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Susceptibility of Mango Varieties to Anthracnose Fruit Rot in South West Nigeria

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Abstract: Anthracnose fruit rot is the most devastating postharvest disease of mango fruits in Nigeria. This study, investigated the susceptibility of mango varieties commonly grown in South West Nigeria to fruit anthracnose. Four locations (Ayetoro, Ibadan, Ogbomosho and Agege) in South west Nigeria, which fall along mango production belt, were selected for this study. Physiologically matured mango fruits freshly harvested separately from Alphonso, Julie and Ogbomosho varieties were ripened at room temperature for 16 days under alternating 12 h light and dark periods to assess the incidence and severity of fruit anthracnose in each variety. In addition, freshly harvested healthy fruits were deliberately inoculated with spores of *Colletotrichum gloeosporioides* to evaluate the degree of susceptibility of the tested varieties. Results showed that Ogbomosho variety had the lowest percentage of 66.7% disease incidence and 44% disease severity. Similarly, lesion diameter was highest in Alphonso variety (1.18 cm) with the least (0.91 cm) in Ogbomosho variety. The study found Ogbomosho variety less susceptible to anthracnose and consequently recommended it to farmers.

Keywords: Anthracnose, *Colletotrichum gloeosporioides*, Mango Varieties, Susceptibility, Investigated

Introduction

Mango (*Mangifera indica* L.) a member of *Anacardiaceae* family, is among the important fruit crops grown throughout the humid region of Southern Nigeria. The dietary contribution of mango fruits in the diet of most people in Nigeria rank above that of citrus fruits and it is the second largest consumed fruit after bananas. The economic value of fresh mango fruits to most households especially in the rural areas of Nigeria cannot be over emphasized as most families depend greatly on the income generated from the sales of mango for their livelihood. However, its production and marketing especially export of fresh mango fruits from the country is limited by fruit anthracnose caused by the fungus *Colletotrichum gloeosporioides* (Penz.) Penz. and Sacc. 1884, a member of *Glomerellaceae* family of fungi (Index Fungorum, 2015) The disease has become a menace to mango producers and home gardeners in Southwest Nigeria with over 34% fruit loss annually due to this disease (Onyeani *et al*., 2012).

There is no mango variety or cultivar that has been documented to be completely resistant to anthracnose (Tarnowski and Ploetz, 2008; Pandey *et al*., 2011), production therefore rely heavily on the use of fungicide (Dodd *et al.*, 1997; Ploetz, 1999). Nevertheless, the use of fungicides has reduced drastically due to development of resistance by fungal pathogens and public perception that fungicides have harmful effect on human health and the environment. Meanwhile, differences in susceptibility among mango varieties have been reported from other parts of the world. Haggag (2010) reported maximum damage of Alphonso due to anthracnose whereas, Tommi and Fahr Kelen varieties were found to be resistant to the disease.

If well exploited, the varieties found to be tolerant and/or resistant to this disease could be further developed into hybrids that could be resistant to anthracnose infection. This study was therefore initiated to evaluate the susceptibility of three (Alphonso, Julie and Ogbomosho) mango varieties most commonly grown in South West Nigeria.

Materials and Methods

The study was carried out in four locations (Agege, Ayetoro, Ibadan and Ogbomosho) in

Southern humid region of Nigeria which falls along mango production belt.

Ripening Method

Fifteen physiologically mature-green mango fruits each of Alphonso, Julie and Ogbomosho varieties were randomly picked from 15 trees of each variety in each location in Southwestern region of Nigeria following Masyahit *et al*. (2009) method. The fruits were thoroughly washed under running tap water and air-dried before being ripened at room temperature for 16 days under alternating 12 h light and dark periods. The fruits were individually examined and rated for Disease Incidence (DI) and Disease Severity (DS) beginning from the 6th day after harvest using rating score scale 1-5 and formula as proposed by Akhtar and Alam (2002):

Where:
1 = No fruit lesions
2 = 1 to 3 lesions
3 = 4 to 6 lesions
4 = 7 to 15 lesions
5 = >30% of fruit surface is covered with lesions

$$DI = X \div N \times 100$$

Where:
X = Number of infected fruits
N = Total number of fruit sampled

$$DS = \Sigma (a + b) \div N \times 100 / Z$$

Where:
$\Sigma (a + b)$ = Sum of symptomatic fruits and their corresponding score scale
a and i = Individual symptomatic fruit scores
N = Total number of fruits sampled
Z = Highest score scale
5 = the highest disease score scale

Inoculation Method

Collection and Isolation of Anthracnose Pathogen

Anthracnose pathogen, *C. gloeosporioides* was isolated from symptomatic mango parts collected from orchards and home gardens in Agege, Ayetoro, Ibadan and Ogbomosho in South West Nigeria. Lesions on the symptomatic parts were carefully excised and sterilized before incubation at room temperature for 5 days. Isolated colonies were sub-cultured onto fresh potato dextrose agar media to obtain pure cultures.

Identification of Isolated Pathogens

Pure cultures obtained from the various isolations were identified by visual examination and viewing under stereo and compound electronic microscope. To identify the isolated pathogens, smear of the pure cultures were made by picking little quantity of conidia with sterilized wire loop and smearing it on droplet of sterile water on sterile viewing slide and viewed under electronic microscope. Identification was based on conidia and colony morphology as described by Dugan (2006; Mordue, 1971). Single spore isolates were cultured on potato dextrose agar slants in Bijour bottles and stored in a refrigerator until use.

Collection and Inoculation of Fruits

Six green physiologically matured mango fruits of each of the three varieties were randomly selected making eighteen fruits. The fruits were thoroughly washed; surface sterilized by soaking in 70% alcohol for 15 min and later in 1% NaOCl for 15 min to preclude opportunist pathogens. The fruits were then rinsed in four changes of sterile distilled water and thereafter air dried for 15 min before inoculation with spore suspension of *C. gloeosporioides* at three equal distant points on the fruit surface. Fruits from each variety were inoculated separately while three fruits were inoculated with sterile distilled water as control.

The fruits were covered with sterile paper towels moisten with sterile distilled water; then sealed in plastic bags moisten with sterile distilled water and incubated for 5 days in a moist incubation chamber after which lesions developed on the fruits were measured using measuring rule. Varietal susceptibility was then calculated based on the surface area covered by anthracnose lesion developed on the pathogen-inoculated fruits compared to the surface area of lesion developed in the control:

$$Susceptibility = a - b$$

Where:
a = Surface area of lesion in pathogen-inoculated fruit
b = Surface area of lesion in control fruit

Pathogenicity Test

Identification of Isolated Pathogens

Six healthy freshly harvested green matured mango fruits were surface sterilized by swabbing with 70% alcohol and 1% NaOCl solution. The fruits were inoculated with spore suspension of C. gloeosporioides prepared following the procedure of Sivakumar *et al*. (1997). Fruits were inoculated following Sun *et al*. (2008) wound inoculation procedures. The fruits were then sealed in moist plastic bags and incubated for 5 days in moist chamber after which observations on the development of anthracnose infection were made. Isolation and re-isolation of pathogens from fruits that showed symptoms of anthracnose after 5 days of incubation was carried out following Koch's postulate for proof pathogenicity as described by Schumann and D'Arcy (2006).

Results

Disease Incidence Ratings

Anthracnose lesion development on the different mango varieties increased with increasing days during the period of study (Fig. 1). Alphonso and Julie varieties recorded the highest (93.3%) disease incidence each while Ogbomosho variety had the lowest disease incidence of 66.7% 16 days after harvest.

Disease Severity Ratings

The severity of fruit anthracnose lesion developed on mango fruits 16 days after harvest showed that, among the varieties tested, Alphonso variety had the highest severity rating of 86.7%, Julie variety 53.3% and Ogbomosho variety recording the least severity percentage of 44% (Fig. 2). Severity also increased with increasing days during the period of study.

Lesion Diameter

The lesion development of *C. gloeosporioides* isolates on the inoculated fruits of the tested mango varieties showed a significant variation among the varieties. Lesion size (98%) observed in Alphonso variety was the highest while the least of 71% was recorded in Ogbomosho variety (Table 1).

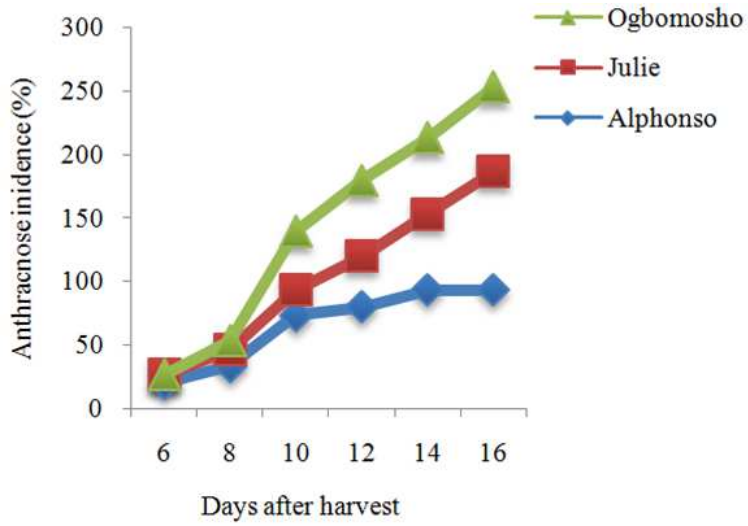

Fig. 1. Susceptibility of mango varieties to anthracnose disease incidence 16 days after harvest

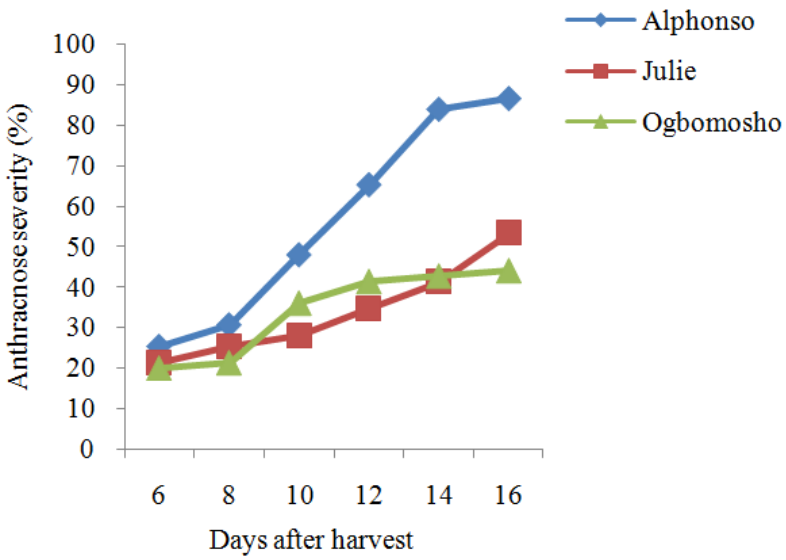

Fig. 2. Susceptibility of mango varieties to anthracnose disease severity 16 days after harvest

Table 1. Susceptibility of mango varieties inoculated with spores of *Colletotrichum gloeosporioides* to anthracnose

	Lesion diameter (cm) 7 days after inoculation		
Treatment	Alphonso	Julie	Ogbomosho
Control (sterile distilled water)	0.2[b]	0.2[b]	0.2[b]
Inoculated with *C. gloeosporioides*	1.18[a]	1.05[a]	0.91[a]
Percentage increase over control	98.00	85.00	71.00

Means with same letter are not significantly different at 5% probability by duncan multiple range Test. Results are mean values of three replicates

Discussion

Based on the results of this study initiated to evaluate the susceptibility of different mango varieties to anthracnose infection, none of the tested varieties was totally free from the disease. Several workers including Tarnowski and Ploetz (2008) in earlier reports found no mango cultivar completely resistant to anthracnose infection. In this study, there was a significant variation in susceptibility among the tested mango varieties. Anthracnose incidence and severity and lesion diameter on inoculated fruits were significantly higher in Alphonso variety than in Julie and Ogbomosho varieties in the study. Ogbomosho variety showed some degree of resistant to anthracnose infection. This result confirms the observation of Haggag (2010) that Alphonso mango fruits were completely damaged by anthracnose whereas less damage was recorded on Tommi and Fahr Kelen varieties.

Conclusion

The susceptibility of all the three varieties tested in this study to anthracnose infection suggests that the production of anthracnose free mango fruits in South West Nigeria would depend on the use of fungicides to control anthracnose disease in mango. However, because of the challenges of development of resistance by fungal pathogens and public perception that fungicides have harmful effect on human health and the environment, Ogbomosho variety that was observed to be less susceptible to anthracnose infection is recommended to farmers. In addition, breeding work for resistance to anthracnose in mango should be intensified.

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Ethics

This manuscript has not been published or submitted for publication in any other journal.

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