ISOLATION OF FUNGI FROM DETERIORATED ONIONS (*ALLIUM CEPA* L.) IN KEFFI, NASARAWA STATE, NIGERIA

A. O. Ogaraku, A. E. David and I. R. Iyonmanhan

Department of Biological Sciences, Nasarawa State University, P.M.B 1022, Keffi, Nigeria

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Abstract

A survey on fungi deterioration of onions (Allium cepa L.) from four different locations in Keffi was carried out. The locations include; Angwan Lambu, Angwan Jarmai; Angwan NEPA and Keffi market. Out of 96 samples of onion bulbs examined, 86 (89.6 %) bulbs had fungi isolates. The species of fungi isolated and identified from the deteriorated bulbs were Aspeergillus niger (22.9 %), Aspergillus flavus (6.3 %), Fusarium oxysporium (25.0 %), Fusarium moniliforme (10.4 %), Penicillium spp (16.7 %) and Rhizopus stolonifer (8.3 %). The incidence of fungi species in the different locations include, Angwan Lambu (23.96 %), Angwan Jarmai (21.88 %), Angwan NEPA (20.83 %), and Keffi Market (22.92 %). There was no significant difference ($P < 0.05$) in the incidence of different fungi isolates in relation to different locations in Keffi Local Government Area. The pathogenicity test showed that Rhizopus stolonifer was a mere contaminate while the others were pathogenic on onion bulbs. Determination of relative humidity showed that high relative humidity increases the rate of deterioration of onion bulbs. pH determination also showed that weak acidic, neutral to weak alkaline environments enhanced fungi spread. These factors should be controlled to reduce onion bulb deterioration in this area.

Keywords: *Fungi, isolation, deteriorated onion, Keffi.*

INTRODUCTION

The onion (*Allium cepa* L.) belongs to the family Alliceae (Ara *et al.*, 2008). It is an evergreen biennial monocot with prominent bulb growing up to 0.6 m (2ft) in height. The bulbs are characterized by the presence of adventitious roots. The flowers are hermaphroditic in nature. The leaves are hollow cylindrical in shape and the stems are lateral primordial (Agblor & Waterer, 2001). Onions are used every day in the Kitchen and on the dining table creating a demand for its availability in the market. Onions are vital to livelihood of several people in the tropical world. They are highly valued for their nutritional qualities in supplying minor constituents such as minerals and trace dements, and also for their flavor. Contents of major nutrients and vitamins in onion bulb per 100 g edible portion are water (87 %), calories (48J), protein (g) (1.5), fat (g) (trace), carbohydrate (g) (11), fibre (g) (0.5), calcium (g) (3.0), phosphorus (mg) (–), iron (mg) (0.5), B – carotene equiv. (µg) (trace), thiamine (g) (0.04), riboflavin (mg) (0.02), niacin (mg) (0.3), ascorbic acid (mg) (10) (Schwartz & Mohan, 1995)

Wide – ranging claims have been made for the effectiveness of onion against conditions ranging from the common cold to heart disease, diabetes, osteoporosis and other diseases. They contain chemicat compound believed to have anti – inflammatory, anti – cholesterol, anti – caner and anti – oxidant properties such as asquercetin (WHO, 1983). However, it has not been conclusively demonstrated that increased consumption of onion is directly linked to health benefits. Onion bulb deterioration has made people to stop purchasing onions in large scale. The most serious loss arises from storage rot due to bulb rottening microorganisms and from unwatned sprouting (Ara *et al*., 2008). During storage of onions, many fungi were isolated from diseased onions (Schwartz & Mohan, 1995). Some of these fungi species are known to cause bulb and basal rot during storage (Agblor & Waterer, 2001).

Therefore, this survey was carried out to create awareness on the prevalence of fungi deterioration of onion bulbs in Keffi and determine factors which enhance their spread in this area.

MATERIALS AND METHODS

Sample Collection

The laboratory analysis was conducted in Plant Science and Biotechnology Laboratory, Department of Biological Sciences while survey work was carried out among selected locations in Keffi Local Government Area, Nasarawa State. The selected locations include Angwan Lambu, Angwan Jarmai, Angwan NEPA, and Keffi market. Regular onion bulbs retailers were visited twice monthly for the collection of deteriorated onion bulbs. For the month of July, 2011, from each location six (6) rotted onion bulbs were obtained, in four locations twenty four (24) rotted onion bulbs were obtained. Hence, from July to September, 2011, a total of ninety six (96) rotted onion bulbs were obtained from the four locations in Keffi Local Government Area. The mean samples from two times visit in each month

represented a replicate, hence, in three (3) months, there were triplicates.

Isolation and Identification of Fungal Isolates

Fungal isolation was done using direct surface agar plating method described by Udo *et al.* (2001). Small portions of onion bulbs containing advancing margin of rot and adjoining healthy tissue were pinched with sterile wire loop which was passed over the flame for red host sterilization (Onyike & Maduewesi, 1985). The portion was transferred unto potato dextrose agar and incubated at 28^0C for seven days. Fungal identification was carried out according to Domsch *et al.* (1980). 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, healthy onion bulbs were collected and surface sterilized with 2 % (v/v) sodium hypochlorite and allowed to dry. 2.0 mm hole was made on the onion bulbs with cork borer and equivalent 2.0 mm diameters of the fungi isolates were inoculated into the holes. The inoculated tubers were left for 2 – 7 days for fungal growth (Ogaraku & Usman, 2008). A control was setup with the 2 mm hole made on the onion bulbs and covered with Vaseline gel.

pH Determination of the Various Locations in Keffi

The alkalinity and acidity of these locations were determined using a pH meter and readings taken.

Determination of the Relative Humidity (RH) of the Various Locations in Keffi

The relative humidity of the surveyed locations in Keffi was examined monthly using a hygrometer as described by Binbol (2007).

RESULTS AND DISCUSSION

From the results obtained, 96 onion bulbs were obtained and sampled for fungi species, out of which 86 bulbs had fungi isolates while 10 samples were without fungi isolates. The species of fungi isolated and identified from deteriorated onion bulbs were *Aspergillus niger* (22.9 %), *Aspergillus flavus* (6.3 %), *Fusarium oxysporium* (25.0 %), *Fusarium moniliforme* (10.4 %), *Penicillium spp* (16.7 %) and *Rhizopus stolonifer* (8.3 %) (Table 1). The incidence of fungi species in four different locations in Keffi Local Government Area is presented in Table 2. There was no significant difference ($P \leq 0.05$ %) in the incidence of the different isolates in relation to location (Table 3). The six fungi isolates artificially inoculated on onion bulbs were found to induce rot. *Aspergillus niger* and *Fusarium oxysporium* were the most virulent and destroyed bulbs after few days of inoculation by producing 100 % rot each. *Aspergillus flavus* and *Penicillium spp* produced 80 % rot each. *Fusarium moniliforme* produced (60 %) rot and *Rhizopus stolonifer* produced 20 % rot as against the control (Table 4). Result from the relative humidity showed that Angwan Lambu had the highest amount of water vapour in the air 60 % while Keffi market had 55 % (Table 5). pH determination also showed that weak acidic (6.2) to weak alkaline (7.3) environments enhanced fungi spread in the study area (Table 6).

Table 1: Frequency of occurrence of fungi isolates from 86 onion bulbs

Fungal Isolate	No. attacked on 86 bulbs	Attack rate (%)
Aspergillus niger	22	22.9
Aspergillus flavus	6	6.3
Fusarium oxysporium	24	25.0
Fusarium moniliforme	10	10.4
Penicillium spp	16	16.7
Rhizopus Stolonifer	8	8.3
Total	**86**	**89.6**

Table 2: Incidence of fungi species in different locations in Keffi Local Government Area

Location	No. of onion bulbs examined	No. (%) infected with fungi species
Angwan Lambu	24	23(23.96)
Angwan Jarmai	24	21(21.88)
Angwan NEPA	24	20(20.83)
Keffi Market	24	22(22.92)
Total	**96**	**86(89.59)**

The result from the disease survey has shown that onion (*Allium cepa*) bulbs in Keffi, Nasarawa State, Nigeria suffered various attacks by fungi. These fungi that cause deterioration in onions are well known and have been reported in some countries of the world (Ara *et al*., 2008). These include: *Aspergillus niger*, *Aspergillus flavus*, *Fusarium oxysporium*, *Fusarium moniliforme*, *Penicillium* spp and *Rhizopus stolonifer*. These fungi species isolated and identified in this study corroborate those isolated and reported earlier (Ara *et al*., 2008). The result showed that Angwan Lambu had more fungal attack than other locations in the study area while Angwan NEPA had least fungal attack. Angwan NEPA which had least attack by fungi may be as a result of the low relative humidity (54%) and an alkaline environment of pH 7.1 which is a weak alkaline. Angwan Lambu which had more fungal attack than other locations may be due to high relative humidity (60%) and the storage method adopted by the farmers; it has the pH of 6.8. Hence, it can be concluded that high relative humidity increases the rate of storage rot in onion bulbs while low relative humidity minimizes bulb rot. This corroborates the work of Stow (1975).

Table 3: Chi – square on the relationship between fungi isolates and different locations in Keffi Local Government Area

Location	No. of onion bulbs examined	No. with fungi species	No. without fungi species
Angwan Lambu	24	23 (21.5)*	1 (2.5)*
Angwan Jarmai	24	21 (21.5)*	3 (2.5)*
Angwan NEPA	24	20 (21.5)*	4 (2.5)*
Keffi Market	24	22 (21.5)*	2 (2.5)*
Total	**96**	**86**	**10**

*****Numbers in parenthesis are expected chi – square values;
Ho: There was no significant different ($P \leq 0.05$ %) in the incidence of different isolates in relation to location; F tab 7.82 > F cal 4.64, therefore we accept the hypothesis.

Table 4: Percentage infection of onion bulbs artificially inoculated with fungal isolates from diseased bulbs

Fungi isolate	No of bulbs examined	% infection after 7 days
Aspergillus niger	5	100
Aspergillus flavus	5	80
Fusarium oxysporium	5	100
Fusarium moniliforme	5	60
		80
Rhizopus stolonifer	5	20
Control	5	00

Table 5: Determination of relative humidity of the various locations

Location	Relative humidity (RH%)
Angwan Lambu	60
Angwan Jarmai	56
Angwan NEPA	54
Keffi Market	55

Table 6: pH determination of the various locations

Location	pH value
Angwan Lambu	6.8
Angwan Jarmai	6.2
Angwan NEPA	7.1
Keffi Market	7.3

There is no significance difference ($P \leq 0.05$) on the percentage incidence of the disease conditions in all the locations since each location adjoins each other as such, have barely little variation in the environmental and climatic conditions. The frequency of occurrence of fungi deterioration of onion bulbs from different locations showed that *Fusarium* oxysporium had the highest frequency of occurrence (25.0%) while *Aspergillus flavus* had the lowest frequency of occurrence (6.3%). The presence of the above mentioned fungi are of health significance. Some fungal pathogens produce mycotoxins in their infected agricultural produce. Mycotoxins are hazardous to human and animal health (WHO, 1979). *Fusarium* species produce *Fusarium* toxins such as trichothecenes, diacetoxyscirpenol, nivalenol and zearalenone; these cause skin diseases (Krogh, 1988). *Aspergillus* species produce aflatoxins (B1, B2, G1 and G2) of which aflatoxin B1 is highly carcinogenic causing (WHO, 1983). All the fungal isolates were implicated as pathogens with varying degrees of rate of attack when tested on healthy bulbs and were not mere contaminants.

CONCLUSION

Onions should be handled with care to avoid mechanical injuries which may pave way for the entry of pathogens. Measures should be carried out through genetic engineering to produce onions with improved storage capacity.

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