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Response of Different Mango and Tomato Varieties to Post-Harvest Fungal Fruit Rot in Lafia, Nassarawa State, Nigeria.

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Abstract:*A study was carried out to evaluate the response of some selected varieties of commonly sold mangoes and tomatoes to post-harvest fungal fruit rot in Lafia, Nasarawa State, Nigeria. Fungi isolated from naturally infected tomato and mango varieties were asceptically inoculated into healthy fruits and observed for a total duration of 5 days for the development of rot symptoms. Naturally infected tomatoes had the highest fungal contamination compared to mangoes. A. niger was the most commonly occurring fungus with 40% frequency of occurrence, followed by Trichoderma harzianum, Trichoderma sp. and Alternaria sp. with 20% frequencies of occurrence respectively. Pathogenicity test of A. niger on healthy fruits of different mango varieties indicated highest diameters of rot after five days of post-inoculation. Apple mango recorded the highest rot diameter (38.00mm) followed by Peter (35.33mm), Paparanda (26.83mm) and Maijijia (25.83mm). Tomato fruits belonging to the Dan Eka variety were more susceptible to fungal rot (41.88mm) compared to Seria (36.29mm). Trichoderma harzianum produced the highest diameter of tomato rot (44.50mm) followed by Trichoderma sp. (43.50mm). A. niger produced the least rot diameter (33.75mm) on all tomato varieties. Differences in rot diameters in all inoculated fruits were significant (P=0.05) only after 5 days of post-inoculation. Fruits belonging to the mango variety Maijijia and tomato variety Seria demonstrated higher tolerance to fungal rot and could be considered by farmers and consumers interested in long term storage and post-harvest preservation of mangoes and tomatoes in the study area.*

Key words: *Fungi, Fruit rot, Lafia, Post-harvest, Varieties.*

I. Introduction

Fruits are a major source of vitamins and minerals in human and animal diet. Other properties of substances obtained from various fruits include anti-oxidant, anti-cancer as well as other medicinal properties [1, 2, 3].

Fruit rot in storage and on the field is a major factor affecting production and marketing of fruit products worldwide [4, 5, 6]. About 50% of fruits produced annually are lost to post-harvest rots produced by various pathogens [7], fungi accounting for over 25 to 30 per cent [8]. In Nigeria and other developing countries where post-harvest handling of fruit products is a major challenge [9], losses amount to millions of dollars annually.

In the present study, selected varieties of commonly sold mango and tomato fruits are being screened for ability to tolerate post-harvest fungalrot, as a preliminary means of selecting fruit varieties for longer storage and reduced post-harvest yield loses in the study area.

II. Materials and Methods

2.1. Collection of Diseased Plant Materials

Naturally infected mango and tomato fruits of different varieties showing varying degrees of rot were collected from various markets in Lafia Metropolis and conveyed in sterile polyethylene bags to the Biological Sciences Laboratory of the Federal University, Lafia for further assessments.

2.2. Surface Sterilization of Infected Fruits

Infected fruits were first washed with running tap water to remove dirt and soil debris, after which entire fruit surfaces were disinfected by swabbing with cotton wool soaked with 5% sodium hypochlorite, to remove surface contaminating microbes.

2.3. Isolation and Identification of Fungi Associated With Rotted Fruits

Rotted portions of sampled fruits were cut into smaller pieces of about $2cm^2$ with the aid of a sterile razor blade and plated in 8.5cm diameter disposable petri dishes containing solidified Potato Dextrose Agar (PDA) impregnated with about 0.01mls of streptomycin sulphate solution, to prevent growth of bacteria. Plated plant tissues were incubated for 72 hours at 28^0C, and observed for any fungal growths. Pure cultures were obtained by transferring individual fungal growths unto separate freshly prepared and solidified PDA. Pure cultures were identified by observation of growth characteristics on PDA after 7 days of incubation and further microscopic examination of general morphological features, in line with relevant identification keys such as those reported by Rifai [10].

2.4. Pathogenicity Test of Rot Fungi

The method of Embaby*et al.* [7] was used. Healthy fruits surface sterilized by swabbing with 5% Sodium hypochlorite solution were aseptically wounded by the removal of 7mm diameter flesh tissue to a depth of 4mm, with the aid of a sterile 7mm diameter cork borer. 7mm agar discs obtained from actively growing mycelial regions of 7 days old cultures of potential rot fungi, were asceptically plugged into wounded spots and incubated for 5 days at 28^0C. Artificially inoculated fruits were observed every 48 to 72 hours for the development of rot symptoms. Rot diameters was measured in millimeters (mm) with the aid of a meter rule.

2.5. Experimental Design and Data Analysis

The Completely Randomised Design (CRD) was used and experimental treatments administered in triplicates. Data obtained was subjected to Analysis of Variance (ANOVA) at 5% level of probability, using SPSS version 17.

III. Results

Table 1. Fungi Associated With Post-harvest Rot of Some Selected Fresh Fruits in Lafia.

Fruits	Fungi Isolated
Mango	*A. niger*
Tomato	*A. niger*
	Trichoderma harzianum
	Trichoderma sp.
	Alternaria sp.

Culture of naturally infected fruit tissues (TABLE 1) revealed that Tomatoes had the highest fungal contamination (four fungi) compared to mangoes (one fungus).

Table 2. Frequency of Occurrence of Isolated Fungi

Fungi	Frequency of Occurrence (%)
A. niger	40
Trichoderma harzianum	20
Trichoderma sp.	20
Alternaria sp.	20

Result of Frequency of occurrence of fungi associated with rotted tomato and mango fruits (TABLE 2) indicated that *A. niger*was the most commonly occurring fungus with an occurrence frequency of 40%, followed by *Trichoderma harzianum, Trichoderma sp.* and *Alternaria sp.* with 20% frequencies of occurrence respectively.

Table 3: Response of Different Mango Varieties to Rot by *A. niger*

Mango variety	Rot diameter (mm)	
	Day 3	Day 5
Apple Mango	18.50[a]	38.00[c]
Paparanda	14.33[a]	26.83[ab]
Peter	15.67[a]	35.33[bc]
Maijijia	12.00[a]	25.83[a]

Values followed by same superscript are not significantly different (P=0.05)
Values followed by different superscript are significantly different (P=0.05)

Pathogenicity test of *A. niger*on different mango varieties (TABLE 3) indicated highest diameters of rot after five days of post-inoculation. *Apple mango* recorded the highest rot diameter (38.00mm) followed by *Peter* (35.33mm). *Maijijia* was the least infected, with a rot diameter of 25.83mm. Differences in rot diameter between different mango varieties by *A. niger*were significant (P=0.05) only after 5 days of post-inoculation.

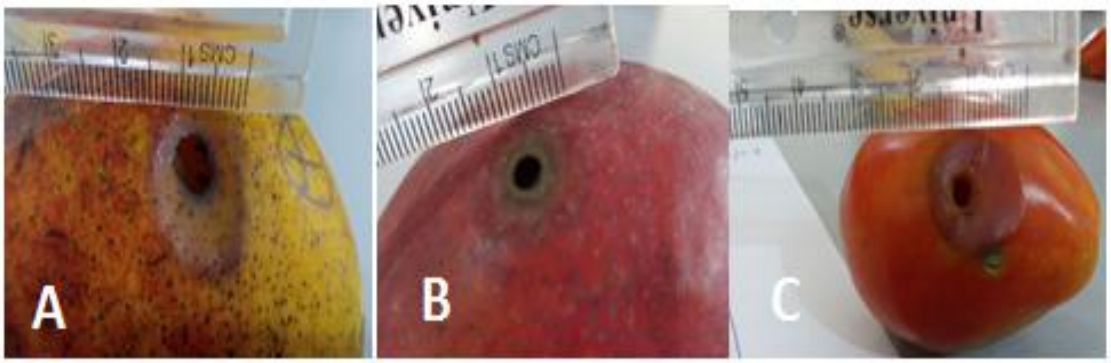

Plate 1: Artificially Inoculated Fruits Showing Various Degrees of Fungal Rot, 3 Days Post-inoculation (A: *Paparanda*; B: *Aple mango*; C: *Seria*).

Table 4: Overall Response of Different Tomato Varieties to Post-harvest Fungal Rot

Tomato variety	Rot diameter (mm)	
	Day 3	Day 5
Dan Eka	17.59[a]	41.88[b]
Seria	17.32[a]	36.29[a]

Values followed by same superscript are not significantly different (P=0.05)
Values followed by different superscript are significantly different (P=0.05)

Overall response of different tomato varieties to artificial inoculation of different rot fungi (TABLE 4) revealed that fruits of *Dan Eka* were most susceptible to fungal rot (41.88mm) followed by *Seria* (36.29mm). The differences in rot diameter were only significant after 5 days of post-inoculation (P=0.05).

Table 5: Overall Rot Effect ofFungi on Fruits of Different Tomato Varieties

Rot fungi	Rot diameter (mm)	
	Day 3	Day 5
Alternaria sp.	13.75[a]	34.58[a]
Trichoderma sp.	18.25[a]	43.50[b]
Aspergillusniger	18.62[a]	33.75[a]
Trichoderma harzianum	19.21[a]	44.50[b]

Values followed by same superscript are not significantly different (P=0.05)
Values followed by different superscript are significantly different (P=0.05)

Overall rot effect of artificially inoculated fungi on different tomato varieties (TABLE 5) revealed that *Trichoderma harzianum*produced the highest diameter of tomato rot (44.5.mm) followed by *Trichoderma sp.* (43.50mm). *A. niger*produced the least rot diameter (33.75mm) on all tomato varieties. Differences in rot diameters were significant (P=0.05) only after 5 days of post-inoculation.

IV. Discussion and Conclusion

In the present study, a total of four fungi belonging to the genus *Aspergillus, Trichoderma* and *Alternaria* were isolated from naturally infected and partly decayed tomato and mango fruits. In a similar study by Bashar *et al.* [8], who investigated fungi associated with rotted fruits in Dhaka Metropolis of Bangladesh, *Aspergillus, Trichoderma and Alternaria*species were also among the fungi isolated. Rotted tissues are a product

of degraded plant tissues and serve to provide saprophytic fungi with nutrients required for further growth and reproduction.

*Aspergillusniger*was the most frequently isolated fungus and the sole agent responsible for mango rot in the reported study. Bashar *et al.* [8]also reported a similar finding where *Aspergillusniger*was reported as the predominant fungi causing mango rotin Dhaka Metropolis of Bangladesh. This observation could be accounted for by the obligate saprophytic feeding habit of the fungus as well as its ability for rapid growth and sporulation on sugary substances.

The higher pre-disposition of tomatoes to rot as compared to mangoes could be as a result of their higher moisture content. Most rot fungi prefer conditions of higher relative humidity and moisture content for optimum growth and reproduction. In a study by Chaurasia*et al.* [11]who investigated the development of fruit rot of tomato caused by *Alternariasolani* (Ellis &Mart.) Jones &Grout, it was reported that the maximum incidence of fruit rot disease was observed in ill drained and low lodging fields, where water lodging was common and soil moisture found to be high.

The mango variety *Maijijia*meaning "veiny" is so named as a result of its highly fibrous nature, which could account for its relative ability to withstand fungal rot compared to the other less fibrous mango varieties. This is because fungi degrade lingo-cellulolytic material much slower than most other compounds.The tomato variety *Seria*was comparatively less susceptible to fungal rot than *Dan Eka.* This could be a result of the presence of certain anatomical, biochemical and physiological features which conferred some measure of rot tolerance in the tomato variety.

Fruits belonging to the mango variety *Maijijia*and tomato variety *Seria*demonstrated higher tolerance to fungal rot and could be considered by farmers and consumers interested in long term storage and post-harvest preservation of mangoes and tomatoes in the study area.

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