



Occurrence and distribution of fungi associated with biodeterioration of cashew nuts in the eastern senatorial district, Kogi State, Nigeria.

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ABSTRACT

*Objective: To investigate the occurrence and distribution of fungi associated with biodeterioration of cashew nuts (*Anacardium occidentale* (L.) in Kogi state, Nigeria. Methodology and results: Ware houses from four designated areas at Anyigba, cocoa research institute, Ochaja, Idah and Ankpa were surveyed for the disease incidence between 2008 and 2010. *Trichoderma viridae*, *Cephalosporium sp* and *Aspergillus nigar* were isolated from the diseased nuts and were identified based on morphological characters and pathogenicity tests. Disease incidence was highest in Ankpa followed by Anyigba. Conclusion: The study provides information serving as a base line in establishing these fungi being associated with cashew nut biodeterioration.*

Keywords: Disease, biodeterioration, fungi, cashew nuts.

INTRODUCTION

The cashew (*Anacardium occidentale* (L.)), is a small to medium sized tree belonging to the family Anacardiaceae [5]. The fruit is a kidney – shaped achene about 3cm long with a hard gray – green pericarp. The seeds are the source of cashew nuts and they are removing from the pericarp after the fruits are wasted, a process which burns off shell oil and cooks the seeds. The plant is a native to northeastern Brazil. Its English name derives from the Portuguese name for the fruit of the cashew tree, caju, which in turn derives from the indigenous Tupi name, acaju. It is now widely grown in tropical climates for its cashew “nuts” and cashew apples [9].

World wide, cashew nuts are esteemed and highly priced food delicacy because of their pleasant taste and flavour. The post-harvest processing, packaging and marketing have been commercialized and modern technology and regulation adopted in major producing countries like India and Tanzania. In Nigeria however, despite the cultivation of cashew in plantations and the establishment of cashew processing factories, shortages are still being experienced on the finished products due to fungal attack. [7].

On the fungi associated with cashew nuts biodeterioration, 14 fungi belonging to 5 genera were recovered at varying levels [3, 4, 10, 6, and 1]. The most predominantly encountered species in decreasing order of isolation from the non-disinfected nuts were *Aspergillus nigar*, *A. restrictus*, *A. Flavus*, *A. Fumigatum*, *Rhizopus nigrians*, *R. arrhizus* and *Macrophomina pusillus*, while *A. tamari*, *Penicillium citrinum*, *A. ochraceus*, *Penicillium Sp*; *P. digitatum* and *Syncephalastrum Sp* were the less frequent isolates and were not recovered from the surface – disinfected nuts. The objectives of the study were to (1) evaluate the distribution of the pathogens and (2) isolate the pathogens causing the disease and describe the symptoms.

MATERIALS AND METHODS

Disease Survey and Collection of Samples

The survey of cashew nuts biodeterioration was carried out in privately owned warehouses at four main cashew growing locations (Anyigba, Ankpa, Idah and Ochaja). These locations were known for cashew nuts productions and hence high rate of disease incidence. Disease incidence was assessed by expressing the number and frequency of affected cashew nuts at each warehouse. Two methods of isolation were used (Serial dilution and direct plating). Forty (40) deteriorated nuts in test tube 50ml of distilled water was added and shaken for three minutes to get a stock solution. 1ml of the stock was pipette into 9ml of distilled water in a test tube to make a serial dilution of 10^{-1} . 1ml of 10^{-1} serial dilution was pipette into 9ml of distilled water in test tube gave 10^{-2} dilution. Similar method was carried out to give final concentrations of 10^{-1} , 10^{-2} , 10^{-3} , 10^{-4} and the stock (10^0). While in the direct isolation, forty (40) nuts were surface sterilized with 0.1% $HgCl_2$ for 30 seconds and rinsed in distilled water. After surface sterilization, the nuts were spaced out in the petridishes containing the medium (PDA). The plates were incubated at room temperature of $25 \pm 1^\circ C$ for five days according to [11].

RESULTS

The survey to determine disease occurrence and distribution at the four locations showed that disease incidence and frequency was highest in Ankpa, followed by Anyigba and least in Ochaja (Table 1 and 2). Three (3) different species of fungi isolated and identified to be associated with biodeterioration of stored cashew nuts are *Trichoderma viridae*, *Cephalosporium sp* and *Aspergillus nigar*. The two methods of isolation showed similar results. Symptoms developed as described in literatures and Koch's postulates were fulfilled with isolation of the pathogens from the inoculated nuts and pathogens identified as above. The frequency of the isolated fungal pathogens was generally low in *Cephalosporium sp* and highest in *Aspergillus nigar* (Table 1 and 2). However, the frequencies of the isolated fungi were more in direct isolation method than serial dilution method.

Symptoms of deteriorated cashew nuts include shrinking and chlosis and offensive odour is peculiar to an advance infection, usually with *Aspergillus nigar*. *Aspergillus nigar* was found to have its conidiospores upright, simple, terminating in a globose, bearing phialides at the apex, conidia 1 – celled, globose and produced basipetally. *Cephalosporium* have slender and simple conidiophore, conidia are 1 – celled, produced successively at the tip. *Trichoderma viridae* was found to have the coinidiophores hyaline, upright, much branched, conidia hyaline, 1 – celled, ovoid, borne in small terminal clusters with rapid growth and green patches or cushions of conidia.

Table 1: Frequency of Fungi per forty (40) cashew nuts by serial dilution

Fungi	Anyigba	Idah	Ochaja	Ankpa
<i>Trichoderma viridae</i>	10	08	08	12
<i>Cephalosporium Sp</i>	07	09	06	07
<i>Aspergillus nigar</i>	13	11	10	15

Table 2: Frequency of fungi per forty (40) cashew nuts by direct isolation

Fungi	Anyigba	Idah	Ochaja	Ankpa
<i>Trichoderma viridae</i>	13	11	10	12
<i>Cephalosporium Sp</i>	12	10	07	09
<i>Aspergillus nigar</i>	14	13	11	17

DISCUSSION

The results shown according to the experimental work on the fungi associated with biodeterioration of cashew nut shows that the predominantly encountered species from the infected nuts were *Aspergillus nigar*, *Cephalosporium sp* and *Trichoderma viridae*. These species are known to have strains that cause toxic metabolites [2, 6]. The presence of *Aspergillus* in stored cashew nuts results in deterioration, discolouration and bad odour, couple with toxins, posses potential hazard to consumer's health; a confirmation of [1], that aflatoxin produced by *A. flavus* is found in cashew nuts and is hazardous to human health. *Cephalosporium sp* reported in Japan in 1930 as reported by [8] caused yield loss of up to 50%. He reported the fungus spread through the soil and enters the plant through wound root, which later affects the nuts.

CONCLUSION AND RECOMMENDATION

In view of the level of disease incidence observed in the study area, it has become incumbent to call on the Local, State and Federal governments, through the agricultural agencies saddled with this responsibility and other concerned stake holders, to as a matter of urgency. To embark on a wide scale control measure, aimed at putting the continuous spread of these fungi and disease under control. This will have the effect of enhancing the development and productivity of cash crop such as cashew nut, and indeed other crops sustainably.

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