



EFFECT OF BOTANICALS AGAINST FUNGI (*Botryodiplodia theobromae*) ON WEIGHT LOSS AND FRUIT DECAY OF THREE VARIETIES OF BANANA (*Musa sapientum* L.)

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ABSTRACT

An experiment was carried out to study the effect of botanicals against fungi *Botryodiplodia theobromae* on the weight loss and fruit decay of three varieties of banana fruits. The botanicals, namely *Eucalyptus camaldulensis*, *Lantana camara* and *Azadirachta indica* leaf extracts were administered to the banana fruits (Gross Michel, Dwarf Cavendish and Lady's Finger) inoculated with fungal pathogens. The experiment was laid out in a Completely Randomized Design (CRD) in two factorial combinations and replicated three times. The results obtained showed a significant ($P < 0.005$) difference among the treatments. The results further revealed that, Lady's Finger variety had the highest percentage weight loss (7.59%, 13.29%, 42.92%, 69.41% and 77.04%) and fruit decay (22.13%, 42.33%, 53.31% and 69.92%). All the botanical extracts gave decent results in fruit weight and decay than the control. However, Eucalyptus leaf extract performed better (3.08% and 6.64%) in reducing weight loss at 3rd and 6th days respectively, though not statistically different with neem extract. Neem extract was generally superior than all other plant extracts next to mancozeb. The use of botanicals could be a better alternative for controlling fungal disease of banana fruits in storage.

Keywords: Banana, Decay, Extracts, Fungi, Weight loss

INTRODUCTION

Banana (*Musa sapientum* L.), is a staple starchy crop consumed in Nigeria and the tropical regions of the world (NatureClaim Team, 2026). The crop plays an important role in strengthening food security and reducing poverty levels in many developing countries such as Nigeria. It is a source of livelihood for about 80% of banana farmers involved in small scale banana production (Shiyam & Idiku, 2025). Banana is rich in vitamin C, B6, minerals, and dietary fiber. It is also a rich source of Calcium, Potassium and Phosphorus and dietary fibre (NatureClaim Team, 2026; Torres, 2026).

Banana is a highly perishable fruit and the quality deteriorates very fast after harvest. Postharvest diseases, especially crown rot caused by complex of *Lasiodiplodia theobromae* (Pat.) Griffon and Maubl, *Colletotrichum musae* (Berk and Curtis) Arx and *Fusarium spp.*, greatly reduces the storage life of bananas in almost all banana-producing countries (Hossain *et al.*, 2025). Ekhuemelo and Yaaju (2017) reported *Botryodiplodia theobromae* as the fungi causing crown rot of banana in Makurdi.

Over the years, various fungicides like mancozeb, benomyl, carbendazim, thiabendazol, etc. have gained popularity among growers to control the post-harvest and to enhance their storage life (Gupta and Jain, 2014). In recent years, restrictions on the use of chemical, synthetic fungicides have been applied in an attempt to eliminate their use and encourage the use of alternative, natural products. In this essence, the investigation of natural products from plants and herbs and other natural compounds has started gaining interest (Pardo-De la Hoz *et al.*, 2016; Khodadadi *et al.*, 2020). Many botanical plants have been proven to possess antifungal activities (Khodadadi *et al.*, 2020; Talhinhos and Baroncelli, 2021; da Silva *et al.*, 2020). The objective of this study is to investigate the effects of some plant extracts on the fungi *Botryodiplodia theobromae* of three varieties of banana under postharvest conditions.



MATERIALS AND METHODS

The study was conducted at Federal College of Horticulture Dadinkowa in Gombe State. Fruits of three banana cultivars namely, Gros Michel, Dwarf Cavendish and Lady's Fingers were purchased from farmer's orchard and transported to the Laboratory of Federal College of Horticulture Dadinkowa in Gombe State. All the different cultivars were utilized for artificial plugs inoculations for the experiments. The fruits were thoroughly washed under running tap water and immersed in 1% v/v sodium hypochlorite (NaOCl) solution for 3 minutes in order to reduce the surface contamination before air-dried at room temperature. Fresh leaves of *Azadirachta indica*, *Eucalyptus camaldulensis* and *Lantana camara* used for the experiment were obtained, washed with distilled water and dried at room temperature (26-28°C). It was ground into powder using pestle and mortar. 100 g of each powder were dissolved in 1 litre of distilled water separately, vigorously agitated and left for 24 hours to stand before filtration using muslin cloth. The experiment was a 5 x 3 factorial experiment consisting of three plant extracts namely, *A. indica*, *E. camaldulensis* and *L. camara*, two controls (Mancozeb and distilled water) which served as positive and negative controls respectively, and three cultivars of banana viz: Gros Michel, Dwarf Cavendish and Lady's Finger. The experiment was laid out in a Completely Randomized Design with three replications. Banana fruit samples were perforated using a 1mm cork borer and inoculated with seven days old *Botryodiplodia theobromae*. A negative control consisting of banana fruit samples dipped in distilled water and inoculated with *B. theobromae* alone and a positive control which consisted of untreated banana fruit sample neither soaked in any plant extract nor inoculated with *B. theobromae*. The fruits were kept at room temperature (Average maximum temperature of 35°C and minimum of 28°C; Relative humidity of 74-85 %) for fifteen days. Data collection was carried out at three days intervals by recording weight loss and fruit decay.

Percentage fruit weight loss

The percentage weight loss was calculated for each sampling interval using the formula given below:

$$\text{Percentage Fruit Weight Loss} = \frac{\text{Initial fruits weight} - \text{final fruit weight}}{\text{Total number of fruits under study}} \times 100$$

Percentage fruit decay

The decayed fruits were calculated by dividing the number of decayed fruits by total number of fruits as described by Genanew *et al.* (2013).

$$\text{Percentage Fruit Decay} = \frac{\text{Number of decayed fruits}}{\text{Total number of fruits under study}} \times 100$$

Data collected were subjected to analysis of variance (ANOVA) using SAS version 9.2 statistical software package (SAS 2009) under Complete Randomized Design (CRD). Means were separated using Least Significant Difference (LSD) at $P < 0.05$ level of probability.

RESULTS AND DISCUSSION

Table 1 shows the results of percentage weight loss of inoculated banana fruits as affected by treatments and the control. The result showed that, fruit weight loss was significantly ($P < 0.05$) influenced by fruit varieties and plant extracts. The results obtained revealed that, Lady's Finger variety had the highest weight loss throughout the storage periods. The least weight loss was recorded in Gros Michel (3.09%, and 7.13%) at 3rd and 6th days of storage followed by Dwarf Cavendish at 9th, 12th and 15th days of storage (20.18%, 28.52% and 30.42%) respectively. In terms of plant extracts, the results showed highly significant ($P < 0.05$) differences among the treatments. Eucalyptus leaf extract was comparably the best in reducing weight loss at 3rd and 6th days of storage having the least percentage values of 3.08% and 6.64% respectively. Neem leaf extracts however, proved more efficacious at 9th, 12th and 15th days of storage with values of 22.69%, 41.00% and 49.10% compared with other treatments, including the positive control. The control however had the highest percentage weight loss of 8.34%, 16.24%, 38.80%, 58.90 and 66.31%.

The significant differences exhibited by the banana fruits under study could be as a result of varietal differences. This assertion has been reported by Charoenchongsuk *et al.* (2018) who reported that the postharvest storage life of banana fruits is significantly influenced by varietal differences. Additionally, the enzyme activity within the banana also varies by variety, which impacts how quickly



the fruit ripens and deteriorates (Umesh, 2022). The highest fruit weight loss recorded in the Lady's Finger variety could be as a result of the thin skin which makes them more prone to damage, resulting in faster ripening and higher postharvest losses. Lady's Finger bananas are also prone to fungal infections like *Fusarium* species, which can exacerbate postharvest weight loss through tissue degradation (Sebastiano *et al.*, 2024).

As regards to the effect of plant extracts on the fruit weight loss, the highest weight loss recorded in Eucalyptus-treated fruits during the first six days could be as a result of the presence of the active compound in the leaves which has the potential to preserve the quality and reduce water loss. This result is in agreement with the works of Manzi *et al.* (2022) who found that 'Eucalyptus leaf extracts have shown promising effects in reducing fruit weight loss in various fruits and can help maintain the quality of fruits by reducing water loss and fungal decay, thus extending their shelf life. However, in this study, the effect was for only 6 days after storage possibly due to the high volatility of eucalyptol, bioactive compound that evaporates quickly when applied as part of a fruit coating or dip (Kaur and Gautam, 2019).

Table 1: Effect of Botanicals Against Fungi (*Botryodiplodia theobromae*) on Fruit Weight Loss of Banana Varieties

	3 DOS	6 DOS	9 DOS	12 DOS	15 DOS
Variety					
Lady's Finger	7.59	13.29	42.92	69.41	77.04
Dwarf Cavendish	4.17	7.85	20.18	28.52	30.42
Gross Michel	3.09	7.13	27.93	41.00	47.00
P<F	0.001	0.001	0.001	0.001	0.440
LSD	1.607	2.348	3.834	5.803	4.425
LS	**	**	**	**	NS
Extracts					
Mancozeb Fungicides	3.73	7.86	27.97	42.92	49.13
Eucalyptus Leaf Extract	3.08	6.64	28.64	42.10	53.22
Neem Leaf Extract	4.04	6.92	22.69	41.00	49.10
Lantana Leaf Extract	5.55	9.46	33.69	46.63	49.64
Control	8.34	16.24	38.80	58.90	66.31
P<F	0.001	0.001	0.001	0.001	4.425
LSD	2.075	3.031	4.950	7.493	5.713
LS	**	**	**	**	NS
Variety x Extract	*	*	NS	NS	NS

Table 2 shows the results of percentage fruit decay of inoculated banana fruits as affected by all the treatments. The result showed highly significant ($P<0.05$) difference among the three varieties of banana fruits throughout the storage periods. From the results obtained, Lady's Finger varieties had the highest percentage fruit decay from 6th to 15th day. Dwarf Cavendish variety recorded the least percentage fruit decay (2.40%, 7.92%, 21.82% and 34.90%), though it was not significantly different with Gross Michel variety except at 15th day of storage. The results of the plant extract also showed highly significant differences ($p<0.05$) among the extracts with gradual increase in fruit decay as the storage days increased. From the results, Mancozeb fungicide was more efficacious in preventing fruit decay in all the days (6.24%, 13.82%, 26.44% and 39.92%), followed by extracts of neem leaves (7.62%, 16.14%, 29.42% and 47.22%) at 6th, 9th, 12th and 15th days respectively. The highest fruit decay recorded in the Lady's Finger variety could be attributed to the thin skin which makes them more prone to postharvest losses. This assertion has been elucidated by Kader (2002) that varietal differences in bananas directly affect their susceptibility to diseases, and their shelf life. On the other hand, the least fruit decay obtained in Dwarf Cavendish variety might be as a result of its ability to resist diseases. This result is in agreement with the works of Aziz *et al.* (2023) who maintained that Dwarf Cavendish bananas have a long postharvest life due to their moderate resistance to diseases like black Sigatoka. The least decay rate in neem leaf-treated banana may also be attributable to the bioactive compounds



from neem leaf extract that enhanced the fruit's resistance to pathogen-induced decay. The bioactive compounds present in neem, azadirachtin, have antimicrobial properties that can inhibit the growth of fungi and bacteria that cause decay (Mostafa *et al.*, 2023).

Table 2: Effect of Botanicals Against Fungi (*Botryodiplodia theobromae*) on Percentage Fruit Decay of Banana Varieties

	6 DOS	9 DOS	12 DOS	15 DOS
Variety				
Lady's Finger	22.23	42.33	53.31	69.92
Dwarf Cavendish	2.40	7.92	21.82	34.90
Gross Michel	3.91	11.90	27.70	51.04
P<F	0.001	0.001	0.001	0.001
LSD	5.00	6.741	8.200	9.752
LS	**	**	**	**
Extracts				
Mancozeb Fungicides	6.24	13.82	26.44	39.92
Eucalyptus Leaf Extract	9.43	22.50	38.00	53.00
Neem Leaf Extract	7.62	16.14	29.42	47.22
Lantana Leaf Extract	9.40	20.32	37.30	51.34
Control	15.00	30.74	40.31	68.30
P<F	0.089	0.005	0.049	0.002
LSD	6.460	8.711	10.590	12.592
LS	NS	*	*	*
Variety x Extract	NS	NS	NS	NS

CONCLUSION AND RECOMMENDATION

The present study revealed that postharvest dipping of banana fruits in plant extracts can reduce weight loss and decay of fruits. All the leaf extracts treatment gave decent results as all of them gave superior performance than the control. There was less physiological weight loss in neem leaf extract treatment. Similarly, fruit decay was comparably inhibited in neem leaf extract treated fruits next to the mancozeb fungicides treated fruits. The performance of neem leaf extract was superior among other leaf extract treatments and was comparable with the bench mark (mancozeb) treatment; indicating that, the use of plant extracts can be a better alternative for maintaining quality and extending postharvest life of banana in place of hazardous chemical fungicides.

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