



Effectiveness of Some Plant Leaves in the Preservation Habanero Pepper (*Capsicum chinense*)

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ABSTRACT: The effectiveness of *Persea americana* (Avocado), *Musa sapientum* (Plantain), *Veronia amygdalina* (Bitter leaf), *Colocasia esculenta* (Cocoyam) and *Carica papaya* (Pawpaw) leaves were compared in the preservation of habanero pepper (*Capsicum chinense*) against storage rot for a period of six weeks. Habanero pepper are tender and have high water content which makes them enormously perishable and susceptible to fungal attack thereby making storage a problem. Habanero pepper was wrapped in surface sterilized leaves of the above-mention plants and control was kept in a different basket without leaves. At seven (7) days intervals, soft, rotten and wilted habanero pepper were counted, pick out and the leaves replaced with fresh ones. Examining the performances of the different leaves, *P. americana* and *V. amygdalina* were significantly ($P=0.05$) better than those of *M. sapientum*, *C. esculenta* and control. To show the different percentage rates of survival, *M. sapientum* and *C. esculenta* had 0% by the end of the 42 days treatment. *C. papaya*, *V. amygdalina* and *P. americana* had 5%, 26.25% and 28.75% survival rate respectively. Some organisms responsible for the decay of the pepper fruits were inoculated, incubated, isolated, inspected and finally identified as: *Fusarium moniliforme*, *Aspergillus niger* and *Mucor irregularis*. These findings showed that *Persea americana* leaves preserved pepper better and reduced storage rot. The results of this experiment have created an alternative storage method and can be used to back up the claims of local farmers that lined baskets with *V. amygdalina* leaves.

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Habanero pepper are hot since they contain lots of healthy capsaicin. They are orange and red in colour but green when unripe. The flavour and aroma of habanero make them popular ingredients in hot sauces and other spicy foods (Friedman, 2018). Pepper is tender and have high water content which makes it enormously perishable and susceptible to fungal attack thereby making storage a problem (Elenwo, 1997). Although there are modern methods of food preservation such as refrigeration, canning and processing into powder, they are quite expensive and not readily available for rural residents especially the local farmers who harvest farm produce in large quantities or a trader that buys in bulk and is not able to sell off on time. Storage of delicate and perishable foods has become a problem as many crops are lost due to infestation of microbes rendering them unfit for human consumption. However, different means has been adopted in keeping these fruits fresh for as long as possible and one of the major ways is using leaves of plants to wrap or cover them. This method is mostly

seen in the market. There is need to preserve habanero pepper because of its numerous health benefits. It increases the heart rate and may help in lowering blood pressure, weight loss, reduces the risk of lung and breast cancer and loosens up mucus membranes which breaks down bacteria and viruses. It also reduces bad cholesterol levels without reducing the levels of good cholesterol. They are excellent sources of phytochemicals, vitamin A, vitamin C and magnesium. The 'stress-fighting' B-complex group of vitamins, such as niacin, pyridoxine, riboflavin and thiamine. It stimulates the production of endorphins, hormones responsible for blocking pain signals and causing a euphoric sensation. It is added to food as preservative because of their antifungal and antibacterial effects. Studies have shown that most of these plants are medicinal and can preserve fruit for 7 to 14 days. Some of these plants are *Anthocleista vogelli* (Cabbage tree), *Cassia alata* (ringworm bush), and *Veronia amygdalina* (bitter leaf) among many others. Studies have revealed that these plants have

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components in them that act against some fungal activities (Lai and Roy, 2004). This study examined some plant leaves for a longer preservation of pepper.

MATERIALS AND METHODS

The collection of materials: Freshly harvested pepper fruits were bought from Afule Market in Osisioma Ngwa local market Aba, Abia State in June 2020. Fresh matured leaves of the *Persea americana* (Avocado), *Musa sapientum* (Plantain), *Veronia amygdalina* (bitter leaf), *Colocasia esculenta* (cocoyam) and *Carica papaya* (pawpaw) leaves were collected from bushes and farmland around Umuimo village, Abia State. These leaves were chosen based on history of previous use, medicinal properties and local availability.

Selection of pepper: Healthy looking habanero pepper fruits were selected from the bulk separating them from injured fruits then divided into five equal parts with eighty (80) fresh pepper in each part.

Preparation of leaves for preservation: The leaves were thoroughly inspected to ensure there were no insects on them. After which they were surface sterilized with 70% ethanol and cotton wool.

Lining of baskets with leaves: The habanero pepper fruits were wrapped up in *M. sapientum*, *C. esculenta* and *C. papaya* then twines used to tie the leaves to support the wraps and placed in different baskets. Leaves with smaller surface area like *Persea americana* (Avocado) and *Veronia amygdalina* (bitter leaf) were placed in baskets and the baskets lined with the leaves.

For control a different basket was used to hold fresh peppers without leaves.

Sorting out of soft, rotten and wilted pepper fruits and replacement of leaves at 7 days intervals: At seven (7) days, soft, rotten and wilted pepper fruits were counted and pick out of the wrap and the leaves replaced with fresh ones. The remaining fruits were cleaned with a dry paper towel to remove any deposits of the rotted ones from them. Then the leaves of each of them were taken out and replaced. The soft, rotten and wilted pepper fruits included those with all categories of rots (soft and dry), dehydrated ones, the physical state and

appearance of the pepper fruits were recorded. those with lesions.

Isolation and identification of fungi organisms: The five (5) I's methods involved in the cultivation of fungi described was used to culture the test fungi. Organisms obtained from the pepper were Inoculated (A process where tiny fungal sample were taken and transferred onto various media), then Incubated at a temperature of 25°C for 5-7 days to encourage an elaborate growth of fungi. By the end of the seventh day (7), the visible fungi were Isolated (Separation of different species) individually into freshly prepared media to obtain pure culture (culture containing single species). After this, they were Inspected (viewing colonies under the microscope and their characteristics described. This was done by preparing slides to show cell shape, size motility and using staining techniques to gather information about cell type. Finally, the fungi were Identified using pictorials representation by Dr. Chinyerum Gloria Ikechi-Nwogu in the Department of Plant Science and Biotechnology, Faculty of Science, University of Port Harcourt Choba, Nigeria.

Data Analysis: The data for each treatment was collected weekly. The number of rotten fruits were taken note of and the healthy ones as well. The data collected was analysed statistically using analysis of variance (ANOVA) techniques to compare the effectiveness of each of the leaves from the others and check their significant differences.

RESULTS AND DISCUSSION

The result of the performance of leaves of *Persea americana* (Avocado), *Musa sapientum* (Plantain), *Veronia amygdalina* (bitter leaf), *Colocasia esculenta* (cocoyam) and *Carica papaya* (pawpaw) in the preservation of pepper fruits are presented in Table 1.

Performance of the leaves: The habanero pepper screened were visually observed. The results obtained from the observation showed that all the pepper fruit in the control without leaves, *Musa sapientum* and *Colocasia esculenta* were lost (0%) by the end of the 42 days of treatment as shown in Fig 1. *Carica papaya* had 5% survival, *Veronia amygdalina* had 26.25% survival and *Persea americana* had the highest rate of survival at 28.75%. The graphical representation of the survival rates are shown in Figure 1.

Table 1: Performance of the leaves of *P. Americana*, *M. sapientum*, *V. amygdalina*, *C. esculenta* and *C. papaya* in the preservation of pepper fruits in storage

Treatments	Number Of Days						Total Losses	Survival
	7	14	21	28	35	42		
<i>P. Americana</i>	10	11	4	13	11	8	57	23
<i>M. sapientum</i>	20	23	17	15	5	0	80	0
<i>V. amygdalina</i>	8	12	10	11	11	7	59	21
<i>C. esculenta</i>	31	19	23	7	0	0	80	0
<i>C. papaya</i>	11	20	12	10	13	10	76	4
Control	21	29	30	0	0	0	80	0

*The number of fruits per treatments = 80; *Total losses include all fruits that had rots on them, wilted fruits and discoloured ones.

*Survival is the number of fruits remaining after 42 days of treatment and observation.

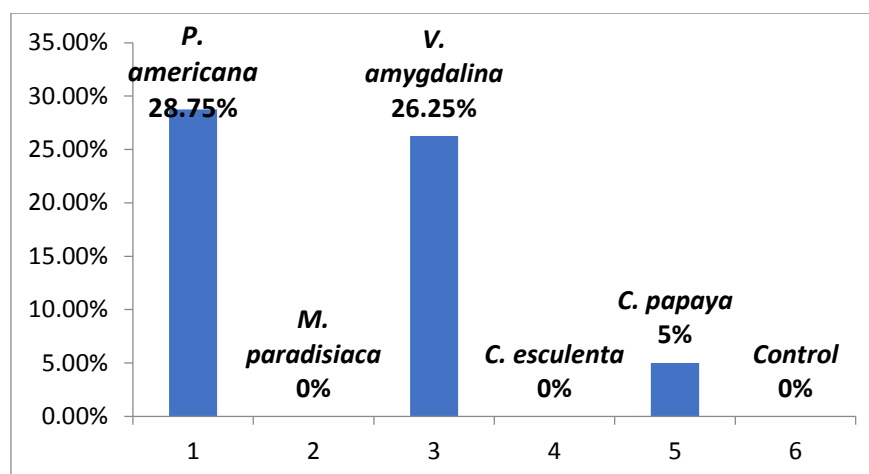


Fig 1: Graph Showing Percentage Survival of Fruits in Each Leaf

Identification of fungi organisms: Organisms isolated from the rotten pepper are identified as: *Fusarium moniliforme*, *Aspergillus niger* and *Mucor irregularis*: The pepper fruits were seen to have been stored better and preserved longer in baskets that were completely lined with leaves of *P. americana* and *V. amygdalina*. From physical observation, the pepper fruits in the above-mentioned leaves had higher number of survived fruits at 6 weeks. The leaves have some antimicrobial properties so were able to reduce the rate of microbial activities on the fruits causing less infestation (Elenwo, 1997). This present investigation, justifies the study by Elenwo, (1997) but proved that *V. amygdalina* is good for pepper preservation. It is also important to note that the leaves of *P. americana* and *V. amygdalina* have relatively low moisture content and could imply long shelf life (Onwuka, 2005) in comparison to *M. sapientum*, *C. esculenta* and *C. papaya*. Hence, it can be deduced that moisture of the leaves aided the microbes in the attacking the fruits and leading to 100% loss by week 5 (this is in the case of *C. esculenta*). Furthermore, this experiment can be used to back up the claims of local farmers and traders that used baskets completely lined with *V. amygdalina* to protect or preserve their produce that is being carried from place to place or rather from farm to market. They believe that it keeps the fruits fresh till it reaches its destination. Also, these plants are readily available to us as they are very common especially in this part of the country. Isolation of *Fusarium moniliforme*, *Aspergillus niger* and *Mucor irregularis* from the rotten pepper as the organisms associated with rotten pepper, agrees with earlier works of Ikechi-Nwogu *et al.*, 2021. Their findings, showed that *Mucor irregularis*, formerly known as *Rhizomucor variabilis* is one of the emerging causal fungal pathogens of post-harvest habanero pepper. Elenwo, (1997) also identified *Fusarium* and *Aspergillus* spp as causal pathogen responsible for the spoilage of some vegetables. Many fungi and bacteria are associated with different varieties of pepper, but due to some environmental conditions, only a small proportion of the kind of microorganism(s) present

will grow rapidly and cause deterioration (Alfred and Patrick, 1985). Among the casual pathogens of pepper, *lasiodiplodia*, *Aspergillus flavus*, *Penicillium corylophilum*, *Aspergillus fumigates*, *Aspergillus niger*, *Rhizopus stolonifer* and *Verticillium spp* have all caused various diseases such as, damping off, writing, powdery-mildew, soft rot and general spoilage in pepper and other plant species (Lema *et al.*, 2018). Numerous studies have reported that *Aspergillus* spp. are associated with spoilage of pepper, tomatoes, apricot, orange, lemon, peach, apple, kiwi, mango using molecular characterization (Rashad *et al.*, 2011). This study agrees with the study by Wada *et al.* (2015), *A. niger* and *A. fumigatus* were isolated from pepper fruits were said to be the most active pathogens that caused rot of the pepper fruits. This current study is in agreement with the works of Onuorah and Orji (2015) who specified that *Aspergillus* had the highest decay diameter among other fungi associated with pepper spoilage. In addition, Akinyemi and Liamngee (2018), established in this study that, *Aspergillus niger*, *Fusarium moniliforme*, *Colletotrichum asianum*, *Fusarium oxysporum*, *Bipolaris zeicola* were isolated from the pepper samples.

Conclusion: The results suggest that as an alternative, plants established to have high antimicrobial properties can be used in the preservation of fresh produce provided the plant is healthy and the fruits are free from visible rot, wounds or infestations. This will help rural dwellers in food preservation where the luxury of having standard storage facilities such as refrigerators is rare.

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