ISSN No:-2456-2165

Studies on Postharvest Deterioration of *Allium cepa* L. (Onion) Bulbs

Ewekeye, T.S*, Oke, O.A., Shittu, B.F., Esan, O.O., Ogun, M.L.
Department of Botany, Faculty of Science, Lagos State University, Ojo Lagos, Nigeria

Abstract:- Fungi are the most significant and predominant pathogens infecting a wide range of host plants and causing economically important losses to crop produce in transit and storage. In this study, fungi associated with postharvest rot of onion bulbs and their effects on the proximate composition was investigated. Diseased onion bulbs were obtained from three markets around Lagos State University, Ojo Nigeria. Potato Dextrose Agar (PDA) and Malt Extract Agar (MEA) were used for isolation. Pathogenicity test was conducted to determine the causal organism(s) from isolated fungi. Proximate analysis was carried out on infected onion bulbs to ascertain the effects of fungi on the moisture, ash, crude fat, protein and ascorbic acid contents. The fungi isolated from the bulbs were *Aspergillus flavus, Aspergillus niger, Rhizopus* sp. and *Penicillium* sp. Pathogenicity tests showed that all isolated fungi induced disease symptoms when inoculated on healthy onion bulbs. The fungi were found to cause an increase in the moisture content of the bulbs and a general reduction in the nutritional composition of the bulbs.

Keywords:- *Onion Bulbs, Postharvest Rot, Fungal Pathogens, Nutritional Composition.*

I. INTRODUCTION

Allium cepa (onion) is an essential vegetable crop in Nigeria based on its intake and financial value to farmers [1]. It is the most widely cultivated species of the genus *Allium* belonging to the family Alliaceae [2]. It is an evergreen biennial (sometimes perennial) plant which grows to about 0.6m (2ft) in height, and produces hermaphrodite flowers which are pollinated by insects. Onions prefer a sunny, sheltered position in a rich, light, well-drained organic soil. They tolerate a soil pH in the range of 4.5 to 8.3 although the optimum pH is 6.5. Onion bulbs are basically used for food purposes, all parts of the plant are edible especially the foliage leaves and storage leaves. The bulb may be eaten raw in salads and sandwich fillings or cooked to serve as flavouring in soups, stews and other continental dishes [3]. Onions have been found to have numerous medicinal benefits to the human body, and when eaten on a regular basis will promote the general wellnessof the body [4].

There are specific diseases which are associated with the bulb during production or storage as a result of contact with pathogen(s) found in the environment. These diseases can also be due to handling practices during processing resulting in contact and ingress of variety of microorganisms that are present in the production and processing. Therefore, the present study was undertaken to investigate the fungal pathogen(s) associated with post-harvest spoilage of onion and determine the effects of isolated fungi on the nutritional composition of onion.

II. MATERIALS AND METHODS

2.1. Collection of samples

Onion bulbs showing symptoms of rots and discolouration were collected from three different markets around Lagos State University, Ojo, Lagos Nigeria namely; Iyana-iba, Okoko and Igando markets into separate polythene bags and adequately labeled.

2.2. Preparation of Media

Two culture media were used in the isolation of fungi from diseased samples. These were Potato Dextrose Agar (PDA) and Malt Extract Agar (MEA).

2.3. Isolation, Preservation and Identification of Fungi

Fungal pathogens of onion bulbs were isolated using the direct plating method. The outer dry scales of onion bulbs were removed, and tiny pieces approximately 2 mm in diameter were cut from the diseased parts. The cut pieces were surface sterilized and blotted dried with filter paper and placed at two opposite ends on the plate. The plates were incubated at room temperature (28 ± 3^0C) and observed for fungal growth after 48hours. To obtain pure cultures of the isolates, growing fungal colonies were continuously sub-cultured on fresh media plates. Fungal isolates were identified by comparing their cultural and morphological characteristics to previously identified fungi [5].

2.4. Pathogenicity Test

Pathogenicity of the isolated fungal species were proven by infecting healthy onion samples with the fungi isolated in the laboratory to test for their ability to cause rot in healthy bulbs. Fresh onion samples were surfaced-sterilized with absolute ethanol after which a hole was created in the bulbs using a sterile 4mm cork borer. A hole of the same size was bored on the fungal growth in the plates. The mycelial disc of each isolated sample of fungi was then used to fill the hole made on the onion samples and the part of the bulb removed was replaced. The wounded area was sealed with Vaseline and cotton wool to avoid external infection. Inoculated bulbs were incubated at room temperature for one week. Control bulbs consisted of pure sterilized media placed in holes made on healthy onion bulbs.

ISSN No:-2456-2165

The degree of pathogenicity of each fungus was evaluated by measuring the extent of rot (mm) on the infected bulbs.

2.5. Proximate Analysis and Determination of Nutritional Content

Standard Methods of the Association of Official Analytical Chemists [6] were used for the determination of proximate composition of onion bulbs, particularly their fibre content, ash content, protein content, crude fat content and the ascorbic acid content. The control and infected onion bulbs analyzed to know the effect of different fungal pathogens on the food composition of onion bulbs (Table 1).

III. RESULTS AND DISCUSSION

Table 1: Effect of the fungal isolates on Proximate content of Onion bulbs

Fungi	Moisture content (%)	Ash content (%)	Fat content (%)	Crude Fibre (%)	Protein content (%)	Ascorbic acid (%)
Control	86.80	1.10	0.05	1.20	0.95	22.81
Aspergillus niger	89.42	0.74	ND	0.30	0.56	15.10
A. flavus	88.96	0.62	ND	0.20	0.41	15.69
*Rhizopus*sp.	88.56	0.68	ND	0.60	0.59	17.17
*Penicillium*sp.	88.72	0.70	ND	0.50	0.70	14.50

ND– Not detected

The fungal species isolated during the course of this research were *Aspergillus flavus, Aspergillus niger, Rhizopus* sp. and *Penicillium* sp.The proximate analysis is given in Table 1.

The measurement of radial growth of each fungus recorded was used to determine their rate of growth and the effect of the different culture media used on their growth. From Table 1, it can be seen that the control sample has a moisture content of 86.80%, ash content of 1.10%, fat content of 0.05%, crude fibre content of 1.2%, protein content of 0.95% and ascorbic acid level of 22.81%. The various samples infected with the isolated fungal species showed variations to the control which showed the effect of the pathogens.

A. niger caused an increase in the moisture content of the bulb to 89.42% and caused a reduction of all other components. Ash content was reduced to 0.74%, fat content was not detected, crude fibre was reduced to 0.3%, protein decreased to 0.56 % and the ascorbic acid level became 15.10 %.

A. flavus showed 88.96% moisture content, 0.62% ash, 0.20% crude fibre, 0.41% protein content and an ascorbic acid level of 15.69%. No fat content was detected.

The sample infected with *Rhizopus* sp. showed 88.56% moisture content, 0.68% ash content, fat content was not detected, 0.6% crude fibre level, protein content of 0.59% and an ascorbic acid level of 17.17%.

Penicillium sp.increased the moisture content of the onion sample to 88.72% and reduced the ash content to 0.70%, crude fibre level was reduced to 0.50%. Protein content was reduced to 14.5% and the ascorbic acid level became 14.5%. No fat content was detected in this sample.

Aspergillus spp. were the most prevalent and virulent as *A. niger* caused the greatest increase in moisture content and *A. flavus* was responsible for the greatest loss in nutrient composition except for the vitamin C level where the greatest reduction was caused by *Penicillium* sp. Two species of *Aspergillus* were associated with postharvest deterioration in this study. This is in line with reports of Abubakar and Naqvi [7]; Narayana *et al.* [8]; Kumar *et al.* [9] who documented that *Aspergillus* spp. were the most virulent pathogen in field and storage.

According to the results, these organisms were found to affect onion bulbs by increasing their moisture content to create a favorable environment and may induce a greater activity of water soluble enzymes and co-enzymes involved in metabolic activities and cause rots to develop which reduces the nutritional composition of the bulbs. This agrees with work of Oulai *et al.* [10]; Shehu and Aliero [11] and Iheanacho and Udebuani [12]and Onuorah and Obika [13]. This result is further supported by the work of Ewekeye *et al.* [14] who isolated *Aspergillus niger, A. terreus, Rhizopus* sp. and other fungi from apple fruits.

IV. CONCLUSION

Since onion bulbs are perishable vegetables like other fresh produce, a certain level of fungal spoilage during storage is inevitable but this can be kept to the barest minimum by the use of proper post-harvest handling methods in order to reduce the development of rots and deterioration by fungal species.

REFERENCES

[1]. Shehu K, Muhammad S. 2011. Fungi Associated with Storage Rots of Onion Bulbs in Sokoto, Nigeria. *International Journal of Modern Botany*, 1(1): 1-3. DOI: 10.5923/j.ijmb.20110101.01

[2]. Brewster JL. 1994. Onions and Other Vegetable Alliums. CAB International, Wallingford, 236.

[3]. Ole H, Torben L, Lars, PC, Ulla K, Nazmul H. Shakuntala HA. 2004. Contents of Iron Zinc, and β - carotene in Commonly consumed vegetables in Bangladesh. *Journal of Food Composition and Analysis*, 17: 587 – 595.

[4]. Lust JB. 1980. The herb book. Bantam Books, 659pp.
[5]. Barnett HL, Hunter BB. 1987. Illustrated genera of imperfect fungi. Macmillan, 218.
[6]. Association of Official Analytical Chemists International (AOAC)**.** 2000. Official Methods of Analysis, 17th edition (AOAC International, Gaithersburg, MD, USA).
[7]. Abubakar A, Naqvi SHZ. 1996. Studies on Pathophysiology of storage rot of onions (*Allium cepa* L) infected by *Aspergillus niger*. *Nigerian Journal of Basic and Applied Science*, **5** (1): 7-14.
[8]. Narayana KJP, Srikanth M, Vijayalakshmi M, Lakshmi N.2007. Toxic Spectrum of *Aspergillus niger* causing black mold rot of onions. *Research Journal of Microbiology*,**2:**881-884. DOI: 10.3923/jm.2007.881.884.
[9]. Kumar V, Sharma NS, Sagar NA. 2015. Post Harvest Management of Fungal Diseases in Onion - A Review. *Int. J. Curr. Microbiol. App. Sci*., 4(6): 737-752.
[10]. [10]. Oulai P, Lessoy Z, Rose-Monde M, Ryta D, Sébastien N, 2014. Proximate Composition And Nutritive Value Of Leafy Vegetables Consumed In Northern Côte D'ivoire**.** *European Scientific Journal*, **10**(6): 212-227.
[11]. Shehu K, Aliero AA. 2010. Effects of Purple Blotch Infection on the Proximate and Mineral Contents of Onion Leaf.*International Journal of Pharma Sciences and Research (IJPSR),***1**(2): 131-133.
[12]. Iheanacho K, Ubebani AC. 2009. Nutritional composition of some leafy vegetable consumed in Imo State, Nigeria. *Journal of Applied Science and Environment Management*,**13**: 35-38.
[13]. Onuorah S, Obika I. 2015. Fungi Associated with the Deterioration of Post-harvest Onion Bulbs Sold in Some Markets in Awka, Nigeria. *Bioengineering and Bioscience*, 3(5): 90-94. http://www.hrpub.org DOI: 10.13189/bb.2015.030503.
[14]. Ewekeye TS, Oke OA, Esan OO. 2016. Studies on post harvest rot of apple (*Malus domestica* Borkh). *Indian Journal of Plant Sciences*. 5(1): 36-41.