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Control of Yam Rot using Leaf Extracts of Utazi *Gongronema latifolia* and *Moringa oleifera*

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Authors' contributions

This work was carried out in collaboration between all authors. Author ECF designed the study, performed the statistical analysis, wrote the protocol and wrote the first draft of the manuscript. Authors OOJ managed the analyses of the study. Author NNE managed the literature searches. All authors read and approved the final manuscript

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ABSTRACT

Dioscorecea rotundata are among the most important tropical root crop. Yams are a staple crop in many parts of Africa and Southeast Asia. Besides their importance as food source, yams also play a significant role in the socio-cultural lives of some producing regions like the celebrated new yam festival in West Africa, a practice that has also extended to overseas where there is a significant population of the tribes that observe it. This research was carried out on the antimicrobial effect of the leaf extracts of *Gongronema latifolia* and *Moringa oleifera* for the control of *Dioscorecea rotundata* tuber rot caused by *Fusarium oxysporum, Penicilium oxalicum, Fusarium solani, Botryodiploidia theobromae, Rhizopus spp, Aspergillus niger and Aspergillus flavus.* The highest percentage occurring organisms were *P. oxalicum, Rhizopus sp, F. oxysporum,* and *A. niger*. Qualitative phytochemical screening of the extracts was conducted which revealed the presence of

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alkaloids, flavonoids, tannins, saponins, sterols and phenols. The zone of inhibition of the leaf extracts of *G. latifolia* and *M. oleifera* revealed that *M. oleifera* gave higher inhibition of *F. oxysporum* (at all concentrations), *A. niger* and *A. flavus*. However, *G. latifolia* gave higher inhibition of *A. niger* and *A. flavus* at different concentrations. The study revealed that *A. flavus* was the most susceptible organism to the effect of the leaf extracts of *G. latifolia* and *M. oleifera* while *F. oxysporum* and *A. niger* were the most resistant organisms against these leaf extracts. There was significant difference in the inhibitory activity of the leaf extracts of *G. latifolia* and *M. oleifera* against *F. oxysporum, A. niger* and *A. flavus* at different concentrations. Hence, *G. latifolia* and *M. oleifera* leaves could be the best alternative ways of reducing and controlling rot by farmers these extract can be easily prepared by farmers.

Keywords: Yam rot; leaf extracts; fungi; control.

1. INTRODUCTION

Yam is an important staple food crop in many communities in Anambra state of Nigeria. Yam according to [1] belongs to the family of Dioscoreceae, which is one of the monocot plants which is planted and harvested every farming season. Its propagation as food and staple crop is made of with six species, which are popularly cultivated in Nigeria namely, *Dioscorecea rotundata* (white yam), *Dioscorecea alata* (water yam) *Dioscorecea cayenesis* (yellow yam), *Dioscorecea bulifera* (aerial yam), *Dioscorecea esculenta* (Chinese yam) and *Dioscorecea dumentorum* (trifoliate yam). [2] stated that all yams are classified as monocotyledonous crop under the genus Dioscorecea, family Dioscorceaceae and order Dioscoreales.

[2] stressed further that many people lay emphasis on *D. rotundata*, which is consumed mostly on the tropical zone. Others species like. *D. alata, D. cayenesis, D. dumentorum, D. esculenta,* and *D. bulferia*, are also cultivated but in a minute quantity. In the opinion of [3] yam is a stem tuber crop which is rich in carbohydrate. [1] emphasized that among all the six species of yam that is cultivated in Nigeria. *D. rotundata* is the most important species that is cultivated in most of the Eastern states of Nigeria. These states include Anambra, Ebonyi, Enugu, Abia, and Imo state. This species of yam is also cultivated in Edo, Benue Adamawa, Taraba and the Southern section of Kaduna State. [1] stated further that *D. rotundata* is much the most important species in cultivation in Southern Eastern State of Nigeria. This is as result of adaptability of yam to the environment and high yield derived from it.

[4] reports that causes of storage losses of yam tubers include germination, water loss from plant parts, respiration, rot because of moulds and bacterial attack and destruction by insects, nematodes and mammals. Germination, water loss from plant parts and respiration are routine plant growth functions which are based upon the environment in which the produce are kept. These plant growth functions affect the inside make-up of the tuber and ends up in destruction of the parts eaten and changes in nutritional characteristics. Storage losses in yam of the order of 10-15% after the initial three months and coming near 50% after six months storage has also been reported. However, postharvest losses certainly at storage are a main task in yam production. The losses arise in different stages from production, after harvest handling, processing, marketing and distribution. These losses incorporate those in amounts harvested and overall acceptability of the tubers as a result of mechanical injury, pest damage, disorders caused by fungi and bacteria, and physiological processes such as germination, loss of water, and respiration. Estimated shortage of 10 to 60% of entire crop harvested was recorded.

Yam production has gained prominence for export in Nigeria and has led to substantial gain in foreign exchange. It generates about 20 million dollars from 26, 000 metric tons of yam produced annually [5]. Postharvest losses peculiarly at storage are foremost undertaking in yam production [5]. Available statistics indicate between 30 and 60 percent of yam harvested in Nigeria are lost through postharvest storage. The income levels of farmers, processors, traders and other stakeholders are affected yearly as a result. The major causes of post-harvest losses are weight loss due to evapo-transpiration intensified by sprouting, rotting due to fungal and bacterial pathogens and insect infestation [5]. For an annual loss of one million MT of tubers from West Africa, this therefore deemed it necessary to determine the antimicrobial effect of Moringa

leaves and Utazi leaves extracts as preventive agents on rotting yam.

Weight reduction throughout the period of keeping yams in average storage barns can reach between 10-12% within the initial 3 months and thirty to 60% beyond 6 months. Loss of weight only accounts for 33 - 67% beyond 6 months of storage and this has been mentioned by [6]. In the Western parts of Africa for instance, this amounted to an annual loss of 1,000,000 tons of tuber [4].

Domestically, yam is not only a most important source of income; however it's a staple crop principal to food availability. Owing to difficulties in propagation, the yam plant is close to extinction in a lot of indigenous areas of production and yam cultivation in West Africa has been on the low side partly because the underground tuber which is the supply of food can also be the source of planting materials. Colossal portions of tubers and bulbils are committed to producing new vegetation, which otherwise would have been on hand for human consumption [7]. The contribution of this crop to the dietary needs of man and economic gains accrued from its cultivation cannot be over emphasized [3].

Therefore this study will help in the cost of preventing meals from going waste and more commonly not up to that of producing an extra quantity of food crop of the equal price and number. It therefore becomes imperative to find a more suitable and workable means of improving yam storage using relatively cheaper and available materials in construction of storage structures to hold the surplus harvest and make the crop available all year round. It will also afford farmers easy, cheap and convenient method of storing yams using locally available materials. It identifies the specific yam varieties that can store for relatively longer period of time. The present research has been undertaken to assess the antimicrobial effect of *Moringa* and utazi leaves extract as preventive agents on yam rot.

2. MATERIALS AND METHODS

2.1 Collection of Plant Material and Preparation of Extract

The leaves of utazi and moringa were bought from eke Awka market, Anambra State. The plant was identified and authenticated by Mr Egboka Tochukwu of the Department of Botany, Nnamdi Azikiwe University, Awka. The voucher specimens were deposited at the Department of Botany Herbarium, NnamdiAzikiwe University, Awka. Rotted white yam tubers (*Dioscorecea rotundata)* were collected from the yam storage site at eke Awka Market. This was packaged in polyethylene bags and taken to the Laboratory where they were kept until required. Healthy yam tubers were also obtained from the same market. The tubers were washed and rinsed in running tap water before being used for pathogenicity test.

2.2 Materials Used

The materials and instruments used for the study included plant specimen (utazi and moringa leaves), blender (grinder), masking tape, mortar and pestle, moisture cans, crucibles, Whatman filter paper No 42, burettes, volumetric flasks, beakers, conical flasks, sample tubes, desiccators, spectrophotometer, muslin cloth, oven, measuring cylinder, spatula, electric scale, Bunsen burner (stove), funnels, aluminium foils, test tubes, syringes, pipettes, cotton wools, etc.

2.3 Chemical and Reagents Used

Ethanol (alcohols), concentrated acetic acid, sulphuric acid, diluted ammonia, water, ferric chloride, potassium ferrocyanide, ethyl acetate, hydrochloric acid, petroleum ether, sodium hydroxide, potassium hydroxide (potassium permanganate). Hydrogen peroxide, sodium chloride, copper sulphate, sodium picrate, methyl red, cresol green, folin-ciocaltean reagent, folin-dennis reagent, Eriochrome black and solechrome dark blue.

2.4 Preparation of Plant Materials for Phytochemical Studies

Fresh leaves of utazi and moringa were oven dried and blended with electric blender. 250 g of each of the ground samples were added to 25 ml of hot water. This was vigorously stirred and left to stand for 1h. The solution was later filtered and used as the extract.

2.5 Phytochemical Screening

Phytochemical tests were carried out to determine the presence of phytochemical constituents. This was carried out using the methods as described by [8-11]. Qualitative phytochemical screening of the extracts was

conducted to determine the presence of these phytochemicals: Hydrogen cyanide, Alkaloids, Flavonoids, Saponins, Sterols, Tannins and Phenols. Quantitative phytochemical test of the extracts was conducted to determine the percent quantitative contents of above phytochemicals.

2.5.1 Tannin determination

The presence of tannins was determined using the [8] method.2g of the powdered samples was boiled with 50ml of water, filtered using Whatman filter paper and the filtrate useds to carry out the ferric chloride test. Few drops of ferric chloride were added to 3ml of the filtrate in the test tube. A greenish black precipitate indicates the presence of tannins.

2.5.2 Alkaloid determination

The presence of alkaloid was determined using the Mayer and Wagner's test as described by [8]. About 2g of each portion of the powdered samples were put in a conical flask and 20ml of dilute sulphuric acid in ethanol was added into it and then placed in water bath to boil for 5 minutes. The mixture was filtered and the filtrates were separated, and treated with 2 drops of Mayer and Wagner's reagents (iodine in potassium solution) in a test tube. Development of a reddish-brown precipitate confirmed the presence of alkaloid [12].

2.5.3 Saponin determination

The emulsion test as described by [8] was used to determine the presence of saponins. Exactly 20ml of water was added to 0.05g of the powdered sample in 100ml beaker and boiled, then used for the test. Two drops of olive oil was added to the frothing solution and shaken vigorously. The formation of emulsion indicated the presence of saponins.

2.5.4 Glycosides determination

Glycoside test was conducted according to the method reported by Hikino et al. [9]. To 1g of powdered sample was mixed with few drops of toluene reagent in a test tube and a sodium picrate paper was suspended inside for about 10-20 minutes and covered with foil. The change of colour from yellow to brick red indicates the presence of cyanogenic glycosides.

2.5.5 Steroid determination

Analytical method used is according to Ejikeme et al. [10]. Exactly 1.0ml of the extract was dissolved in 20ml of chloroform in a test tube, and then 1.0ml of concentrated sulphric acid (H_2SO_4) was carefully added to the side of the test tube. A red or reddish-brown colour at the interface was taken as a positive test for steroids. The above test is known as the Salkowskis test.

2.5.6 Flavonoid determination

The presence of flavonoids in the samples was determined using the [8,11] method. To 2g of the powdered samples, 10ml of ethyl acetate was added and was heated in a water bath for about 5 minutes. The mixture was cooled, filtered and the filtrates used for the test.

2.5.7 Ammonium Test

This was determined by using the [11] method. Exactly 2ml of filtrate was shaken with 1ml of dilute ammonium solution. The layers were allowed to separate and the yellow colour in the ammonical layer indicated the presence of flavonoids.

2.5.8 Ammonium Chloride Test

This was determined by using the [11] method. Just 1ml of 1% ammonium chloride solution was added to 20ml of the filtrate and shaken. A yellow colouration indicated the presence of flavonoid.

2.5.9 Phenol Determination

This was determined by using the [13] method. Dry sample of 2g was boiled with 50ml of ether for the extraction of the phenolic compound for 15 minutes. Then 5ml of the extract was pipette with a 50ml flask, and then 10ml of distilled water was added 2ml of ammonium hydroxide solution and 5ml of concentrated amyl alcohol were also added to react for 30 minutes for colour development. Also 2ml of the samples was added in a test tube 1ml of ferric chloride was added as well into the test tube. The development of greenish-brown precipitate indicated the presence of phenols.

2.6 Isolation of Pathogens

Rotted yam tuber was rinsed in sterilized water, surface sterilized with 70% ethanol and cut open. About 3 pieces (3 mm diameter) of the infected tissues were picked with a flamed sterilized forceps and inoculated on the solidified PDA medium in different plates. The inoculated plates were incubated at room temperature (28°C) and observations were made daily for emergence of

colonies. Sub-culturing was done to obtain pure cultures of the isolate. Stock cultures were prepared using slants of PDA in McCartney bottles and stored in a refrigerator at 4°C using the method [14].

2.7 Pathogenicity Test

A fresh, healthy tuber yam was washed with tap water and distilled water, and thereafter sterilized with 70% ethanol. Cylindrical discs were removed from the tuber with a sterile 4 mm cork borer. A four disc of five days old cultures of the isolates was used to plug the holes created in the tubers and the disc of the tuber in the cork borer was replaced, then Vaseline was applied on the point of inoculation. This was done for all the isolates obtained in pure cultures using the method [15].

2.8 Effect of the Extract on Fungal Growth

The method of [16] was used to determine the effect of the extract on fungal growth. This involves creating a four equal section on each petri-dish by drawing two perpendicular lines at the bottom of the plate, the point of intersection indicating the centre of the plate. This was done before dispensing PDA into each of the plates. About 2 ml of the extract of the various plant materials were separately introduced into the petri-dish containing the media (PDA). A disc (4 mm diameter) of the pure culture of *Fusarium* sp. or *A. Flavus* or *A. niger* was placed on the extract, just at the point of intersection of the two lines drawn at the bottom of the petridish. Control experiments were set up without the addition of any plant material. Fungi toxicity was recorded in terms of percentage colony inhibition and calculated according the formula of [13].

Zone of inhibition (%) = [(DC-DT)/DC] X 100

Where DC = average diameter of control, and

DT = average diameter of fungal colony with treatment.

2.9 Statistical Analysis

The results were analyzed using ANOVA, data was presented in percentage. All analyses were carried out at 5% level of significance.

3. RESULTS

Table 1 shows the presence of the following constituents in the leaves of utazi and moringa. Traces of saponins, sterols and flavonoids were found in the leave utazi, while saponins, flavonoids and phenols were found in traces in the leaves of moringa. Cardiac glycosides was absent in the leaves of utazi and moringa. Tannin, alkaloids and phenols were conspicuously present in the leaves of both utazi and moringa. These phytochemicals were reported to be responsible for many antimicrobial activities of different plant species [17,18]. Pharmaceutical and therapeutic values of plants and their products lie on the presence of these phytochemicals in them [19,20]. Flavonoids have been reported to be synthesized by plants in response to microbial infections and are good antibacterial agents. Tannins have been demonstrated to have antibacterial activities [21]. Alkaloids are known to have effects on the central nervous system and act as antipyretic such as morphine, a painkiller. Similarly, saponins which are a special class of glycosides have been found to possess antifungal activity [22].

Table 2 shows the percentage occurrence of various fungi isolated from the rotted yam used for the study. *Penicillium sp, F. oxysporum, Rhizopus sp* and *A. niger* all have the highest percentage occurrence 15.21%, 13.96%, 13.58% and 11.51% respectively. *Fusarium solani* had the lowest percentage occurrence of 2.13%.

Table 1. Result of preliminary phytochemical analysis on the leaves of *G. latifolia* and *M. oleifera*

Phytochemical	*G. latifolia*	*M. oleifera*
Alkaloids	++	++
Saponins	+	+
Tannins	++	++
Flavonoids	+	+
Cardiac glycosides	-	-
Sterols	+	++
Phenols	++	+

+=Trace; ++=Present; -=Absent

Table 2. Percentage occurrence of fungi in rotted yam

Isolates	Occurrence %
Fusarium oxysporum	13.96
Aspergillus niger	11.51
Aspergillus flavus	3.62
Rhizopus sp	13.58
Penicillium oxalicum	15.21
Botryodiploidia theobromae	5.70
Fusarium solani	2.13

Table 3. Zone of inhibition (mm) of the leaf extracts of *G. latifolia, A. flavus* and *M. oleifera* on pathogens at 50mg/ml concentration

Extracts	*F. oxysporum*	*A. niger*	*A. flavus*
Control	7.22±0.283a	8.38±0.460a	9.39±0.035b
Gongronema latifolia	4.19±0.184c	4.69±0.170b	7.51±0.141c
Moringa oleifera	5.20±0.007b	3.44±0.304c	9.78±2.230a
p-value	0.001	0.001	0.000

Results are in Mean ± Standard Deviation
Means with the same letter in a column are not significantly different (p>0.05)

Table 3 shows zone of inhibition of the leaf extracts of *G. latifolia* and *M. oleifera* on pathogens at 50mg/ml concentration. From the table, *M. oleifera* gave higher inhibition of *F. oxysporum* (5.20±0.007 mm) and *A. flavus* (9.78±2.230 mm) than *G. latifolia*. However, *G. latifolia* gave higher inhibition of *A. niger* (3.34±0.085 mm) than *M. oleifera*. In comparison between the control and the plant extracts, the control gave higher inhibition of *F. oxysporum* and *A. niger* than the plant extracts. There was significant difference in the inhibitory activity of the leaf extracts of *G. latifolia* and *M. oleifera* against all the pathogens investigated at 50mg/ml concentration ($p<0.05$) (Table 3).

Table 4 shows zone of inhibition of the leaf extracts of *G. latifolia* and *M. oleifera* on pathogens at 100mg/ml concentration. From the table, *M. oleifera* gave higher inhibition of *F. oxysporum* (7.18±0.262 mm) and *A. niger* (7.09±0.255 mm) than *G. latifolia*. However, *G. latifolia* gave higher inhibition of *A. flavus* (12.79±0.141 mm) than *M. oleifera*. In comparison between the control and the plant extracts, the control gave higher inhibition of *F. oxysporum A. niger* and *A.flavus* than the plant extracts. There was significant difference in the inhibitory activity of the leaf extracts of *G. latifolia* and *M. oleifera* against all the pathogens investigated at 100mg/ml concentration ($p<0.05$) (Table 4).

Table 4. Zone of inhibition (mm) of the leaf extracts of *G. latifolia, A. flavus* and *M. oleifera* on pathogens at 100mg/ml concentration

Extracts	*F. oxysporum*	*A. niger*	*A. flavus*
Control	8.48±0.106a	11.39±0.262a	14.65±0.035a
Gongronema latifolia	5.34±0.085c	5.50±0.021c	12.79±0.141b
Moringa oleifera	7.18±0.262b	7.09±0.255b	8.21±0.120c
p-value	0.034	0.002	0.000

Results are in Mean ± Standard Deviation
Means with the same letter in a column are not significantly different (p>0.05)

Table 5. Zone of inhibition (mm) of the leaf extracts of *G. latifolia, A. flavus* and *M. oleifera* on pathogens at 150mg/ml concentration

Extracts	*F. oxysporum*	*A. niger*	*A. flavus*
Control	10.83±2.058a	13.26±0.113a	15.64±0.184a
Gongronema latifolia	8.52±0.028a	8.05±0.042b	14.45±0.035b
Moringa oleifera	9.29±0.191a	6.37±0.311c	10.90±0.021c
p-value	0.288	0.023	0.007

Results are in Mean ± Standard Deviation
Means with the same letter in a column are not significantly different (p>0.05)

Table 5 shows zone of inhibition of the leaf extracts of *G. latifolia* and *M. oleifera* on pathogens at 150mg/ml concentration. From the table, *M. oleifera* gave higher inhibition of *F. oxysporum* (9.29±0.191 mm) than *G. latifolia*. However, *G. latifolia* gave higher inhibition of *A. niger* (8.05±0.042 mm) and *A. flavus* (14.45±0.035 mm) than *M. oleifera*. In comparison between the control and the plant extracts, the control gave higher inhibition of *F. oxysporum A. niger* and *A.flavus* than the plant extracts. There was significant difference in the inhibitory activity of the leaf extracts of *G. latifolia* and *M. oleifera* against *A. niger* and *A. flavus* at 150mg/ml concentration ($p<0.05$) (Table 5).

Fig. 1 revealed that *A. flavus* was the most susceptible organism to the effect of the leaf extract of *G. latifolia* at all concentrations while *F. oxysporum* was the most resistant organism against the leaf extract at 50 and 100 mg/ml concentrations. This means that on application of these extracts with increased concentrations, the zone of inhibition increases. This increase in value is increased effect of the plant extracts on the pathogens. However, decrease in value is decreased effect on the pathogens. Thus, the growth of the pathogens was most inhibited in the control and at 150 mg/ml concentration. There was a significant difference in the effect of the leaf extract of *G. latifolia* and the control on the test organisms ($p<0.05$).

Fig. 2 revealed that *A. flavus* was the most susceptible organism to the effect of the leaf extract of *M. oleifera* at all concentrations while *A. niger* was the most resistant organism against the leaf extract at all concentrations. Thus, the growth of the pathogens was most inhibited in the control and at 150 mg/ml concentration. There was a significant difference in the effect of the leaf extract of *M. oleifera* and the control on the test organisms ($p<0.05$).

4. DISCUSSION

From the study, several spoilage fungi were isolated from the rotted yam sample. The most frequently occurring fungi are *P. oxalicum*, *F. oxysporum, Rhizopus sp* and *A. niger*. The pathogenicity test revealed that three spoilage fungi (*F. oxysporum, A. niger and A. flavus*) induce rot in yams. *A. niger* was the most virulent. This agreed with the several works on spoilage fungi. [23] identified similar organisms in their study as causes of tuber rot of yam in stored yams and in the field. [24] also pointed post-harvest losses of yam tuber to be fungal deteriorations from organisms such as *A. niger*.

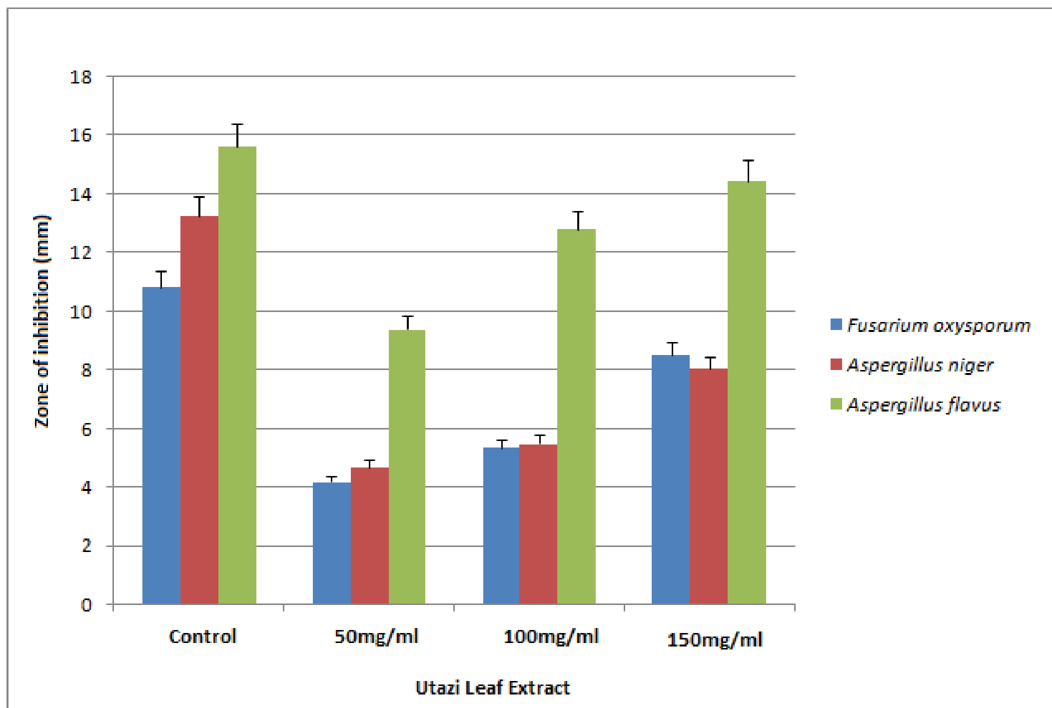

Fig. 1. Zone of inhibition of pathogens by the leaf extract of *G. latifolia* (utazi)

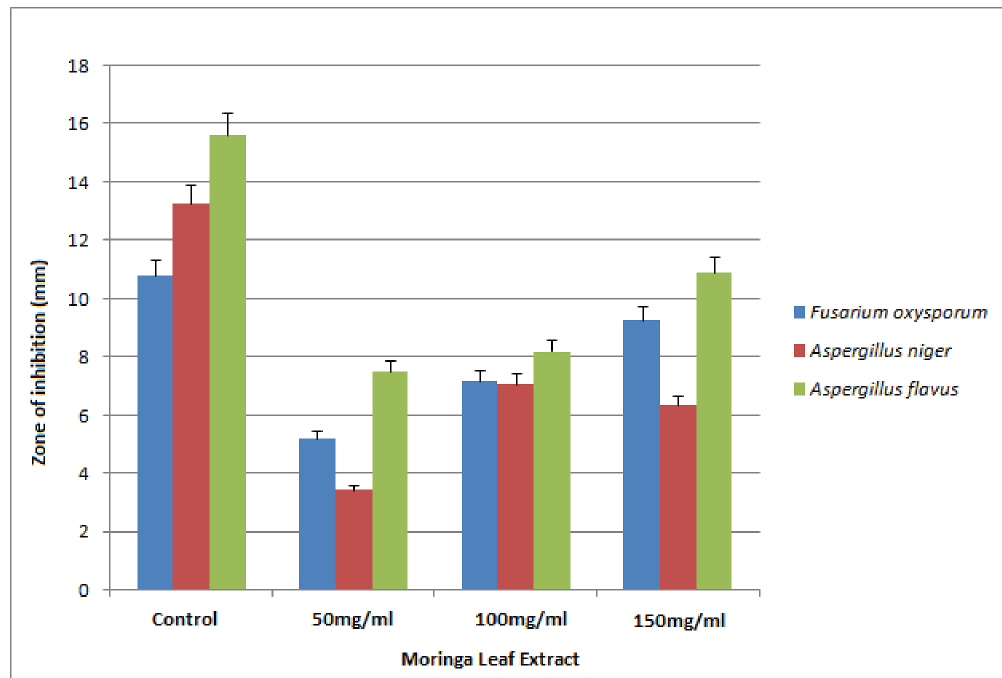

Fig. 2. Zone of inhibition of pathogens by the leaf extract of *M. oleifera*

On the zone of inhibition of the leaf extracts of *G. latifolia* and *M. oleifera* on the pathogens, *M. oleifera* gave higher inhibition of *F. oxysporum* (at all concentrations), *A. niger* and *A. flavus*. This was supported by the study of [25] who noted that *M. olifera* leaf extract has antibacterial and antifungal properties against pathogens such as *Staphylococcus aureus*, *Bacillus subtilis*, *Streptococcus pyrogenes*, *Aspergillus niger*, *Escherichia coli*, *Pseudomonas* and *Candida albicans*. Other reports have identified Moringa to be used for the treatment of some ailments. It has been found promote digestion, infectious disease, diarrhea, as stimulant in paralytic afflictions, epilepsy and hysteria [26].

On the other hand, *G. oleifera* gave higher inhibition of *A. niger* and *A. flavus* at different concentrations. Several studies have indicated the use of the plant to treat ailments including rheumatism, sprains, sore throats, muscular aches, pains, constipation, arthritis, vomiting, hypertension, indigestion, dementia, fever, and infectious disease [27]. In addition, [28] noted that the plant can inhibit bacterial infections because of the anti-microbial compounds it contains.

Thus, from the study *A. flavus* was found to be the most susceptible organism to the effect of the leaf extracts of *G. latifolia* and *M. oleifera* while *F. oxysporum* and *A. niger* were the most resistant organisms against these leaf extracts. These effects were significant against the test organisms. This means that on application of these extracts with increased concentrations, the zone of inhibition increases. This increase in value of zone of inhibition is increased effect of these plant extracts on the pathogens. However, decrease in value of zone of inhibition is decreased effect on the pathogens. Thus, the growth of the pathogens was most inhibited in the control and at 150 mg/ml concentration.

As [29] identified the species of *Fusarium* found in dry tuber yam rot as *F. oxysporium, F. moniliforme* and *F. solani*, the leaf extracts of *G. latifolia* and *M. oleifera* could be the best antimicrobial drug against them, especially in post-harvest yam storage. In support is [30], who used *Bacillus subtilis* to control pathogens that affects white yam (*D. rotundata*) and it was found that *B. subtilis* displaces the natural occurring mycoflora on the surface of yam tubers as was observed in yams with *T. viride*. This work revealed that fungitoxic compounds were present in *G. latifolia* and *M oleifera* leaves since they were able to suppress the growth of microorganisms tested. This agrees with earlier reports by some workers on effects of these

plants on pathogens of other crops [31,32] demonstrated the fungitoxic activity of leaves extracts of *G. latifolia* and *M oleifera* against the anthraconose fungus (*Collectotrichum lindemuthianum*) of cowpea.

5. CONCLUSION

Yams are stored relatively longer in comparison with other tropical fresh produce, and therefore stored yam represents stored wealth which can be sold all-year round by the farmer or marketer. In parts of Igbo land in Southeastern Nigeria, it is customary for the parents of a bride to offer her yams for planting as a resource to assist them in raising a family. The result of this work has shown that both *G. latifolia* and *M oleifera* leaves have potential to control post-harvest yam rot. This can provide an alternative ways of reducing and controlling rot by farmers. Fungicides of plant origin are environmentally safe and non-phytoxic. The extract of these plant materials can be easily prepared by farmers. These naturally occurring antimicrobial plant extracts could render some of the current synthetic antimicrobial agents non-useful and obsolete in the controlling of bacterial diseases because of their accessibility and non-severe damages to plants, animals and man.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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