FULL LENGTH RESEARCH ARTICLE

ISOLATION AND IDENTIFICATION OF FUNGAL FLORA ASSOCIATED WITH GROUNDNUT IN DIFFERENT STORAGE FACILITIES.

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ABSTRACT
Stored and unshelled groundnut samples were obtained from different storage facilities, namely Rumbu, Market silos and Warehouse with the aim of isolating and identifying fungi associated with stored groundnut in different storage facility. Samples were grounded and cultured on SDA plates for 5 days and fungal floras microscopically identified. A total of 25 colonies were isolated from all the samples from which 6 fungal species were identified, namely *Mucor, Aspergillus, Rhizophus, Curvularia, Pencillium* and *Fusarium spp*. Of these, *Mucor* and *Rhizopus* were most prevalent having been isolated from the three storage facilities studied. *Curvularia* and *Penicillium* were both found in the warehouse and market silo while *Fusarium* was encountered only from the market silos. It is concluded that the market silos were more susceptible to fungal contamination than the Rumbu because of the high moisture content of the sample.

Keywords: *Arachis hypogea*, storage facility, fungal species, contamination, Nigeria

INTRODUCTION
Groundnut (*Arachis hypogea* L.*)* also known as pea nut is an annual, wet season plant grown in many tropical, sub tropical and temperate countries of the world (Halima 2000). It is usually harvested and stored dry in different storage facilities, traditional and modern. Under such storage conditions, groundnuts are susceptible to attack by fungi, insects and other microorganisms. The extent of deterioration depends on the condition of the groundnut. These conditions range from maturity of the crop in the field, completeness of shell to the type of storage facility used.

According to Sullivan (1984) groundnut seed are highly susceptible to disease because they have a rich source of stored nutrients useful for numerous fungi such as *Rhizophus, Penicillium, Aspergillus niger* and *Aspergillus flavus*.This is evident in the report of Woodroof (1984) who discovered that groundnut samples that are not removed from their shells are not subject to attack by microorganisms and insects as much as sample that have been removed from their shells. This report has also corresponded with that of Ibrahim & Ebo (1986) that if grains are dry harvested they cannot be subjected to great damage by microorganisms because the microorganisms normally requires certain amount of moisture in order to grow and multiply. It appeared therefore that the single most important environmental factor that influences the growth of endogiocarpic microflora during drying and curing in pod and kernel is moisture (McDonald & Harkness 1963).

Apart from moisture contents of the seed, several environmental factors within the storage facilities influence the extent to which fungal growth and aflatoxin contamination occurs. Some of these factors are relative humidity, temperature and of storage. Diener and Cole (1982) observed that when the seed moisture exceed 9% at the equilibrium humidity of 80% and 30^{o}C temperature, the chances of invasion by Aspergillus flavis increase drastically. Panasenko (1967) reported that even at constant relative humidity, a temperature increase can stimulate fungi activities. Therefore, spores can germinate on the pod or seed surface in stored groundnut when the temperature and relative humidity triggers the growth process. Affected nuts are usually a total loss which consequently leads to serious economic loss. This work was carried out to isolate and identify the fungal taxa that causes contamination of groundnut in different storage system aimed at identifying a more reliable and safe method of storing the crop.

MATERIALS AND METHODS
Samples collection: Samples of stored and unshelled groundnut were collected from three different groundnut storage facilities namely: Rumbu from Dawakin Kudu town, Silos in Rimi market and Warehouse of Nigerian oil mills, all in Kano State Nigeria. The samples were collected in sterilized aluminum foil, wrapped and labeled accordingly.

Determination of moisture content: Moisture content (%) of samples were determined in samples obtained from different storage facility in three replicates

I 5 g of each samples was weighed and covered with aluminum foil
II Samples were then kept for 5 hr in the oven at 104 ^{o}C to dry
III Finally, samples were removed from the oven and re-weighed and the % moisture was calculated using the formula

$$\frac{100(x-y)}{x}\ \%$$

where X = initial weight of sample
Y= final weight of sample

Isolation and identification of fungal taxa: Samples were grounded in sterile mortar and inoculated separately on SDA plates for 5 days. Subcultures were also made to obtain pure colonies and the resulting isolates were identified microscopically by their characteristics using x10, x20 and x40 objectives.

RESULTS
The % moisture contents in relation to samples collected from different storage facilities is shown in Table 1. The results showed that the samples collected from market silos had the highest moisture contents (14%) while samples from warehouses had the lowest moisture content (8%).

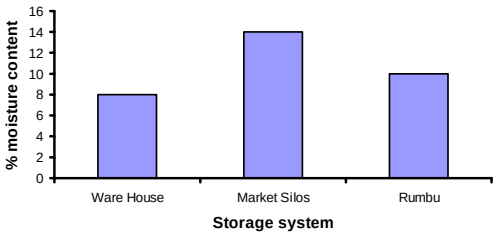

Fig 1. Mean moisture content (%) in relation to sample storage systems

The number and taxa of the fungi isolated from each storage system is shown in Table 2. A total of 25 colonies were isolated from the different storage systems out of which the most frequently occurring were *Aspergillus* and *Rhizophu*s, (24% each).

The results also showed that 6 fungal taxa were identified, namely *Aspergillus Rhizophus, Penicillium Curvularia, Fusarium* and *Mucor*. The distribution of these isolates was not equal among the different storage systems. *Aspergillus, Rhizopus and Mucor* wer the most frequently occurring taxa found in all the storage system studied.

TABLE 1. TYPE OF FUNGI AND NUMBER OF COLONIES ISOLATED FROM DIFFERENT STORAGE SYSTEMS

Storage system	Fungi isolated						Total
	Aspergillus	*Rhizophus*	*Penicillium*	*Curvularia*	*Fusarium*	*Mucor*	
Local Rumbu	2	1	-	-	-	-	5
Market silos	3	3	1	1	3	1	12
Warehouse	1	2	1	2	-	2	8
Total	6	6	2	3	3	5	25
Frequency %	24	24	8	12	12	20	100

The results also showed that 6 fungal taxa were identified, namely *Aspergillus Rhizophus, Penicillium, Curvularia, Fusarium* and *Mucor*. The distribution of these isolates was not equal among the different storage systems. *Aspergillus, Rhizopus and Mucor* wer the most frequently occurring taxa found in all the storage system studied.

Fusarium was found in only market silos while *Penicillium* and *Curvularia* were obtained in both the market silos and warehouse but absent in the local Rumbu. The total number of colonies isolated throughout the study was highest in samples from market silos and lowest in local Rumbu.

DISCUSSION

Six fungal taxa identified in this study included *Aspergillus, Rhizophus, Mucor, Curvularia*, *Fusarium* and *Penicillium* all of which except *Curvularia* were implicated by Garren (1966) as responsible for rotting of about one-half of rotted groundnut.

The 8% moisture content encountered in all the storage facilities studied was conductive to encourage the growth of fungi in both unshelled and shelled groundnuts (Woodroof 1984). Recent report of Halima (2000) also supports the view that fungi being non–chlorophyllous can grow on variety of situations and thrives under conditions of moisture, warmth and good supply of organic food.

A total of 25 colonies of different fungi were isolated from different samples. This result has shown that market silos have the highest number of colonies isolated among the three storage systems. Market silos are air-tight and do not allow for ventilation or air circulation resulting to continuous increase or rise in the humidity and temperature of the silos which consequently favors fungal growth.

The results also showed that all the six taxa of fungi occurred in the market silo samples. This may not be unconnected with the presence of 14% high moisture content recorded in the market silos that favored the growth and multiplication of fungi.

Panasenko (1967) reported that spore germination occurred on the pod or seed surfaces of stored groundnut where the moisture contents, relative humility and ambient trigger the growth processes. The samples from the market silos had most moisture content probably because groundnut is considered by many farmers as a major cash crop in northern Nigeria (Panasenko 1967), as a result farmers are eager to sell their produce immediately after harvest before it is completely dry.

While *Rhizophus, Aspergillus* and *Mucor* were isolated in all the samples from the different storage systems, *Fusarium* was only found in the market silos samples. Since species of *Fusarium* are soil inhabitants, there was probably a mixed up of shelled with unshelled groundnut containing some soil remains, giving them the opportunity to invade the unshelled groundnut in storage causing great damages.

It is concluded that fungal colonization and contamination in stored groundnut is dependent on the moisture content of the harvested groundnut prior to storage. Therefore groundnuts which are stored before sale or use should be kept dry with a maximum moisture content of not more than 7 %. Also soil debris should be removed completely from the harvested groundnuts so as to avoid soil dwelling microbes such as *Fusarium* from infecting the nuts and consequently causing disease in the field.

REFERENCES

Diener, U. L., and Cole, R. J. 1982. Aflatoxins and other mycotoxins in peanuts. In: Peanut science and Technology Pattee, H. E. & Young, C.T. Eds. Yoakum, Texas USA. *American Peanuts Research and Education Society:* 486-519.

Garren, A.C. 1966. Peanuts, Groundnuts microflora and pathogenesis of peanut pod. *Root Phytopathology,* 55(4):359-367.

Halima, A. S. 2000. Isolation and preliminary Identification of fungi in stored groundnut. HND project. Department of Science Laboratory Technology, Kano State Polytechnic, Nigeria

Ibrahim, M. H. & Ebo, K. C. 1986. Mycoflora of stored crops from Six Northern States in Nigeria. *National Stored Product Research Institute Technical Report* No. 1:26.

McDonald, D. & Harkness, C. 1963. Growth of *Aspergillus flarus* and Production of Aflatoxin in Groundnut. *Tropical Science* 5:208-414.

Panasenko, V. T. 1967. Ecology of Microflora. *Botanical Review* 33: 189-215

Sullivan, G. A. 1984. Seed and Seedling Diseases In: *Compendium of Peanut Diseases* edited by D. M. Porter, D. H. Smith, & R. Rodriguez-Kabana, St. Paul, Minnesota, USA*, American Phytopathological Society:* 37-38.

Woodroof, J. G. 1984. *Peanuts: Production, Processing, Products*. 3rd ed. Westport, Conn. AVI Publishing.