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POSTHARVEST ROT AND EFFICACY OF DIFFERENT PLANT LEAVES ON THE PRESERVATION OF OKRA

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ABSTRACT

This study assessed the preservative efficacy of some plant species in order to enhance the shelf of Okra pods. Okra is a multiuse crop appreciated for its tender and delicious pods subjected to rapid deterioration due to its high moisture contents. Freshly harvest 'Star of David Okra' variety were wrapped in Colocasia esculenta (Cocoyam), Musa sapientum (Plantain), Carica papaya (Pawpaw), Persea americana (Avocado) and Vernonia amygdalina (Bitter leaf) leaves respectively for comparism against storage rot for a period of 28 days. At seven (7) days intervals, soft, rotten and wilted Okra pods were pick out, counted, and the leaves replaced with fresh ones. The Okra pods were visually observed and the results obtained from the observation showed that C. esculenta had 58%, M. sapientum 42%, P. americana 34%, V. amygdalina 22%, C. papaya 20%, Control 14% survival rate by the end of the 28 days treatment. Some organisms accountable for Okra pod deterioration were isolated and finally identified as: Geotrichum candidum, Aspergillus niger and Mucor irregularis organisms. As time duration stretches and due to lack of good refrigeration facility, food spoilage is eminent nevertheless these findings showed that Colocasia esculenta leaves enhanced the shelf life of Okra pods and reduced storage rot creating an alternative storage method that can be used when there is power outage.

Keywords: Bitter leaf, Cocoyam, Okra pods, Plant leaves, Plantain, Preservation

INTRODUCTION

Vegetables are essential parts of a healthy diet and are excellent sources of fibre, vitamins, and minerals (Slavin and Lloyd, 2012). One of the most popular and commonly used vegetables is Okra (*Abelmoschus esculentus*), and it is a highly perishable annual vegetable. It belongs to the Malvaceae family (Judd *et al*., 2008). It is a vegetable crop planted in tropical and subtropical regions of the world (Abidia, 2012) that is commercially important due to the money made from the sale of its fresh immature pods and fresh leaves. Seasonal fruits and vegetables are abundant in Nigeria and are quickly replaced by others when they go out of season. Although some of these fruits and vegetables can be grown out of season, doing so drives up their prices. Okra is a multipurpose and lucrative crop in Nigeria, that can be grown out of season. It can be eaten fresh or cooked to make a variety of soups and medicinal items. This is due to its high folate, dietary fibre, antioxidant, vitamin A, B, C, and E, and mineral content (sodium, calcium, sodium, potassium, Zinc and Iron magnesium) (Gemede *et al.*, 2015).

Due to its high water and mucilage content, Okra is extremely perishable (Dantas *et al.*, 2021) and prone to simple rotting, which causes serious storage issues for farmers,

dealers and consumers. Considering the increase in the cost of foodstuff in the market due to the economic recession in the country, the need for traditional means of preservation cannot be over emphasized. The amount of Okra produced by local farmers in Nigeria that is lost due to improper storage is rather discouraging. Finding a long-term solution to the Okra pod preservation issues is therefore necessary because the conventional methods of drying, canning, and refrigeration leave the Okra pods with physical damage that makes them unsaleable.

Food storage is important, especially in this era of epileptic power supply, climate change when farmers can no longer fully trust their own climatic and weather predictions. The use of plant leaves in preserving Okra pods after harvest was investigated in the southern areas of Nigeria, particularly in Port Harcourt, Rivers State and some elderly farmers report that some plant leaves may preserve fruits for five to seven days (Elenwo, 1997). For instance, *Anthocleista* sp. leaves (*A. vogelli or A. djalonensis*) are known to be used by farmers and traders to cover baskets while conveying fruits and vegetable to the market (Elenwo, 1997). This study was conducted to find out the leaves that can serve as a natural preservative and increase the shelf-life of okra pod.

MATERIALS AND METHODS

Source of materials

Freshly harvested Okra pods were purchased in October 2022 at the Aluu Market in the Ikwere local government area of Rivers State. Fresh leaves of the following plants were gathered from bushes in Omoko village, Aluu, Rivers State: *C. esculenta* (cocoyam), *M. sapientum* (plantain), *C. papaya* (pawpaw), *P. americana* (avocado), and *V. amygdalina* (bitter leaf). These particular leaves were chosen due to their availability, therapeutic qualities and use in rural areas.

Wrapping of Okra pods with different plant leaves during storage

Eighty (80) good looking Freshly harvested Okra pods were picked out of the bulk. To sanitize the surfaces, they were then scrubbed with cotton wool dipped in 70% ethanol. The freshly harvested Okra pods were wrapped individually with freshly harvested leaves of cocoyam, plantain, pawpaw, avocado and bitter leaf. To support the leaves, sterilized twines were used to support bitter leaf and avocado leaf because the leaves have smaller surface areas. Experiments under control were positioned in a separate basket devoid of leaves. All treatments were at ambient conditions of 25 ± 3°C.

Storability of individually wrapped Okra pods at ambient conditions

The Okra pods were examined every two days for signs of deterioration, colour changes, wilting and rotting. After seven (7) days, the leaves were removed from the wrap, the soft, rotten and wilted ones were picked out and counted, then the leaves were replaced with new ones. To take off any traces of the rotten fruits from the remaining pods, a soft, dry paper towel was used to clean them. The soft, rotten, and wilted pods included those with all types of rots (soft and dry), those that were dehydrated, and those that had lesions. The physical condition and looks of the Okra pods were also noted.

Morphological and Microscopic Characterization and Identification

The test fungi were cultured using the five (5) I's methodologies described by Ikechi-Nwogu *et al.* (2021). In order to foster an elaborate fungi growth, organisms found growing on Okra pods, were cultured on PDA medium for

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5-7 days at a temperature of 25°C. The visible fungi were sub-cultured into freshly prepared PDA media to obtain pure culture. The colonies were then examined using a light binocular microscope at X40 for their characterization and identification. The morphological identification of isolates from Okra pods, was conducted by visually observing the mycelium and comparing the diameters, overall colours, conidial colours, reverse colours and textures with the pictorial guide of Samson *et al.* (2010).

Data analysis

Weekly data collection occurred for each treatment. Both the quantity of rotten fruits and the number of healthy fruits were counted. The data was statistically analysed using analysis of variance (ANOVA) procedures to compare the efficacy of each leaf to the other and determine whether there were any statistically significant differences.

RESULTS AND DISCUSSION

Performance of the Leaves

Table 1 displays the findings of experiments on the preservation of Okra pods by the leaves of the following plants: *C. esculenta* (cocoyam), *M. sapientum* (plantain), *P. americana* (avocado), *V. amygdalina* (bitter leaf) and *C. papaya* (pawpaw).

Table 1: Performance of the leaves of *P. americana, M. sapientum, V. amygdalina, C. esculenta and C. papaya* in the preservation of Okra pods in storage

TREATMENTS	No of days				TOTAL LOSSES	SURVIVAL	% Loss (Total Lost X 50) / 100
	7	14	21	28			
C. esculenta	1	4	7	9	21	29	42
M. sapientum	3	6	9	11	29	21	58
P. americana	4	7	10	12	33	17	66
V. amygdalina	5	8	11	13	39	11	78
C. papaya	5	9	12	14	40	10	80
Control	6	9	13	15	43	7	86

*The number of Okra pods per treatments = 50
*Total losses include all pods that had rots on them, slimy fluid, brown spots, mouldy smell, black or grey woolly moulds.
*Survival is the number of pods remaining after 28 days of treatment and observation.

The Okra pods were visually observed and the results obtained from the observation showed that *C. esculenta* had 58%, *M. sapientum* 42%, *P. americana* 34%, *V. amygdalina* 22%, *C. papaya* 20%, Control 14% survival by the end of the 28 days of treatment as shown in Table 1 with graphical representation of the survival rates shown in Figure 1.

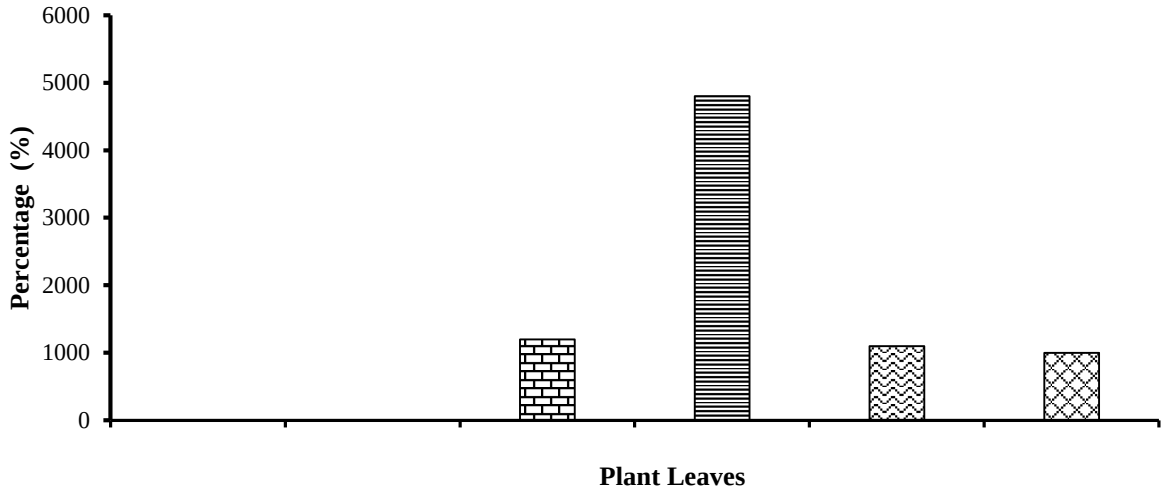

Figure 1: Percentage Survival of Okra Pods

Isolation, morphological and microscopic Description of fungi associated with Okra

This research was conducted to develop natural preservative from some leaves that would help increase the shelf-life of Okra pods and to identify the fungal species linked to Okra deterioration. The fungi associated with Okra have been the subject of numerous investigations and reviews.

The results of the fungal isolates were labelled OF-1, OF-2 and OF-3.

OF-1, isolate produced an eye-visible black spores bordered by white spores. This organism was initially white but after a few days, it turns black. The conidia of *A. niger* have smooth conidiophores and conidia and range in colour from brown to black. Comparing with the pictorial guide of Samson *et al.* (2010), the colonies' borders have a light-yellow appearance and form circular gaps. The Petri dish's reverse side has a white to yellow appearance. Based on the photomicrograph, the isolate was identified as an *A. niger*.

OF-2, the isolate had white to cream-coloured colonies that spread quickly. The reverse is colourless and suede-like. When viewed under the microscope, it was observed that the hyphae are septate and branched into chains of cylindric arthrocondia. This had same appearance as the *Geotrichum candidum* organism found in the pictorial guide of Samson *et al.* (2010).

OF-3, this organism's hue in the Petri dish ranged from cottony to fluffy white. The hyphae are non-septate and wide. The photomicrograph of the isolate was recognized as a *Mucor irregularis* using the pictorial guide of Samson *et al.* (2010).

Nine (9) fungal isolates such as: *Microsporum canis, Aspergillus fumigatus, Aspergillus flauus, Paecilomyces variotii, Penicillium memeffei, Cladophialophora carrionii, Aspergillus niger, Phaeoacremonium parasiticum,* and *Chrysosprium corda* were identified as agents related with post-harvest deterioration of Okra as reported by Abubakar *et al.* (2019). This report corresponds with this study as *Geotrichum candidum, Aspergillus niger* and *Mucor irregularis* were identified as some of the fungi responsible for the post-harvest rot of Okra pods.

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Fruits and vegetables have been given a longer shelf life by the application of chemicals. However, these chemicals are bad for both the consumer and the produce. It has recently been a research focus to substitute synthetic chemicals for natural plants as preservatives.

Many different natural plant species are employed in the preservation of fruits and vegetables. Plants possess medicinal and antibacterial qualities (Cowan, 1999, Bari *et al.*, 2010). According to Ubani (2006), banana leaves had been effective in reducing weight loss and peel drying of fruits.

They generate defence mechanisms that guard them against microbial infection and other illnesses. This experiment can be used to support the statements made by local farmers and merchants who claim that they brought their product from farm to market in baskets totally lined with plant leaves to protect or preserve it. Also leaves of guava in time past, have been used as a natural preservative to increase the shelf life of food, his could be because they possess antioxidant and antibacterial qualities.

Conclusion: It can be concluded that post-harvest storage with various leaves had significant effects on the self-life of the Okra. This would assist people who live in remote areas where it is uncommon to have the luxury of typical storage facilities like freezers with food preservation.

The adoption of these methods, will be crucial in reducing post-harvest losses in fresh produce along the food chain, increasing income, and enhancing nutrition for all parties involved.

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