EVALUATION OF CONTROL MEASURES AND ISOLATION OF FUNGI ASSOCIATED WITH DETERIORATION OF SWEET POTATO *(Ipomoea batatas* L.) TUBERS IN KEFFI LOCAL GOVERNMENT AREA, NASARAWA STATE

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Study was carried out on the fungi associated with deterioration of sweet potato tubers and their control measures in *Kcffi Local Government Area, Nasarawa State. The study areas were Angwan Lambu, Angwan Fulani, Angwange, Old Barracks and Keffi Market. The areas were visited six times in three months for the collection of diseased* fswrt *potatoes. Out of 60 sweet potato samples examined, 48 tubers had fungi isolates. The fungi include Ehizopus* 1 stoloni/er, *Fusarium oxysporum andAspergillus nigerwith the occurencefrequencies of 41.7%, 31.3% and27.0%, Irtspectivehj in the three types of diseases identified. The diseases include soft rot, dry rot and watery rot which ;Kcmtnted for* 39.6%, 29.1% *and 31.3%, respectively. There was no significant difference (p < 0.05%) in the incidence of the different isolates in relation to location. The treatment of tubers with local and synthetic substances controlled rot at varying degrees. Benlate Qie synthetic fungicide controlled rot more effectively while wood ash was mare effective compared with palm oil. Wood ash could be used as a better alternative far the control of rot compared .vrifhmoreexpensiveBenlate (Methyl 1 (butylcarbamoyl)* 2 *benzimidazolecarbamate).*

Keywords: Control measure, fungi, deterioration, sweetpotato.

INTRODUCTION

The sweet potato *(Ipomoea batatas* L.) is a dicotyledonous plant and belongs to the convolulaceae family (Purseglove, 1991). Its large, starchy, sweet tasting tuberous roots are important root vegetable (Woolfe, 1992). Sweet potato is also rich in complex carbohydrates, dietary fiber, beta carotene, vitamin C and vitamin B6 (Abidin, 2004). It also contains iron and calcium hence it is ranked highest in nutritional value when compared with other vegetables (Abidin, 2004). It also contains iron and calcium hence it is ranked highest in nutritional value when compared with other vegetables (Abidin, 2004). In-spite of the sweetness, it may be a beneficial food for diabetics, as preliminary studies on animals have revealed that it helps to stabilize blood sugar levels and to lower insulin resistance (Austin, 1998). Increased consumption of sweet potatoes has been advocated both for their health benefits and because of their importance in traditional southern cuisine in th6 United States of America (Austin, 1998). In South America, the juice of red sweet potatoes is combined with lime juice to make a dye for cloth (Purseglove, 1991).

In Nigeria sweet potato is an important staple food crop, particularly in northern Nigeria where most of it is produced. It is one of the six important root and tuber crops grown in Nigeria (Nwokocha, 1992). The roots are most frequently boiled, fried or baked. They can also be processed to make starch and a partial flour substitute. Although the leaves and shoots are also edible, the starchy tuberous roots are by far the most important product.

Sweet potatoes are susceptible to a wide range of field and storage diseases especially fungi, bacteria and nematodes (Lauritzen, 1935). Major fungal diseases of sweet potato in the tropics include soft-rot caused by *Erwinia chrysanthemi* black-rot caused by *Ceratocystis finibriata* and circular sport due to *Sckrotium roljsii* (Collin, 1988). Anon (1982) had previously reported on the control of such root crop diseases using chemicals. Nevertheless, such measures were not popular because the chemicals are expensive and scare and when available, their over-use contaminates the environment, increase resistances to pesticides and causes health hazards. It is, therefore, desirable to study some of the traditional and cultural practices which may be used alone or adopted in an integrated pest management package for important sweet potato diseases.

As important as this root crop is, if the pathogens that cause rots are not controlled or eliminated, it will pose a serious problem on the economy of the nation. It is on this basis, that this research is aimed at isolating fungi pathogens associated with sweet potato tubers and determine the best local means of fungi control in Keffi, Nasarawa State, Nigeria.

MATERIALS AND METHODS

Collection of Samples

The study was carried out in the Plant Science and Biotechnology Laboratory, Department of Biological Sciences, Nasarawa State University, Keffi while the survey work covered selected locations in Keffi Local Government Area, Nasarawa State. These locations include Angwan Lambu, Angwan Fulani, Old Barracks, Angwan Kuje and Keffi Market. Regular potato farmers were consulted twice (2) monthly for the collection of decaying sweet potatoes for three months of June August, 2010. At each sampling time, two (2) sweet potato tubers were randomly collected from each of the five (5) locations, making a total of ten (10) sweet potato tubers. Hence, 60 decaying sweet potato tubers were used.

Isolation and Identification of Fungal Isolates

Isolation of fungal species was done using direct surface agar plating method of Udo *el al.* (2001). Small portions of sweet potato tubers containing the advancing margin of rot and adjoining healthy tissue (Onyike and Maduewesi, 1985), were pinched with flame-sterilized wire loop and was streaked onto potato dextrose agar and incubated at 30°C for 7 days. Fungal identification was carried out according to Samson *et al.* (1984) method. Photomicrography of the fungi isolates were obtained and the fungal structures compared with those published by Samson *et al.* (1984). The data obtained from the survey were subjected to Chi-square for analysis,

Pathogenicity Test

To establish which of the fungal isolates caused the decay, sweet potato tubers were first washed with 2% (v/v) sodium hypochlorite and allowed to dry. Two (2) mm hole was made on the sweet potato tubers with cork borer and equivalent 2 mm diameters of the fungal isolates were inoculated into the holes. The inoculated tubers were left for 2 7 days for fungal growth (Ogaraku and Usman, 2008). A control was setup with The 2 mm holes made on the sweet, potato tubers covered with Vaseline gel.

Treatment of Wounded Sweet Potato Tubers

A hole of about 5 mm in diameter was made on freshly harvested sweet potato tubers. Fungal spores of 3 4 days old cultures of *Aspergillus niger, Khizopus stolonifer* and *Fusarium oxysporum* were inoculated into the hole made on the tubers before treatment with a fungicide (Benlate), wood ash and palm oil.

Some wounded tubers were treated with 2_0g or Benlate (Methyl 1 (butylcarbamoyl) I benzimidazole carbamate) by dusting on the surface while some others were treated with ZOg of wood ash shaken several times in a polytehene bar to ensure total dusting of the tuber surfaces Another set of wounded tubers were sprayed vrti 10 ml of palm oil using a hand spray gun. The control experiment was set up in the same manner except that the wounded surface after fungi inoculation was sprayed with 10 ml sterile water. Each of the four treatments was replicated thrice, so that, there were a total of twelve (12) replicates. AH wounded and treated tubers inoculated with difference fungi were stored in sterile desiccators for 14 days at room temperature. The experiment was replicated three times. Presence of visible rots around! wounded tubers was recorded as incidence of decay (Udo *et al,* 2001). After incubation the tubers were incised with a sterile Knife. The length' of rotted portion from each hole was measured over j the total surface with a transparent meter rule in i millimetre (mm) as diameter of rot (Shivipuri *et* a/., 1997). The data obtained were subjected to Chi-j square for Statistical Analysis.

RESULTS AND DISCUSSION

The species of fungi isolated and identified from < rotted sweet potato tubers were; *Asperfillus niger,* J *Rhizopus stolonijer,* and *Fusarium oxysporum* while! their frequencies of occurrence were 27.0%, 41.7%,] and 31.3%, respectively (Table 1). I

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The research revealed the prevalence of three major 1 postharvest diseases of sweet potatoes. These] include; dry rot, soft rot and watery rot. These j accounted for 29.1%, 39.6% and 31.3% of the] diseases, respectively (Table 2). The incidence of J fungi species in five different locations in Keffi j Local Government Area is presented in Table 3,1 Angwan Kaje had the highest incidence of fungi I species while Angwan Fulani had the lowest. There: \ was no significant difference (P<0.05%) in the, incidence of the different isolates in relation to the 1 sweet potato tubers (Table 4). The percentage] infection of tubers artificially inoculated with fungi isolated from rotted tubers is presented in Table 5. The three fungi isolates artificially inoculated cc sweet potato tubers were found to induce rot *'Rhizopus stolonifer* was the most virulent and destroyed tubers after few days of inoculation •* producing 100% rot while *Fusarium oxysptrai* produced 80% rot and *Aspergillus niger* produce: 70% rot as against the control.

Sweet potato tubers were inoculated with different trpes of fungi isolates and treated with various substances. These substances include; Benlate, wood ash, palm oil and sterile water (Table 6). Benlate; a fungicide was the most effective especially in the control of *Rhizopus stolonifer,* with mean rot diameter of 0.0 mm, 1.1 mm for *Aspergillus niger,* and 0.3 mm for *Fusarium oxysporum.* Wood ash was also effective with a mean rot diameter of 11 mm, 2.3 mm and 2.4 mm for A. *niger, R. stolonifer* and F. *oxysporum,* respectively. Palm oil with a mean rot diameter of 9.0 mm, 9.3 mm and 9.5 mm for A. *niger, R. stolonifer* and F. *oxysporum,* respectively. As against sterile water (control) with a mean rot diameter of 24.3 mm, 24.6 mm and 24.1 mm for respective A. *niger, R. stolonifer* and F. *oxysporum.*

The study has revealed a range of fungi responsible for sweet potato tubers post-harvest rot. These fungi include; *Rhizopus stolonifer, Aspergillus niger* and *Fusarium oxysporum.* The fungal species isolated and identified in this study corroborate those isolated and identified earlier by Clark and Hoy (1994). The survey also showed that there are three types of storage rots associated with sweet potato tubers in Keffi local Government Area. They include; dry rot, soft rot and watery rot. These diseases have been reported to be associated with post-harvest rot (Oyewale, 2006). There is no significant difference ($p < 0.05\%$) in the incidence of the different isolates in relation to local since the locations adjoin each other as such, have barely little variation in weather and climatic factors, though with little variation in the soil types, ranging from loamy to sandy loam.

Table 1: Frequency of occurrence of fungi isolates form sweet potato tubers

Isolate	Frequency of attack	% Frequency of occurrence
Aspergillus niger	13	27.0
Rhizopus stolonifer	20	41.7
Fusarium oxysporum	15	31.3
Total	48	100

Table 2: Frequency of occurrence of different disease conditions

Disease	**Frequency of**	**% Frequency of occurrence**
Dry rot	1 **currence**	**29.1**
Soft rot	4	39.6
Watery rot	1	31.
Total	9	3

Table 3: Incidence of fungi species in different locations in Keffi Local Government Area

Location	Total No. of sweet potato tubers examined	No with fungi species	No without fungi species
Angwan Lambu	12	9	3
Angwan Fulani	12	8	4
Old Barracks	12	10	2
Angwan Kaje	12	11	1
Keffi Market	12	10	2
	60	48	12

Table 4: Chi – square on the relationship between fungi isolates and different locations Keffi Local Government Area

Location	Total No. of sweet potato tuber examined	No with fungi species	No without fungi species
Angwan Lambu	12	9 (9.6)*	3 (3.6)*
Angwan Falani	12	8 (9.6)*	4 (3.6) *
Old Barracks	12	10 (9.6)*	2 (3.6)*
Angwan Kaje	12	11 (9.6)*	1 (3.6)*
Keffi Market	12	10 (9.6)*	2 (3.6)*
Total	**60**	**48**	**12**

* Numbers in parenthesis are expected frequencies

H_o: There is significant difference in the incidence of the different isolates in the relation to location.

F tab 2.76 < F cal 3.58, therefore we reject the hypothesis.

Table 5: Percentage infection of sweet potato tubers artificially inoculated with fungi isolates.

Fungi Isolate	No of tubers inoculated	% infection after 14 days
Rhizopus stolonifer	10	100
Fusarium oxysporum	10	70
Aspergillus niger	10	80
Control (Vasoline gel).	10	00

Tabie **6: Effect of** treatment on the development of rot on sweet potato tubers

Table 6: Effect of treatment on the development of rot on sweet potato tubers

Treatment	Mean diameter of rot (mm)		
	A. niger	*R. stolonifer*	*F. oxysporum*
Benlate	0.1	0.0	0.3
Wood ash	2.1	2.3	2.4
Palm oil	9.0	9.3	9.5
Control (sterile water)	24.3	24.6	24.1

The degree of protection of tubers from different fungi using various substances varied. The highest in the reduction of rot was benlate. This is followed by wood ash which was more effective compared with palm oil. Benlate is a systemic benzimidbzole fungicide that is selectively toxic to microorganisms (Anonymous, 2004). Benlate used here is a synthetic fungicide and was more effective than the rest of the substances used because of its chemical composition. The chemical constituent are toxic to fungal structures, hence reducing rot diameter as compared with the other substances. Wood ash is the residue powder left after the combustion of wood. Wood ash contains calcium and carbonate as its major component. There are also trace elements of iron, manganese, zinc, copper and heavy metals (Demeyer *et al.*, 2001). Wood ash being more effective than palm oil, could be due to the presence of carbonate and a trace of copper. Carbonate and copper are known to be an active ingredient in some synthetic fungicide (Hastead, 1980). Palm oil controlled rot to a lesser extent compared with Benlate and wood ash. This control may be due to the physical and chemical properties of palm oil (stearic, palmitic, myristic, lauric, linoleic and oleic acids) that gave its activity against the fungal species (Oduro *etal.*, 1990).

CONCLUSION

Wood ash which is a local substance protected wounded tubers more compared with palm oil. This can provide an alternative method of reducing and controlling rot for farmers as it is less expensive, environmentally safe and easy to produce.

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