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FUNGI ASSOCIATED WITH POST HARVEST DECAY OF OKRA (ABELMOSCHUS ESCULENTUSL.) IN ALIERO LOCAL GOVERNMENT AREA, KEBBI STATE, NIGERIA

***[1]Abubakar, M., [1]Keta, J.N., [1]Anas, H., [2]Mohammed, M.T., and[1]Abdullah, H.A.**
[1]Department of Plant Science and Biotechnology, Kebbi State University of Science and Technology, Aliero.
[2]PLANT Protection Department, Bayero University Kano
*Corresponding author's e-mail**: abubakarm431@gmail.com**
Phone No: **+2348104063366**

ABSTRACT
Fungal pathogens are among the most important biotic agents causing reduction in yield on the vegetables produced in Nigeria. This study was carried out to determine the fungal pathogens associated with post-harvest decay of Okra fruits in Aliero local government area, kebbi State. A total of 50 rotted Okro samples were collected from five locations viz; Danwarai, Sabiyal, Kashinzama, Gumbulu and Aliero markets. The fungi were isolated using ager plate method and pure isolates were identified in accordance with a standard chart. A total of nine (9) fungal isolates were identified as agents associated with post-harvest decay of Okra namely; *Microsporum canis,Aspergillus fumigatus,Aspergillus flauus, Paecilomyces variotii, Penicillium memeffei, Cladophialophora carrionii, Aspergillus niger, Phaeoacremonium parasiticum* and *Chrysosprium Corda*. From the results obtained, *Aspergillus niger* has the highest percentage of occurrence (26.67%) followed by *Aspergillus flauus* (17.33%) while *Cladophialophora carrionii* had the lowest (2.67%). Okro vegetables are liable to damage and deterioration during harvesting, transportation, marketing, storage and consumption, if not properly handled. Proper handling method should be adopted to manage the high rate of deterioration of okra in the study area.

Key words: Fungi, identification, okra, Aliero

INTRODUCTION

Okra (*Abelmoschus esculentus* L.) belonging to Malvaceae family is an economically important vegetable crop grown in tropical and sub-tropical regions of the world for its green edible fibrous fruits and pods containing round, white seeds as well as for its ornamental value (Kumar *et al.,* 2010). It is known by different names and has a number of varieties depending on plant size, shape, pod type, colour and number of spines. It is called Lady's finger in English, Ila in Yoruba, Kubewa in Hausa and "Okworo" in Igbo land (Benchasri, 2012).

The plant grows to a height of 3-6 feet or more with some varieties reaching 12 feet with a stem base of up to 4 inches in diameter. Propagation is through seeds and seeds can be soaked overnight in warm water before sowing to improve germination. Seed quality has been reported to affect yield in various okra varieties (Thapa *et al*., 2012).

The flowers are large and up to 2inches in diameter, mostly yellow in colour and last only for a day in most varieties (Tripathi *et al.*, 2011).

Okra is susceptible to several diseases, both in the field and in storage. Some varieties are highly susceptible to root decaying and root rot organisms, while some are associated with both field and storage deterioration of the fruits (Adeniyi, 2008). Okro is often colonised by fungi, including species from the genus Aspergillus, Penicillium and Fusarium, which caused significant reduction in crop yield, quality and safety due to their ability to produce mycotoxins. Mycotoxins commonly occurring in vegetables and fruits products include zearalenone, fumonisins, trichothecenes (as deoxynivalenol and T2-HT2), ochratoxin and aflatoxins (Miller, 2008) Some reported causal agents of okra fruit rot in Nigeria include *Choanephora cucurbitarum* and *Fusarium solani* (Esuruoso *et al.*, 2000). *Rhizopus stolonifer* in Romania, *Phoma exigua* in India, *Geotrichum candidum* in Egypt and *Rhizoctonia solani* in Malaysia (Snowdon, 2011).

The most serious fungal diseases of okra in Africa are damping-off (*Macrophomina phaseolina, phythium aphanidermatum, and rhizoctonia solani),* vascular wilt *(Fusarium oxysporum),* Cercospora blight (*Cercospora Abelmoschus, Cercospora malayensis)* and powdery milded (*Erysiphe cichoracearum, Oidium abelmoschi)* (Ricciardi *et al.,* 2012).Okra mosaic virus (OKMV), transmitted by flea beetles (*Podagrica),* is widespread in Africa but damage is much less important than that caused by okra leaf curl disease (OLCV), transmitted by whitefly (*Bemisia tabaci*).

This research aimed at identifying and determining the frequency of occurrence of the fungal pathogens on the spoiled okra in Aliero Local Government Area, Kebbi State Nigeria Provision of these information would be of great benefit to farmers, researchers especially plant pathologists, as well as policy makers in optimizing the growth and yield of the plants in the area.

MATERIAL AND METHODS

Study Area

Aliero local government area is located at approximately latitudes 11^0 03' S, 12^0 47'N and longitudes 3^0 6'W and 4^0 27'E. It has a total area of 412 square kilometre and is bordered in the east by Tambuwal Local government area of Sokoto state in the North West by Birnin-Kebbi local government area in the South West by Jega local government area and has a population size of 125,785 inhabitants(Uzondu, 2008).

The area enjoys a tropical type of climatic condition, generally characterize by wet and dry season. The rainfall begins in May with the heaviest rainfall recorded in the month of July and August. The cold harmattan periods characterized by dust laden wind prevails in the month of November to January while the month of March and April are extremely hot. The mean annual temperature vary considerably but usually stand at 42^0C the mean annual rainfall is 500mm (Singh, 2013).

Sample Collection

Spoilt Okra fruits were collected from five different places: Danwarai, Gumbulu, Aliero Sabiyal and Kashinzama markets in Aliero Local Government Area. The symptoms were carefully noted; completely rotten fruits were avoided for isolation as they contained mostly secondary pathogens. The collected fruits were transferred to microbiology laboratory, Kebbi State University of Science and Technology, Aliero for analysis (Ricciardi *et al.,* 2012)

Sterilization of Glass Wares

The glass wares were washed thoroughly with detergent and sterilized using a hot air oven at 160°C for one hour. Then, the oven was allowed enough time to cool, to prevent, the glass from cracking and for ease of handling.

Media Preparation
The culture medium used in this research work was prepared in accordance to the manufacturer's instructions using standard aseptic technique (Cheesbrough, 2000).

Inoculation and Incubation
The direct plating technique described by Pitt and Hocking (1985) was employed. The affected tissues were surfaced-sterilized with 10% ethanol using a cotton wool. Four small pieces from each sample were directly inoculated aseptically on prepared sterile plates of Potato dextrose agar (PDA) and incubated at 28^{O}C for 7 days.

Sub-culturin
When fungal growth from the tissue was visible, fungi were sub cultured onto freshly prepared sterile PDA plates to obtain a pure cultures for identification. Where there is a mixed culture, fungi were continuously sub cultured until pure isolates were obtained. Stock cultures of the pure isolates were prepared and preserved at 4^{O}C in the refrigerator (Ricciardi *et al.,* 2012).

Identification of Fungal Isolates
The fungal isolates were subjected to certain comparative morphological studies by an image and analysis system using published descriptions in a mycological atlas contained in the Microbiology Laboratory of Department of Biological Sciences Kebbi State University Kebbi. This was followed by a slide mount of each isolate. The characteristics observed were matched with those available in the aforementioned mycological atlas andwere identified accordingly (Adebayo and Okonko *et al.,* 2012).

Determination of Percentage Occurrence of the Isolates
This was done to determine the percentage occurrence of the different fungal isolates. The number of occurrence for each of the isolates were recorded and calculated using the formula of Carlson (2014)

$$\% \text{ frequency} = \frac{\text{Number of identified fungin}}{\text{Total number of fungi}} \times 100$$

RESULTS
The result in table one (1) presents the nine (9) fungal isolates identified from the five locations in the study area. They include *Microsporum canis, Aspergillus fumigatus, Aspergillus flauus, Paecilomyces variotii, Penicillium memeffei, Cladophialophora carrionii, Aspergillus niger, Phaeoacremonium parasiticum* and *Chrysosprium Cord.* The result in table two (2) indicates the frequency of occurrence of the several of Fungi Associated with Spoilt Okra in The Study Area. *Aspergillus niger* had the highest frequency of occurrence (26.67%) followed by *Aspergillus flauus* (17.33%) with *Cladophialophora carrionii* being the lowest (2.67%). Table three (3) shows the result of percentage of occurrence of the isolated fungi with respect to locations of sample collection. Danwarai had the highest percentage of the fungal loads (33.33%) followed by by Kashin zama (28.57%) with Aliero and Gumbulu having the lowest (9.52%) each.

Table 1: Fungi Species Isolated From Spoilt Okrain the Study Area

S/N	FUNGI
1	*.Aspergillus niger*
2	*Aspergillus fumigatus*
3	*Aspergillus flavus*
4	*Chrysosprium Corda*
5	*Cladophialophora carrionii*
6	*Microsporum canis*
7	*Paecilomyces variotii*
8	*Penicillium marneffei*
9	*Phaeoacremonium parasiticum*

Table 2: Frequency of Occurrence of Fungi Associated With Spoilt Okra in the Study Area

Fungal isolates	Frequency of occurrence	Percentage of occurrence (%)
Aspergillus niger	20	26.67
Aspergillus fumigates	11	14.67
Aspergillus flavus	13	17.33
Chrysosprium Corda	4	5.33
Cladophialophora carrionii	2	2.67
Microsporum canis	7	9.33
Paecilomyces variotii	3	4.00
Penicillium marneffei	8	10.67
Phaeoacremonium parasiticum	7	9.33
Total	**75**	**100**

Table 3: Frequency of fungal isolates with respectto locations of sample collection

Location	Fungal Isolates (%)
Aliero	9.52
Gumbulu	9.52
Danwarai	33.33
Sabiyel	19.05

DISCUSSION

Okro is often colonised by fungi, including species from the genus Aspergillus, Penicillium and Fusarium, which cause significant reductions in crop yield, quality and safety due to their ability to produce mycotoxins. Mycotoxins commonly occurring in vegetables and fruits products include zearalenone, fumonisins, trichothecenes (as deoxynivalenol and T2-HT2), ochratoxin and aflatoxins (Miller, 2008). This study was conducted to determine the fungi species associated with spoilage of Okro in Aliero Local Government area, Kebbi State from January to October, 2018. A total of nine fungi species were isolated in this study where *A. niger*, had the highest frequency of occurrence (26.67%) while *Cladophialophora carrionii* had the lowest (2.67%). The higher number of fungi species identified may be due toclimatic conditions such as high temperature and air humidity which favor the growth of microorganism particularly fungal pathogens leading to deterioration of okra fruits (Moekchantuk and Kumar, 2004). The number of fungi identified in this study is higher than that was reported by Shaker *et al.,* (2013) in Iraqi which showed the presence ofeight (8) fungal isolates.Similar study was carried out by Ezekiel and Sombie, (2014), in Ogun State-Nigeria where eleven(11)fungal pathogens were identified on okra fruits.

The occurrence of the isolated fungi with respect to locations of sample collection revealed that Danwarai had the highest percentage of the fungal loads (33.33%) followed by by Kashin zama (28.57%) with Aliero and Gumbulu having the lowest (9.52%) each. The variations in the fungal load may be due to the handling methods of the fruits during packaging, transportation or storage (Aladele*et al*., 2008.)

A considerable number of fungal pathogens belonging to the genera of *Fusarium, Aspergillus*, *Colletotrichum*, *Rhizopus* and *Penicillium* have been detected in okra by many researchers (Alam, 2011; Jamadar *et al.,* 2013). The presence of these fungal pathogens on okra fruits suggests that they used compromised surfaces of the fruits such as wounds to cause rots. Moreover, most vegetables sellers use polythene sheets with poor ventilation to cover the fruits at the end of their sales period and before resuming sales or distributions; condition that favours growth of rot pathogens especially, fungi (*Adetuyi et al*., 2008). The fruits must therefore, be properly checked for deep and even light scratches prior to shelving on fruit stalls or packing in storage as these rot pathogens can cause considerable fruit loss if they remain on wound sites.

CONCLUSION

The present study revealed the presence of several fungi associated with spoilt okra fruits in Aliero local government area, kebbi State Nigeria. Postharvest diseases of fruits in general and Okra in particular are of huge economic importance. This indicates the possibility of disease occurrence when such infected seeds are planted. Although the results of the present study may be considered preliminary, these fungi associated with this vegetable are potential threat to its production. Further research should be taken on the pathogenicity of fungi causing spoilage of Okro to confirm the primary pathogens and to differentiate them from secondary invaders. Similarly, Proper handling methods should be adopted by both farmers and consumers to minimize the fungal deterioration of okro fruit in the study area.

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