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Guava Fruit Anthracnose and the Effects on its Nutritional and Market Values in Ibadan, Nigeria

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Abstract: The etiology of guava fruit anthracnose was investigated at Ibadan in the humid forest of Southern Nigeria. Result of the investigation revealed that *Colletotrichum gloeosporioides* was responsible for the anthracnose and the fruit rot diseases of guava fruit. Eighty percent of the guava plants were found infected with anthracnose disease and over 40% of the fruit produced on those trees were severely infected. The non-infected guava fruit was significantly higher than the anthracnose infected guava fruit in carbohydrates, crude fibre, ash, fat, protein, Ca, Fe and P. A significant reduction in the price of guava was found associated with anthracnose infected fruits in all the 3 major market surveyed.

Key word: Guava · fruits anthracnose · *Colletothrichum gloeosporioides* · market surveyed

INTRODUCTION

Guava *(Psidium guajav*a) a vitamin C enrich fruit plant is grown abundantly throughout western Nigeria. It is an important fruit in many parts of the world where the climate is suitable for its production [1]. Guava is one of the leading fruits of Mexico [2]. The guava fruits contain moisture (85%), proteins (7%) and carbohydrate (11%) [1]. Guava fruits are processed into guava paste and guava cheese, which are staple sweets and guava, jelly which is almost universally marketed [2]. It is also made into fruit leather [3] and syrup for use on waffles, ice cream, puddings and in milkshakes [2]. Guava juice and nectar are among the numerous popular canned or bottled fruit beverages of the Caribbean area [2].

In South Africa, a baby-food manufacturer markets a guava-tapioca product and a guava extract prepared from small and overripe fruits is used as ascorbic-acid enrichment for soft drinks and various foods. Also, guavas are mixed with cornmeal and other ingredients to make breakfast-food flakes [2]. Despite the economic importance of this crop, it's production is limited by some biotic factors in humid forest region of Nigeria. Most of the guava fruits produced in the humid forest region of south-western Nigeria is associated with fruit anthracnose. This anthracnose was commonly found on the fruits right on the tree prior to ripening. This disease has made guava production in the region almost non-attractive to both farmers and in the home gardens. It has been reported that anthracnose has becomes a serious obstacle to guava cultivation, food values and market price are falling and cause a great threat to germplasm preservation in Bangladesh [4].

The present research was initiated to investigate the etiology of fruit anthracnose, its effects on the nutrition and the market value of guava fruit in Ibadan the humid forest of south-western Nigeria.

MATERIALS AND METHODS

Survey of fruit anthracnose of guava in Ibadan the lowland rain forest zone of western Nigeria was carried out in the year 2000, 2001 and 2002. Ibadan (7° 20'N, 3° 50'E: 200 mm above sea level) is in a transition zone between the humid forest and derived savannah agro-ecologies of Nigeria. It has a mean annual rainfall of 1200 mm and mean daily temperature of 34°C (max) and 24°C (min), with over 2 million people.

Guava fruit showing symptoms of infection and the non-infected ones were collected from home gardens in Apata, Ojo and Moniya all within Ibadan metropolis. These were then kept in sterile sampling bags and

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brought to the plant pathology laboratory of the institute of Agricultural research and Training/ Obafemi Awolowo University, Moor plantation Ibadan, Nigeria. Three guava trees mainly grown in the zone were used for the experiment in each of the above locations.

The sampled fruits were surface sterilized for 3 min with 1% NaOCL and rinsed in 4 successive changes of sterile distilled water. The surface-sterilized fruits showing symptoms of canker were then sliced into 2 mm^2 pieces, then plated on sterile potato dextrose agar (PDA) in Petri dishes and incubated for six days under alternating 12 hr light and dark periods at 26°C. The fungal isolates were examined under a stereo binocular microscope. The identity of these fungi was determined using cultural, morphological and description in existing publications [5, 6]. Pathogenicity tests were carried out on the identified isolates as described below.

Pathogenicity Test: Six freshly harvested guava fruit intact to the twigs were surface sterilized by swabbing with 70% alcohol and placed in the conical flask containing sterile water when the distal end of the twigs immersed in water. Fruits were inoculated with one single organism in the way it was done *in situ* inoculation. Inoculations fruits were done following the procedures of Hossain [7]. The inoculated fruits were then placed in moistened plastic container and incubated at 25°C in Gallenkamp incubators for 72 hr. After which observations on the development of infection were made.

The experiments consist of 6 guava fruit intact to the twigs inoculated with sterile PDA agar discs and incubated as decribed above. The extent of rot was determined by measuring the size of infection (mm).

Nutrient composition: Three guava fruit each from Apata and Moniya were used for the analysis; at 3 days interval for 9 days along with 10 freshly picked fruits. The fruits were kept in clean containers, de-seeded and weighed. The fleshy pulp was cut into pieces and dried in a hot air oven at 60°C for 3 days. The dried fruits pulp was ground into powder. The pulverized samples of the guava fruit (in-triplicates) and those of the freshly picked non-infected fruits were analyzed for moisture, carbohydrate, ash, crude fibre, proteins and crude fat according to AOAC [8] procedure. The mineral analysis was also carried out according to standard AACC [9] method at the livestock analytical laboratory of the institute of Agricultural Research and training Obafemi Awolowo University, Moor Plantation, Ibadan, Nigeria.

Market survey: The market survey of the anthracnose infected guava fruits were conducted in the year 2001 and 2002, respectively. The price of both anthracnose infected guava fruits and the non infected ones were obtained in 3 main markets located at Ojo, Sango and Apata in Ibadan metropolis.

RESULTS AND DISCUSSION

The first observable symptom of the guava fruit anthracnose on the field was small, slightly sunken, dark or blackens (necrotic lesions) on immature fruits. The spots often enlarge up to 1-2 cm in diameter and their central portion becomes dark black due to the presence of black acervuli. The spots are usually numerous and coalesce, leading to the eventual rotting of the fruit. Both green and ripe guava fruits were usually affected with infected fruits often with several necrotic lesions. The diseased portions are comparatively harder than soft. The symptoms were initially observed in mid-March and by the end of June over 80% of the fruit on the field were infected. Green unripe fruits once infected undergo forced ripening and then dry up rapidly becoming mummified.

When the cavity of the fruit is open, the canker was seen to extend to the inner cavity of the fruit. Seeds from the infected fruits harboured the pathogen.

The pathogen found mainly associated with the fruit anthracnose was *C. gloeoisporioides*. In Culture, the fungus produced whitish mycelium at the early stage of growth followed by pinkish coloured conidia that grows in a concentric manner on PDA. Black acervuli developed from the centre of the plate towards the periphery. The pathogen was isolated from 95% of the samples. While the other fungal isolates includes *Fusarium* spp, *Pestalotia psidii* and *Macrophomina* spp. Pathogenicity tests revealed the presence of *C. gloeoisporioides* as the pathogen responsible for guava fruit anthracnose in the humid region of south-western Nigeria. When re-isolated the fungus was identical to the initial isolate.

Out of 12 guava trees examined 10 of them were found associated with severe anthracnose infection and on most of the trees over 40% of the fruit produced were infected.

The non-infected guava fruit was significantly higher than the anthracnose infected guava fruit in the percentage carbohydrates, crude fibre, ash, fat, protein, Ca, Fe and P (Table l). Market survey also revealed that the anthracnose-infected fruits attracted low prices

Table 1: The effect of anthracnose on the nutrient composition of guava in Ibadan Nigeria

Chemical composition (%)	Apata-Ibadan		Moniya Ibadan	
	Non-infected fruit	Anthracnose infected fruit	Non-infected fruit	Anthracnose infected fruit
Moisture	77.890 [a]	91.290 [a]	78.290 [a]	90.190 [a]
Crude Fiber	7.010 [b]	2.320 [c]	7.000 [c]	2.310 [c]
Protein	1.660 [c]	0.300 [c]	1.260 [c]	0.320 [c]
Fat	1.000 [c]	0.430 [c]	0.890 [c]	0.410 [c]
Ash	0.670 [c]	0.230 [c]	0.680 [c]	0.240 [c]
Carbohydrates	11.290 [b]	10.240 [b]	11.420 [b]	10.260 [b]
Calcium	0.023 [c]	0.002 [c]	0.023 [c]	0.002 [c]
Phosphorus	0.032 [c]	0.012 [c]	0.032 [c]	0.012 [c]
Iron	0.001 [c]	0.004 [c]	0.001 [c]	0.004 [c]

Means in the same column followed by the same letter are not significantly different from one another at $p<0.05$

Table 2: The effect of fruit anthracnose on the market price of guava fruits in three major markets in Ibadan, Nigeria

Market location	Infected fruits/ market prices (N/10 fruits)		Non-infected fruits/ market prices (N/5 fruits)	
	2001	2002	2001	2002
Ojo	15	20	50	60
Apata	20	25	65	75
Sango	20	30	65	80

Price survey 2001 and 2002

(Table 2). A significant reduction in the price of guava was found associated with anthracnose infected fruits in all the 3 major market surveyed.

Collectotrichum spp is an ubiquitous pathogen infecting several crops causing anthracnose diseases [10, 11]. Wahid [12] had earlier on reported that the pathogen guava anthracnose has a wide host range, which includes mango, pear and apple fruits. The attack of fruits by *Colletotrichum gloeosporioides* inducing anthracnose diseases especially in the rainy season has been reported by Morton [2].

The presence of the pathogen in the guava seeds probably occurred when the fungus penetrates the fruit to the seed cavity. Grover and Bansal [11] reported the isolation of *C. capsici* from the rotten stems, leaves and seeds of *C. frutescens*.

Result revealed that about 80% of the guava plants are infected with anthracnose and over 40% of the fruit produced on those trees were severely infected. It was also gathered that those guava plants with no symptoms of infections were subject to fungicidal treatments on regular basis. The high incidence of guava anthracnose observed during the 3 years of field survey indicates that the disease has become a major constraint to guava production in the lowland humid forest region of south-west Nigeria. In Puerto Rico, up to 50% of the guava crop (mainly from wild trees) was reportedly ruined by the uncontrollable fungus, *Glomerella cingulata,* which mummifies and blackens immature fruits and rots mature fruits [2].

The pathogenicity tests confirmed *C. gloeoisporioides* as the pathogen responsible for guava fruit anthracnose in Ibadan Nigeria. It possible that insect vectors are involved in dissemination of the pathogens propergule into the plant during pollination or during feeding on the fruits as Adelaja [13] reported that fruit fly stings enhance the entry of *Colletotrichum* spp into african star apple fruits by their oviposition on the fruits. The prevalence and the rapid spread of these diseases during the peak of the rainy season could be due to the humid condition prevailing at that time of the year, which supports the rapid production of conidia. *C. capc*isi has been reported to cause rapid infection only during heavy dew or rain fall [14, 15]. Reasons for the above observation might be related to the fact that rainfall or rain-splash probably played an important role in the dispersal of the pathogen's propagules in the field.

The non-infected guava fruit was found to be significantly higher than the anthracnose infected guava fruit in the percentage carbohydrates, crude fibre, ash, fat, protein, Ca, Fe and P. These differences may be due to deterioration caused by the fungus, since the fungus requires some essential nutrients for growth and survival [3, 16]. Increase in moisture content of the infected guava fruit may be due to increased exposure of damaged tissues to moisture absorption as a result of deterioration by the fungal pathogen. Samson [1] reported that the crude protein, carbohydrates, crude fat content of the guava fruits were 7, 11 and 17.1%, respectively, which is in consonance with the report of this finding.

Market survey also revealed that the anthracnose-infected fruits attracted low prices in the 3 major markets surveyed for 2 years. The industrial use of guava fruits in jam, paste, cheese fruit leather and ice cream making

etc.which has been reported by Babalola *et al.* [17] and Morton [2], will be unattainable if the guava fruit produced are of low quality due to fungal infection. Changes in nutrient composition caused by infection of the fruit will adversely affect its uses for jam and other food products. While its commercial value (Market value) as a means of lively hood to peasant farmers the women and the children will equally be affected. Hence there is need to evaluate guava germplasm to identify those that are resistant or tolerant to fruit anthracnose in the humid agro-ecologies of Nigeria, as this has been found useful in other crops, e.g. strawberry [18] and *Stylosanthes* [19].

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