. This crop provides a staple carbohydrate food stuff for most Nigerians from which they derive almost half of their calorie requirement. Six species of yam are cultivated in Nigerua and in the order of importance are as follows; Dioscorea rotundata Poi (white yam)r, D. cayanensis Lam(yellow yam), D.alata L(water yam), D dumentorum Pax. (cluster yam), D. esculenta Bourk (Chinese yam) and D. bulbifera L (aerial yam). The last two species are not popularly grown in many parts of the country.

Coursey (1971) observed that of all the food crops in the Tropics few are closely associated with a particular group of people or particular cultural area as are the yams with West Africa peoples. Production of yams in Nigeria has been largely confined to the corresponding West Africa yam zone. Nigeria produces almost half of the worlds yam and there are over 600 species of yam and 95% of these crops are grown in Africa (Coursey, 1971).

Some varieties of yam can be eaten raw while some require soaking and boiling before eating. Yam is popular in home vegetable garden because it produces crop only after four months of growth and continues production for the life of the vine as long as two years. In Nigeria, yams are stored in various ways such as being left unharvested in the ground during the dry season without an appreciable loss of quality, but are for several reasons such as damage by pigs and rats normally harvested for storage. Secondly, they can be stacked in heaps on the floor, on shelves or racks in sheds or huts. Thirdly it can be stored in a trench dug in the ground and lastly in a yam barn in which the yams are tied one by one on to a framework of erect poles supported by horizontal poles (Adeniji, 1970).

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Of the worlds production of about 20 million tons, about 1 million tons are lost annually by deterioration in storage. Rawnsley (1969) suggested that the total losses fpr West Africa amounted to about 15% of the production. Food and Agricultural Organisation (FAO) IN 2008 SAID THAT Nigeria produced 35 million metric tons of yam followed by Cote d'Ivoire (6.9 metric tons) while Columbia, Brazil and Haiti collectively produced 50 million metric tons for the year 2008.

The major factors responsible for yam losses during storage include sprouting, evaporation of moisture from the tubers and respiratory activities which converts starch into carbon dioxide and water (Campbell et al., 1962). Some authors (Okafor, 1966, Adeniji, 1970 and Ogundana et al.,1970) attributed such losses in yam to microbial rotting after long period of storage (Ogundana, et al (1970) identified some microbes as being responsible fpr the yams rot in storage namely, Aspergillus sp, Fusarium spp, Penicillium sp, and Botryodiplodia theobromae. These fungi infect the tubers through wounds , bruises and lesions made by other organisms. Adeniji (1971) using tubers of D. rotundata studied degree of decay caused by three storage pathogens namely Penicillium oxalicum, Aspergillus niger and B. theobromae. Similar results were obtained by Ogundana et al (1970) working with tuber slices of yam in vitro as Penicillium sclerotigenum was more pathogenic at lower temperature while B. theobromae and Aspergillus niger were more virulent at higher temp. These observations were confirmed in storage trials in the United Kingdom by Noon and Colhoun (1979) while Ezebekwe and Ibe (2010) obtained simiar result in Owerri, Nigeria.

Although microbial rotting of yams have been extensively studied in some parts of Nigeria including Ibadan, Lagos,Owerri etc but it has not been extensively studied in Warri. Hence the need to do some preliminary investigations on the microbial rotting of yams (D. rotundata) sold in Warri markets.

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The objectives of the research is to isolate and identify the fungi responsible for yam deay in Warri and proved pathogenicity of the organisms.

Materials and Method

Whiter yam tubers sold in Warri markets were used for the investigation. Poor rotted yam tubers were identified by visual examination and by exerting slight pressure with the fingers. Unhealthy tubers with signs of decay were taken to the laboratory for fungal isolation and study. Affected portions were sliced radially and the advancing areas of decay were used for the work.

Isolation and Identification of Fungal Isolates from Decayed Yam Tubers

The sliced portions of the advancing areas of decay were surface sterilized by washing in 70% Ethanol and then rinsed in sterile distilled water. Small portion (about 2 mm in diameter) of the advancing area of decay of the yam were removed with a flame sterilized scalpel and placed aseptically into petri dishes of water agar with 5 pieces per plate. They were incubated on the laboratory bench at the room temperature of 25± 2˚C for five days and fungal growths were sub cultured to Potato Dextrose Agar (PDA) plates. Pure cultures were obtained through repeated sub culturing and fungal isolates were labelled A –F.

Slides preparation of the isolates were made and microscopic observation was done for the identification of the isolates which was accomplished with the aid of a textbook on Mycology by Barnett (1962) and confirmation sought from expert mycologists.

Pathogenicity Test with Fungal Isolates

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To ascertain that the fungal isolates implicated for the decay signs observed in the naturally infected tubers using Robert Koch's postulate was made. This involved the inoculation of sound yam tubers with the fungal isolates and the occurrence of identical signs as observed in the naturally infected tubers and re –isolation of similar fungi.

The isolates were tested for pathogenicity by the inoculation of healthy yam tubers according to the method described by Okafor (1966). To study the effects of the various fungal isolates, cylindrical cores of 1.5mm in diameter were taken from the "head", "middle" and "tail" portions of each yam tuber with a 5 mm diameter cork borer. Four millimeters of 7 day old fungal isolates were placed with fungus end first into the holes made in the sound tubers and covered with the yam cores. It was then sealed with Vaseline (petroleum jelly) and disc of non-inoculated PDA was used as the control. The inoculated tubers with each of the fungal isolate as the experiment was replicated thrice and incubated on the laboratory bench.

The inoculated yam tubers were left on the laboratory shelves at room temperature for four weeks as described by Okafor (1966) after which they were sliced through the site of inoculation. Decayed areas were measured in the "head", "middle" and "tail" portions of the tubers.

Results

The fungi isolated from the decayed portions of the tubers were identified using growth pattern, mycelia colors and morphological features as parameters for identification. Slides of the isolated fungi were prepared from pure cultures microscopically studied. The fungal isolates were labelled A, B1, B2, C, D,E and F.

Table 1: Types of Fungi and Frequency of Isolation from Decayed *Dioscorea alata*

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Fungus	Frequency of isolation
Botryodiplodia theobromae	3.0
Aspergillus sp	3.0
Aspergillus niger	2.0
Fusarium sp[a]	2.0
Fusarium sp	1.0
Penicillium sp	2.0
Sclerotium sp	1.0

Table 1 shows the types of fungi and frequency of isolation from decayed portions of the tubers. Isolate A is identified as *Botryodi[lodia theobromae* having dark pycnidia bearing pycnidiospores which are called conidia which were one and two celled.

Isolate B1 formed a brownish black myceliua and showed a coenocytic hyaline and long conidiophores which arose directly from foot cell with vesicles and sterigmata. It was identified to be *Aspergillus* sp.

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Isolate B2 was identified as *Aspergillus niger* because it formed a black mycelium and showed coenocytic conidiophores which arose from the foot cells. It has a black vesicle with sterigmata bearing numerous blackish conidia.

Isolate C formed a whitsh cottony colony with some tinge of pink in the medium. It showed three types of conidia, a cone shaped macro conidia with 2 – 3 septations. Some of the mico and macro conidia were borne on short conidiophores and chlamidiospores borne in intercalary positions. The isolalte was identified as Fusarium sp[a] . Isolate D has two types of conidia; a cone shaped, slightly curved at the end with 2 -3 septations, microconidia with one septation and variable shapes. Both the micro and macroconidia were borne on short conidiophores and chlamydiospores were borne at intercalary positions. Isolate D was identified as species of *Fusarium*.

Isolate D formed a cottony white mycelium with 2 types of conidia, macroconidia which is boat shaped slightly curved at both ends with 2 septations and microconidia which showed variable shapes.The specimen was identified as a species of *Fusarium*.

Isolate E formed a blue green mold with septate conidiophores which were more branched near the apex forming finger – like projections. It had sterigmata with chains of oval greenish conidia and was identified as *Penicillium* sp.

Isolate F formed a greenish powdery mycelium with greenish white patches. Microscopic examination revealed greenish conidia borne on long conidiophores with characteristic right angled branching. It was identified as *Trichoderma* sp

Table 2: Effect of inoculating sound *D. alata* tubers with isolated fungi.

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Isolated Fungi	Average length (cm) of decay	Nature and color
Botryodiplodia. Theobromae	3.1	brown,wet,soft
Aspergillus. sp	2.1	Purple brown,soft
Aspergillus niger	2.4	Purple,brown, soft
Fusarium sp[a]	1.7	light,brown,soft
Fusarium sp	1.4	brown,hard
Penicillium sp	2.9	brown hard
Sclerotium sp	0.6	brown hard

From Table 2 above the maximum distance of decay was observed with both *B. theobromae* and *Penicillium* sp while the least decay was associated with *Trichoderma* sp.

Discussion

The results of the study revealed that all the fungal isolates showed positive pathogenicity with the sound tubers after inoculation. The tubers were bought

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from the open markets in Nsukka Town in Nigeria. Majority of the tubers were transported to the markets from the Northern part of the country in open Lorries while very few were locally grown within the neighboring communities. The tubers are tightly packed together under poor ventilation and high sun intensity which is conducive for the pathogenic fungal growth. The rot fungi isolated and pathogenicity proved above have been reported in other yam cultivars such as *D.rotundata*Poir by Adenuji(1970), Okafor(1966), Noun and Coulhoun(1979),Ezebekwe and Ibe(2010). Other probable yam rot disposing factors include bruises on tubers tubers during harvest and transportation which destroy the protective periderm and exposes them to portal entry and infection by pathogens. The isolated pathogens predominantly showed brownish discoloration on the decayed portions of the tubers. Ogundana*et al*.(1971) also attributed the decay to color to the ability of the pathogens to produce cellulosic and pectin lytic enzymes which degraded the middle lamella of the cell wall.

From the findings it can be recommended that healthy practices associated with postharvest storage such as the avoidance of tubers wounding should be avoided. Equally high temperature exposure of tubers during transportation and sales should be minimized.

References

Adeniji, M.O (1970). Fungi Associated with Storage Decay of Yam in Nigeria. *Phytopathology* 60: 590 -592.

Adeniji, M. O. (1971). Influence of Moisture and Temperature on Yam Decay Organisms. *Phytopathology* 60: 1698 -1699.

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www.ecejournals.org

Anwadike, B.C. (2013). Fungal Rot of White Yam (*Dioscrea rotundata*) sold in Warri Markets. *Warri Journal of Pure and Applied Science*, 10: 53 -59.

Cornelius, E. W. (1998). Causes and control of tuber rot of white yam (*Dioscorea rotundata*) Poir Variety, Araba, Asama and Pura, M. Phil. Thesis, University of Ghana Legon, 123pp

Coursey, D.G. (1971). The history and possible future of yam cultivation in West Africa. *Proc. Of Research Seminar on Root and Tuber Crops in West Africa*, Ibadan, 26pp.

Ezebekwe, I. and Ibe, J (2010). Organisms associated with the rot of yam (*Dioscorea rotundata*) sold in Owerri Market. *Journal of Molecular* Genetics*,* 2: 1 -5.

Food and Agricultural Organisation (2008). World Production Bulletin.

Jova, M.C., Kosky, R.G., Perez, M.B. and Vega, V. M (2005). Production of yam microtubers using a temporary immersion system. *Plant Cell, Tissue, Organ Culture*, 83: 103 -107.

Kochhar, S.L. (2011). Economic Botany in the Tropics. MacMillan Publishers India, 237pp

Noon, R.A. and Colhoun, J. (1979). Market and Storage Diseases of Yams Imported into the United Kingdom. *Phytopathology Z,* 94: 289 -302.

Medoua, C.N., Muna, I., Agbor-Egbe and Mbofong, C.M. (2005).Study on the hard to cook property of stored yam tubers (*Dioscorea dumentorum*) and some determining Biochemical factors. *Food Res. Int.* 38: 143 -149.

Ogundana, S. K. (1971). Studies on soft rot of yams in storage. *Trans. Br. Mycol.Soc.* 56: 73 -80.

International Journal of Agricultural Research (IJAR)
2021, Vol. 2, Issue 3, pp. 1-11

www.ecejournals.org

Okafor, N. (1966). Microbial rooting of stored yams (*Dioscorea* spp) in Nigeria. *Exptl. Agric.* 2:179 -182.

Ukpabi, U.I. (2010). Farmstead breadmaking potential of lesser yam (Doicoreaesculenta) flour in Nigeria. *Austr. J. Crop Sci*. 4: 68 -73.