EFFECTS OF SOME POSTHARVEST FUNGAL DISEASES ON NUTRITIONAL QUALITY OF GUAVA (Psidium guajava)

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ABSTRACT

Some postharvest fungal diseases of guava were observed in three states in South–Western part of Nigeria. Three major soft – rots caused by Botryodiplodia sp, Aspergillus sp and Rhizopus sp, were observed. These fungi were found to have profound effect on the protein contents of the fruits. The effect of these fungi on the total free sugar of infected fruit was not significant. The fibre content of the infected fruit was significantly reduced. The level of Magnesium, Postassium, Zinc and Iron were reduced as a result of infection. The level of reduction was significantly high in Potassium content. These results were discussed in relation to the quality of guava fruits in storage.

INTRODUCTION

Guava (Psidium guajava) is a popular tree fruit which is common in the tropical and subtropical climates. It has variously been claimed to be a native of South America (Hawkes, 1983 and Yadava 1996). Guava is considered insignificant in terms of world trade but is widely grown in the tropics because the fruit enriches the diet of millions of people. The fruit is highly nutritious and exceptionally rich in ascorbic acid and several minerals useful for human health (Wilson, 1980). Campbell (1984) affirmed the nutritional status of guava when the report stated that Guava exceeds other Citrus sp in respect of vitamin C. Guava is a good source of vitamin A, Protein and dietry fibre (Yadava, 1994)

Aside the nutritional status of fruits, the leaves, bark of stem and roots have been variously used for medicinal purposes (Lozoya, 1990). Rathore (1979) reported the use of green fruits for the treatment of gastroenteritis, diarrhoea, and dysentery. The same report also stated the efficiency of ground leaves in the treatment of rheumatic areas and wounds. Singh et.al, (1992) reported the reduction of serum's total chelesterol and triglycerides by the fruits of guava. Thus, guava is nutritionally and medically very important. However, just like all vegetables and fruits, they are exposed to legions of microorganism.

The susceptibility of fresh fruits to spoilage by microorganism depends on various factors. For example, the occurrence and progress of microbial spoilage after harvest depend on both the microorganism, susceptibility of the host; and other factors such as growing conditions, harvesting techniques, storage and distribution methods.

Normally, postharvest diseases of fruits and vegetable could have their origin in any of the stages preceding storage. Infection of the fruit could be the period of its development in the field. It could also be through wounds created during harvesting. Fruits may also be diseased because of physiological injuries due to unfavourable storage environment.

Like any fruit, guava is disposed to various forms of infections because of high moisture content. Such infections include those caused by fungi and bacteria. Yadava (1996) reported a number of fungi to have been associated with Guava. These include Colletorichum gleosporioides that causes rot of ripe fruit; Clitocybe tabescens that causes root-rot and crown rot. Other fruit-rots have been individually associated with Phytophthora parasitica, Botryodiplodia sp and Dithorella sp (Yadava, 1996).

In previous studies (Yadava, 1996, Bressani et al., 1977) the analysis of guava fruits indicated high level of dietary fibre, vitamin C, protein and potassium with low level of fat and sodium. Yadava (1976) reported that, after 5 weeks of refrigeration at 50°c, there was no loss in the proximately analysed nutrient contents of vitamins and minerals.

Singh *et al*. (1977) stated that harvested fruits deterioate in quality rapidly under storage. Previous claim (Yadava. (1976) that storage at 50°c will preserve the fruits for 5 weeks contradicted deterioration in quality as enunciated by Singh *et al*. (1981). Thus this paper was aimed at reporting the influence of some known pathogenic microbes of guava on the nutritional quality of the guava fruits.

MATERIALS AND METHODS

Collection of Disease Specimen and Fungal Isolation

Ripe infected and healthy guava fruits were collected from 10 markets in each of Oyo. Ogun and Lagos States. The infected fruits were washed in clean sterile distilled water and were further surface disinfected with methylated spirit. The infected fruits were then incubated in a micro-humidity chamber for three days. The microbial outgrowths from the fruits were then inoculated onto malt extract Agar (MEA) and Nutrient Agar (NA)

Pathogenicity test

Pathogenicity test was carried out using isolated fungi. The isolates used were six-day-old in all cases. The fungi used include Rhizopus sp, Botryodiplodia sp, and Aspergillus sp. For each fungus, six healthy and ripe guava fruits were used. In each case, one mycelial disc of the fungus (diameter) was inoculated into the healthy guava fruits. The area was covered back with the disc made previously from the fruit. The cut edge was sealed with petroleum jelly before incubation. All incubation was at 29 ± 2°C under aseptic condition.

Preparation of plant material for analysis

Two sets of material were used for analysis: The infected and healthy guava fruits (control). In the infected fruit analysis, the fruits inoculated with each of the three-pathogenic fungi at the point of inoculation and about 1cm around it were cut off and treated for analysis. Similarly, in the control, areas around the point of inoculation of plain agar disc were cut off and treated for analysis. For each of the fungus inoculated fruit, the cut materials were dried at £0°C for 4 hours. The dried materials were pulverised for further analysis.

Determination of total free sugar

For the determination of total free sugar, Phenol-sulphuric acid method as modified from Mc Cseady (1971) and Dubois *et al* (1956) were used. A sample (0.02g) was separately moistened with 1ml of 95% ethnol followed by 2ml distilled water. A quantity (10ml) of 95% hot ethanol was added and vortexed. The sample was certrifuged for 10 minutes at 200rpm. The supernatant was decanted into different test tubes in duplicates. 0.8ml of distilled water was added, then 0.5ml (5.0%) phenol was mixed in each tube. Dilute sulphuric acid (2.5ml) was added for colour development. The tubes were allowed to cool and the absorbence was read in a spectrophotometer at 490mm. The quality of sugar was read off from a standard curve of glucose of different concentrations.

Crude Protein Determination

Crude protein analysis was done using Kjedahl nitrogen method. One gram of the pulverised ground sample was introduced into the digestion flask. Kjedahl catalyst (5 Selenium tablets) were added to the samples. Twenty ml of concentrated sulphuric acid was added to each sample and digested for 8hours. The cool digest was transferred into 100ml volumetric flask and made up to the mark with distilled water.

The distillation apparatus was rinsed for 10 minutes after boiling and 20ml of boric aid was added. Few drops (5ml) of methyl red was added to each flask as indicator and the sample was diluted with 75ml of distilled water. 10ml of the digest was made alkaline with 20ml of 20% NaOH and the mixtures was distilled. The steam exit of the distillation was closed and the colour changed to green was monitored. The mixture was allowed to distil for 15 minutes (A.O.A.C.1990). The filtrate was then treated against 0.05Hcl. The % total of Nitrogen was calculated thus:

% total N_2 = Titre x Normality x 0.014 x 100
Sample of Weight

N = Normality of acid

% = Crude Protein = % Total N_2 x Conversion factor

Conversion factor = 6.25

Crude Fibre Determination

The trichloroacetic acid method of Joslyn (1970) was employed. This is a modified method of Enwistle *et al*, (1949). The samples were defatted with petroleum either. One gram of defatted sample was weighed into 600ml beaker and 100ml of trichloroacetic acid (TCA) was added. The samples were boiled and refluxed for 4 minutes. The cooled sample was filtered with Whatman N°4 filter paper. The residue was washed six times with methylated spirit. The filterpaper together with the sample was transferred into a porcelain crucible and dried in an oven overnight at 100°c. The samples were cooled in a dessicator, weighed, then ashed in a muffled furnance at 600°c for six hours and weighed again after cooling. The loss equivalent to the amount of crude fibre.

$$\%\text{Crude Fibre} = \frac{\text{Weight A} - \text{Weight B}}{\text{Sample Weight}} \times 100$$

Weight A = Initial Weight of sample

Weight B = Weight of sample after ashing.

Determination of Iron, Magnesium, Zinc and Potassium Content

Digestion was carried out using aluminium digestion block and a tector (Model 40) digestor. A known (100g) of oven dried sample was weighed into 70ml digestion tube. Five ml of oxidising agent (2:1 Nitric – Perchloric acid) were added and left overnight under fume at 28 ± 1°C. Further digestion was carried out at 150°C for 1 hr 30 minutes. The tubes were removed and after few minutes, 30ml of distilled water was added and this was subsequently made up to 50ml. The elements were determined spectrophotemetrically.

RESULTS

The result of pathogenicity showed that fruits infected with Rhizopus sp, Botryodiplodia sp and Aspergillus sp manifested rot symptoms that eventually led to complete soft rot of guava fruits.

Rhizophus rot: The guava fruits for both test and control were monitored for seven days. The infected guava fruits became softened with watery exudate. When the fruit was sliced longitudinally, the inner part close to the inoculum appeared brown with watery exudate after 5 days. The control fruits appeared healthy.

Botryodiplodia rot: The guava fruits appeared soft to touch when the infected fruits were longitudinally sliced opened, the spoilage emanated from the inoculums. Areas far from the inoculum appeared healthy. Thus, the rot could be grouped as a localised form of rot. The surface of the inoculated fruit appeared soft to touch.

Aspergillus rot: The whole fruit showed soft rot symptoms characterized with tissue softness, production of watery exudates and general lack of firmness of the fruits. When the infected fruit was sliced opened, the whole fruit manifested brown colour. The control fruits showed no sign of rot, even after seven days. The control fruits appeared more ripened than at the commencement of the experiment.

The result of nutritional analyses showed that there was reduction in the content of crude fibre and crude protein. The total free sugar was not significantly reduced (P= 0.05). In case of mineral analyses, all the elements were significantly reduced as a result of infection (Table 1)

ANALYSIS OF INFECTED AND HEALTHY FRUITS OF GUAVA

s/n		Crude Protein (%)	Total Free Sugar (%)	Fibre (%)	Iron (mg/L)	Magnesium (mg/L)	Zinc (mg/L)	Potassium (mg/L)
1	Rhizophus Infected Fruits	0.43±00.1	5.6±0.02	2.81±0.01	0.344±0.02	0.03±0.01	0.146±0.01	0.143±0.
2	Botryodo plodia Infected Fruits	0.38±0.00	5.5±0.01	2.71±0.02	0.218±0.01	0.30±0.01	0.135±0.01	0.132±0.001
3	Aspergillus Infected Fruits	0.46±0.01	5.8±0.04	2.71±0.01	0.282±0.01	0.25±0.011	0.135±0.001	0.135±0.001
4	Healthy Fruits (Control)	0.62±0.01	5.63±0.03	3.16±0.01	0.530±0.01	0.053±0.01	0.258±0.001	1.870±0.001

DISCUSSION

Several authors (Purseglove, 1991; Yadava, 1996; and Singh *et al*, 1979) have reported different diseases of guava around the world. The present study showed Aspergillus sp as an important rot fungus of Guava. Lal *et al* (1980) reported Aspergillus rot of guava in India. The present study also revealed an infection caused by Botryodiplodia sp. A previous report (Yadava, 1996) had implicated Botryodiplodia sp as a prominent disease of guava. However, previous report and Rhizops rot of guava fruit is scanty.

The effect of these fungal infections on the nutritional quality of guava has no previous record. This investigation was predicated on a previous report (Yadava, 1996) that claimed a satisfactory 5 week storage a 50°C, in USA. The result of present investigation revealed that infections by known microbial inhabitants of guava reduced the nutritional contents of guava at $30^0 \pm 2^0$C . The proximate contents of crude protein and fibre showed significant reduction as a result of infection. The high reduction observed in potassium content revealed the importance of potassium to the healthy development of fungi. Cochrane (1965) previously confirmed this position.

The total free sugar was insignificantly reduced. The insignificant reduction could be due to the fact that, additional glucose units were being produced that replaced those units that were used for metabolism. Additional glucose units could be due to various enzymatic reactions at the infection interface.

Various results in this investigation showed that the quality of fruits is greatly affected especially in storage. These effects are definitely more on the nutritional quality of guava.

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