PAT December 2010; 6 (2): 91-98 *ISSN: 0794-5213*

Online copy available at

www.patnsukjournal.net/currentissue

Publication of Nasarawa State University, Keffi

Decay of Tomato (*Lycopersium Esculentum* Mill) and Vitamin C Content of Infected Fruits In Keffi, Nasarawa State.

Ogaraku A.O., Alanana J.A. and Omananyi P.O.

Plant Science and Biotechnology Unit, Department of Biological Sciences, Nasarawa State University, PMB 1022 Keffi.

Received 05th April, 2010, Accepted 19th December, 2010

Abstract

Studies were carried out on storage decay of tomato (Lycopersium esculentum) and vitamin C content of infected fruits in different locations in Keffi. The disease survey was carried out in four locations in Keffi Local Government Area. The locations include; Keffi market, Angwan Lambu, Angwan Kwara and Angwan Kaje. Out of 48 samples of tomato fruits examined, 34 tomato fruits had fungi isolates. The species of fungal isolated and indentified from the decayed tomatoes were Aspergillus niger, Aspergillus flavus, Alternaria alternate, Alternaria solani and Fusarium oxysporium. The frequencies of occurrence of the fungal species were 47.06%, 17.65%, 14.71%, 11.76% and 8.82% respectively. The incidence of fungal species in different locations includes Keffi market (26.47%), Angwan Lambu (20.59%), Angwan Kwara (29.41%) and Angwan Kaje (23.53%) respectively. Vitamin C content of both the infected and uninfected tomato fruits showed that infected fruits gave 2.2mg/100g of vitamin C while the uninfected fruits gave 2.51mg/100g vitamin C. These fungi species actually reduced the vitamin C content of infected fruits.

Key words:*Decay, Tomato fruits, Vitamin C, Keffi.*

Introduction

Tomato (*Lycopersium esculentum* Mill) belongs to the family solanaceae. Tomatoes rank first in the "relative contribution to human nutrition" when compared to 39 major fruits and vegetables (Saltueit, 2003). The composition of tomato is believed to benefit the hearty among other things they contain lycopene, one of the most powerful natural antioxidants, which especially when tomatoes are cooked has been found to help prevent prostrate cancer (Olson, 2004). One medium sized tomato provides 40% of the Recommendation Daily Allowance (RDA) of vitamin C (Ascorbic acid), 20% of the RDA of vitamin A, substantial amount of potassium, dietary libre, calcium and lesser amount of iron, magnesium, thiamine, riboflavin and niacin, yet contain only about 35 calories (Olson, 2004). It is essential for sperm production, and for the building and health of cartilage, joints, skin and blood vessels. Vitamin C helps in maintaining a healthy immune system. It aids in neutralizing pollutants, is needed for antibody

production, acts to increase the absorption of nutrients (including iron) in the gut, and thins the blood (U.S. Department of Health and Human Services) UDHHS, 1998).

Most fruit diseases are incited by fungi, though this could be used to reduce infestation by other organisms, for example, in certain parts of Florida (USA) where fungi have been reported to reduce infestation of tomato (Walker, 1952).

When blighted, the fruit is invaded by other non- parasitic microorganisms. The fruit rots (Norman and Salunche, 1975). The fruit rots are generally caused by opportunistic pathogens, those that cannot directly infect fruit tissues unless the tissues are stressed. These pathogens are ubiquitous in the natural environment. Mechanical injuries that occur during harvest and handling are a predominant cause for decay because they provide infection courts for decay pathogens. Once it initiates a lesion, a decay pathogen often can engulf the rest of the fruit. During the process of invasion, infection, colonization and reproduction, the pathogen usually produces structures and materials that promote the infection and decay of adjacent and nearly fruit (Mahovic *et al*., 2004).

Tomato fruit which is the most relative contribution to human nutrition has been greatly affected by fungi infection during storage and potentially cause serious reduction in quality and market value of the produce (Friedman, 1960). There is general lack of understanding of the status and nature of the disease in Keffi, Nasarawa state. The aim of this research is to determine the fungi responsible for the post-harvest decay of tomatoes and the vitamin C content of infected fruits in Keffi.

Materials and Methods

The study was conducted in Plant Science and Biotechnology Unit Laboratory, Department of Biological Sciences, Nasarawa State University, Keffi. While the survey work was carried out in some selected locations in Keffi Local Government Area, Nasarawa State. These include; Angwan Lambu, Keffi Market, Angwan Kwara and Angwan Kaje. These locations form parts of the Guinea Savannah Region of Nigeria (Iloeje, 1981). Samples of decayed tomato fruits were collected from the four (4) locations in Keffi Local government Area. Farmers were consulted monthly for the collection of decayed tomatoes. During the first visit which was in May 2009, two (2) tomato fruits were collected from each of the four (4) locations, making a total of eight (8) tomato fruits. For the second visit in the same month another eight (8) tomato fruits were collected, making a total of sixteen (16) tomato fruits for that month. In three (3) months; May – July 2009, 48 tomato fruits were obtained. The mean of the samples

from two times visit in each month represented a replicate, hence, in 3 months, there were triplicates.

Isolation and Identification of Fungal Isolates.

Sampling was done based on the presence of rot on tomato fruits. Tomato fruits obtained were stored in the refrigerator for preservation (Jones *et al*., 1991). Symptoms of different disease types were closely studied. The isolation technique was similar to that used by Onyike and Maduewesi (1985). The mycelium was transferred to potato dextrose agar and the rot fungi were isolated and later identified. Fungal identification was carried out according to Domsch *et al*.(1980);Samson *et al*.(1980) and Rippon (1958) methods. The data obtained from the survey were subjected to chi-square for analysis.

Pathogenicity Test

Healthy tomato fruits were first washed with 2% sodium hypochlorite and allowed to dry. Two (2)mm hole was made on the fruits with cork borer and equivalent 2mm diameters of the fungal isolates were inoculated into the holes. The inoculated fruits were left for 2-7 days for fungal growth (Ogaraku and Usman, 2008).

Titrimetric Determination of Vitamin C (Ascorbic Acid) in Infected and Uninfected Tomato Fruits

This was carried out using David (2004) method. Five (5)g of tomato fruits was weighed and ground with pistle and mortar with few drops of glacial acid. This was transferred quantitatively with distilled water into a 40ml flask. One (1)ml of the dye was transferred into a conical flask and drop of dilute acetic acid was added. This was titrated with the suspension (tomatoes) from a burette and the volume that decolourized the dye noted, this procedure was repeated for the standard ascorbic acid in place of the tomato suspension. The volume of the standard that decolourized 1 ml dye also noted.

Results

For the results obtained, 48 samples of tomatoes were sampled out of which 34 tomatoes had fungi isolates while 14 samples were without fungi isolates (Table 1). The species of fungi isolated and identified from the deteriorated tomato were *Aspergillus niger, Aspergillus flavus, Alternaria alternate, Alternaria solani, Fusarium oxysporium.* There frequencies of occurrence were 47.06%, 17.65% 14.71%, 11.76% and 8.82% respectively (Table 2).

The incidence of fungi species in the different locations in Keffi is presented in Table 3. Angwan Kwara had the highest incidence of fungi (29.41%) while Angwan Lambu had the lowest incidence (20.59%).

Pathogenicity test shows that *Alternaria solani* could not infects fresh tomato fruits after artificial inoculation (Table 4). The frequencies of occurrence of fungi species are independent of the different locations in Keffi Local Government Area (Table 5). The vitamin C content of uninfected tomato fruits was more than that of infected tomato fruits by 0.31 mg/100g (Table 6).

Table 1: Fungal isolates from different locations in Keffi.

Location	**Total No of Samples**	**No with Fungi**	**No Without Fungi Spp**
Keffi market	12	9 (18.75)*	3 (6.25)*
Angwan Lambu	12	7 (14.58)*	5 (10.42)*
Agwan Kwara	12	10 (20.83)*	2 (4.17)*
Angwan Kaje	12	8 (16.67)*	4 (8.33)*
TOTAL	**48**	**34 (70.83)***	**14 (29.17)***

*Figures in parenthesis are percentages

Table 2: Frequency of occurrence of fungi isolated from different locations

Location	***Aspergillus niger***	***Aspergillus flavus***	***Alternaria alternate***	***Alternaria solani***	***Fusarium oxysporim***	**Frequency of attack**
Keffi market	4	3	-	2	-	9
Angwan Lambu	3	-	2	1	1	7
Agwan Kwara	5	2	1	-	2	10
Angwan Kaje	4	1	2	1	-	8
TOTAL	16	6	5	4	3	34
% TOTAL	**47.06**	**17.65**	**14.71**	**11.76**	**8.82**	

Table 3: Incidence of fungi in tomato from different locations in Keffi.

Location	***Aspergillus niger***	***Aspergillus flavus***	***lternaria alternate***	***Alternaria solani***	***Fusarium oxysporim***	***% incidence***
Keffi market	4	3	0	2	0	26.47
Angwan Lambu	3	0	2	1	1	20.59
Agwan Kwara	5	2	1	0	2	29.41
Angwan Kaje	4	1	2	1	0	23.53

Table 4: Percentage infection of tomato fruits artificially inoculated with fungi located from infected fruits.

Fungi isolate	Number of Tomato Inoculated	Infection after 5days of Inoculation
Aspergillus niger	5	100.0
*Aspergillus flavu*s	5	80.0
Alternaria alternata	5	30.0
*Alternaria solan*i	5	0.0
Fusarium oxysporium	5	80.0

Table 5: Chi-square on the Relationship between isolates from Tomato in Different locations in Keffi.

Location	**Total No of Samples**	**No with Fungi**	**No Without Fungi Spp**
Keffi market	12	9(8.5)*	3(3.5)*
Angwan Lambu	12	7(8.5)*	5(3.5)*
Agwan Kwara	12	10(8.5)*	2(2.3)*
Angwan Kaje	12	8(8.5)*	4(3.5)*
TOTAL	**48**	**35**	**14**

* Numbers in parenthesis are expected frequencies

Ho: The frequency of occurrence of fungi is independent of different locations in Keffi Local Government Area. F. table 7.815 > cal 2.017, therefore we accept hypothesis.

Table: 6 Vitamin C content of infected and uninfected Tomato fruits.

Tomato fruit condition	**Vitamin C content mg/100g**
Uninfected fruit	2.51
Infected fruit	2.20

Discussion

The study has revealed a wide range of fungi which are responsible for the storage decay of tomato fruits in Keffi Local Government Area, Nasarawa State, Nigeria. These Fungi that cause deterioration are well known and have been reported in some countries of the world (Mahovic *et al*., 2004). These include *Aspergillus niger, Aspergillus flavus, Alternaria alternate, Alternaria solani,* and *Fusarium oxysporium.* However, the result from the pathogenicity test shows that *Alternaria solani* may have been a mere contaminant. As it did not grow on fresh tomato fruits artificially inoculated with the fungi.

The presence of the above mentioned diseases is of public health and economic importance. Mycotoxins are hazardous to human and animal health (WHO, 1979). Different mycotoxins affect different sites in the body. Aflatoxins produced by *Aspergillus flavus* are the commonest of all the toxins and it affects the liver causing aflatoxicosis or liver poison. High levels of aflatoxin has also been reported to have caused infertility in the samples of serum from men fed with diets contaminated with *Aspergillus flavus* (Ibeh *et al*., 1994). *Fusarium* species produce *Fusarium* toxins such as T.Z, Trichothecenes, rectal hemorrhage, vomiting and several other diseases (Krogh, 1988).

Angwan Kwara has more fungal attack than any other location while Angwan Lambu had the least fungal disease. This could be due to method of harvesting and storage in baskets with little ventilation by farmers in these areas. The pathogens penetrate through cuts, punctures, abrasions and bruises which provide likely sites for infections to occur (UDHHS, 1998). There is no significant difference on the percentage incidence of the disease condition in all the locations examined, which could be due to little variation in climate and weather conditions, though with little variation in soil type.

The vitamin C analysis shows that the uninfected tomato fruits had 2.51 mg /100g vitamin C. while the infected tomato had 2.20mg/100g vitamin C. These show that the fungi species that infected the tomato fruits actually reduced the vitamin C content. Fungi growing on plant parts and produce use them as food. They produce a variety of enzymes, namely, amylases, calluses, pantonese and lipases which hydrolyze the food substances into forms absorbed in the body. This breakdown invariable lead to absolute weight loss (Ogundana *et al*., 1970). Some of the fungi that can cause weight loss in agricultural produce are; *Asperfillus flavus* and *Aspergillus niger* already isolated in this study.

Efforts should be geared towards producing tomato fruits with longer shelf-life through biotechnology (Modern crop improvement programmes). Presently, the first approved

transgenic tomato variety, Flavr Savr with long shelf-life is in the United State of America. Due to high demand, it is rarely available to consumers. Regular monitoring programme should be arranged for commodities like tomato fruits which are susceptible to aflaxtoxin contamination. Processing, packaging, transportation and storage practices should be well managed to eliminate or reduce infestation by moulds especially the toxigenic strains. Decontamination procedures to be designed to remove or inactivate the toxins in feeds and food. Mycotoxins can be removed from food by detoxification using chemical agents.

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