Bima Journal of Science and Technology, Vol. 8(2B) July, 2024 ISSN: 2536-6041

DOI: 10.56892/bima.v8i2B.732

Efficacy of Plant Extract on Post-Havest Fungal Rot Pathogens of Sweet Potato *(Ipomoea batatas L.)* in Selected Local Goverment Areas of Borno State

Mshelia I. Y[1]*, Chimbekujwo I. B.[2], Zakari B.G.[2] and Puma S. H.[3]

[1]Department of Biology, College of Education Waka-Biu Borno State, Nigeria
[2]Department of Plant Science Moddibbo Adamma University Yola, Nigeria
[3]Department of Horticultural Technology, Federal College of Horticulture Dadin Kowa Gombe State

Corresponding Author: mshelia.ibrahim@yahoo.com

ABSTRACT

Sweet Potato (*Ipomoea batatas*) is attacked by fungal diseases especially *fusarium,* soft and dry ro t. Efficacy of the plant extracts were carried out in the laboratory of Plant Science Moddibbo Adama University Yola in a Completely Randomized Design. Rot incidence was of universal in all the four locations Biu, Bayo, Hawul and Kwata kusar with an average of 9.06%. Biu had the highest incidence of 13.75%, Hawul with 8.75%, Kwaya-kusar had 7.5%, with the least as observed at Bayo 6.25%.and three organisms were responsible for the rots: (*Aspergillus niger, Aspergillus flavus* and *Rhizopus stolonifer*. *Aspergillus niger* had the highest level of occurrence with the average of 5 pathogens per sample location, *Rhizopus stolonifer* 4 while *Aspergillus flavus* had the least 3 organisms per. Aqueous extracts of *Balanite aegyptica* and *Parkia biglobosa* pulp, leaf, stem and root bark at 60% proved to be effective in controlling mycelial growth in all the three organisms. *Balanite aegyptica* leaf controlled mycelial growth of *Aspergillus flavus Aspergillus niger,* and *Rhizopus stolonifer*.Aqueous to 5.74, 6.74 and 7.54 mm *invitro* respectively *and Aspergillus flavu s 6.07 invivo. Balanite aegyptica* pulp reduced mycelial growth of *Aspergyllus niger* and *Rhizopus stolonifer* invivo 6.26 and 6.25mm.

INTRODUCTION

Tena, Martín, Asuero, (2020) suggested that food security was defined as a situation in which all people at all times have both physical and economic access to adequate and nutritious food for an active and healthy life; the manner in which the food is produced, preserved and distributed are in consideration of the natural processes of the earth and thus sustainable thus reducing spoilage, scarcity, malnutrition and poverty. Sweet potato has an enormous potenti al to be an effective and economic source of fo od energy. It is an important source of antioxid ants and anthocyanidins (Zehiroglu and Ozturk, 2019; Tena *et al.,*2020). It can be incorporated with yam to make Amala and pounded yam. The production of sweet potato, especially vegetable potato, is seriously affected by rots. According to the survey carried out in Iran, 10% pre-harvest and 20% postharvest rots occurred in sweet potato (Gambari and Okinedo, 2022). Sweet potato is one of the most important crops worldwide. Apart from its importance as food crop and source of income it is also used as livestock feed. Sweet potato p ossesses many positive health benefits includi ng anthocyanins, phenolic compounds and other bioactive compounds (Laveriano-Santos *(*2022).

DOI: 10.56892/bima.v8i2B.732

Sweet potato is susceptible to a variety of field and storage diseases; the most common disease affecting sweet potato production in Nigeria is rot of sweet potato tuber, which has resulted in losses of the vegetable crop over the years Tolani, Lurwanu, Sunusi, and Aliyu, (2019)).

According to Fenta, *et al.,*2023 Postharvest pathogens can be divided into those that penetrate the produce on-farm, but develop in their tissues only after harvest, during storage or marketing on one hand; and those that initiate penetration and colonization during or after harvest on the other. Enormous postharvest losses have been attributed to fungal deteriorations (Kumar and Kalita, 2017; Khatoon, Mohapatra and Satapathy, (2016). Several fungi have been implicated in the spoilage of sweet potato. Paul (2021) reported *Penicillium* sp. *Ceratocystis fimbriata, Aspergillus niger, Diaporthebatatalis*, and *Aspergillus flavus* as fungi responsible for the postharvest decay of sweet potato. Agu (2015), reported fungi that were associated with postharvest fungal rot of sweet potato and they include *Motierella ramanniana, Rhizopus stolonifer, Mucor pusiluss, Botrytis cinerea, Erysiphe polygoni* and *Aspergillus flavus.* During the postharvest storage of sweet potato, *Aspergillus flavus* is the most dominant fungal species followed by *Aspergillus niger*, *Rhizopus stolonifera* Lewthwaite, Wright, and Triggs, 2019). *Balanites aegyptiaca* is a desert plant commonly called Desert date Chothani, & Vaghasiya (2011) screened the stem bark of *B. aegyptiaca* using methanol and acetone and reported the presence of saponins, tannins, Sunil, Sangeetha, Suchitra, Ravishankar, Yash ovarma. (2016). reported the presence of amino acids, carbohydrates, steroids, saponins coumarins and triterpenoids while alkanoids, tannins flavonoids and phenols were absent in fruit of *B. aegyptiaca*. Workers on the fruit mesocarp reported the presence of alkaloids, tannins, saponins, anthraquinones, steroids, flavonoids and cardiac glycosides as active ingredients. The screened leaves of the plant showed the presence of carbohydrates, amino acids, glycosides, saponins, flavonoids, phenols and tannins but there were no alkanoids, as reported by (Kumawat, Gupta, C hand, and Singh, (2023); Ojo, Nadro, and Tell a,(2023). conducted phytochemical screening of the root, stem and leaf of *B. aegyptiaca* and reported presence of very high concentration o f saponins and moderately high concentration of tannin in all the parts of the plant while Cardiac glycosides and anthaquinones were only present in the leaf.

Many researchers have worked on sweet potato in different parts of the World, Africa and Nigeria but little work has been done on sweet potato in the selected local governments of this study and besides little concern is given to sweet potato diseases and their control. The researcher deemed it necessary to try control measures using plants extracts easily accessible to the farmers and sellers to control postharvest rot of sweet potato: hence, the motives behind this research work.

The aim of the study is to isolate, identify and control fungi associated with the postharvest rot of sweet potatoes in some selected Local Government areas of Borno State (Bayo, Biu, Hawul and Kwaya kusar) using *Balanite aegyptica* pulps, leaves, barks of stem and root as a control measure against the isolated organisms *invitro* and *invivo*

MATERIALS AND METHODS

Collection of Studied Plant Materials

The survey of sweet potato rot was conducted in Biu, Hawul, Kwaya kusar and Bayo Local Government areas in the year 2022, where sweet potatoes are produced as well as sold and used as a staple food. A total of 360 sweet potato tubers (healthy and diseased) was collected using random sampling (ninety) 90

DOI: 10.56892/bima.v8i2B.732

from each local government area with thirty 30 from each sub locations from each local government within the location. Both rotten and healthy potatoes tubers was taken labeled and taken `to the research laboratory of Modibbo Adamma University (MAU) Yola for analysis as was done by Baskin and Baskin, (2014). Tubers with physical abnormalities like, shriveling of tubers, reduction or increase in size, discoloration, fungal fruiting bodies or spots on the tubers was considered as abnormal tubers as described by (Bock *et al*.2010). Twelve tubers were replicated three times for each location.

Experimental Design

The design for the experiment was Completely Randomized Design (CRD) (Baskin and Baskin 2014). Incidence of rot was determined by simple percentage as was done by Watanabe, (2002), using the formula below:

$$\text{Disease Incidence (\%)} = \frac{\text{Number of disease samples}}{\text{Total Number of samples examined}} \times 100$$

Extraction of Bioactive Compounds from *Balanite aegyptica*

Leaves, pulp, and barks of stem and roots of *Balanite aegyptica* was obtained in Sangere, Girei Local Government Area of Adamawa State, where it was dried under shade and taken to the laboratory of Plant Science MAU Yola for preparation.

Observation for Fungal Growth on Potato

Observation for fungal growth and tuber rot was made for seven (7) days and result was made. Percentage rot was determined using modified Echemede. (1985) as reported by Talba and Zakari, 2018. visual scale of 1-5. Healthy sweet potato tubers (Ipomoea batatas (L) (uniform in size 100-150g) was selected and washed to remove excess soil, to be surface sterilized in0.5% Sodium hypochlorite solution for 3 minutes and rinsed in 3 changes of sterile distilled water and then air dried Peter,Lees,

Cullen,. Sullivian, Stround,. and Cunning ton,.(2008a) The surface sterilized tubers were wound with 5.0 mm cork borer, with a diameter of 5.0 mm to a depth of 5.0 mm while the bored tissues were removed (Peters *et al.,*2008a; Peter, Lees, Cullen, Sullivian, Stround and Cunning ton. (2008b). The wounded tubers were inoculated with 5.0mm disc of the inoculum and sealed with a sterile vesper prepared from wax and Vaseline. Control experiment was set up in the same way except that 5.0mm of sterile distilled water was used instead of inoculum. All the potato tubers to be wounded was incubated in desiccators that was sterilized. Regular observations were made for isolation and comparison with original isolates.

The tubers were surface sterilized with 0.2% sodium hypochlorite for 3-5 minutes and rinsed in three changes of sterile distilled water. Petri dishes were sterilized in oven at 160^0 for one hour. The inoculating needles was sterilized by flaming over a bunsen burner and cooled by dipping them into ethanol. The media was autoclaved in an autoclave for fifteen (15) minutes at 101 lbs pressure at 121^0 and allowed to cool. The incubation of the organism was done in a sterile environment in the inoculation chamber. The table in the inoculation chamber was wiped with 95% ethanol and then ultraviolet light (UV) was switched on for thirty (30) minutes before carrying out the inoculation (Weber and Rutala, 2012).

Pathogenicity Test

To ascertain the pathogenicity of the fungal strain that was isolated, the approach of

DOI: 10.56892/bima.v8i2B.732

(Baskin and Baskin, 2014) was employed. Apparently healthy sweet potato tubers were surface sterilized with 0.5% sodium hypochlorite solution for five (5) minutes and then rinsed in three changes of sterile distilled water. The surface sterilized tubers were wounded with 5.0 mm cork borer, with a diameter of 5.0mm to a depth of 5.0mm and bored tissues was removed (Peters *et al.,*2008a; 2008b). The wounded tubers were inoculated with 5.0mm disc of the inoculum and sealed with a sterile vesper prepared from wax and Vaseline. A control experiment was set up in the same way except that 5.0mm of sterile distilled water was used instead of inoculum. All the wounded potato tubers were incubated in desiccators that have been sterilized. Rot symptoms that develop was compared with the original rot. The control will not be inoculated with any isolate.

In preparing the media, thirty-nine (39g) grams of Potato Dextrose Agar (PDA) powder was placed in five-liter conical flask. One liter of distilled water was added mixed and completely dissolved the powder. The supernatant was carefully into sterile conical flask which the mouth was covered with sterile cotton wool and then wrapped with aluminum foil for autoclaving at 121^0 for fifteen (15) minutes at 101 lbs pressure (Smith and Onion, 1994). The infected sweet potato tubers were surfaced sterilized using I % sodium hypochlorite solution for 3minutes and then rinsed in 3changes of distilled water and air dried, 5mm long section of diseased tuber was cut using a sterile scissors, razor blade under aseptic condition and be will plated on Potato Dextrose Agar (PDA). The plates were incubated at 25 °C for 24hrs and observed for any growth. The resulting spore colonies was transferred to fresh Potato Dextrose Agar (PDA) plates and maintained at 40°C for further studies. The slides of the organism isolated was prepared and stained with lactophenol cotton blue and observed under the microscope and subsequently identified by comparing the morphological characteristics of the organisms under the microscope and be compared with the structures in (Baskin and Baskin 2014)

After incubation for seven (7) days, the dishes were removed and arranged serially. Moving from one petri dish to other each tuber was examined under a stereomicroscope for its high precision. Habit characters of the fungus was observed and used in identifying the fungal strain that grow on the tubers with the help of identification scheme of Snowdon (1990). Slide preparation of fruiting structures and spores of the fungi was examined under compound microscope to further confirm their identities by consulting mycological literature tuber health analyst adopting the method of (FAO 2016; Odeyemi and Adeniyi, 2015). The abbreviations for the identified fungus were written on the wet blotter beside the tuber with green blotter pencil.

The fungal strain in each petri dish was counted by crossing the abbreviations. Count of each fungal strain from each dish was entered working recording sheets immediately after examination of the dish. Mathur and Konsdal, 2003.

Anti-Fungal Analysis

Leaves, pulp, and barks of stem and roots of *Balanite aegyptica* was dried under shade and pounded separately. One hundred and fifty grams of each sample was soaked in 100 ml (1 l) of distilled water for 24 hours, the aqueous mixture was filtered with sterile cheese cloth and was centrifuged for 15 minutes and the supernatant was taken as aqueous extract (Khatoon *et al.,*2014). 2 g of the extract was weighed and dissolved in 50ml of distilled water, it was vigorously shaken until it was dissolved and was used at 20%, 40% and 60% concentrations.

DOI: 10.56892/bima.v8i2B.732

In vitro assay of the plant extract efficacy was determined by inoculating the PDA/Plant extract with 5mm disc of each pathogenic fungus, using the different plant extract concentrations of 3ml of 20%, 3ml of 40%, and 3ml of 60%. Daily records of mycelia growth were taken and recorded for 7days. Each treatment was replicated three times for each concentration level and control (Taiga, 2011). Inhibition level was recorded by drawing two lines intersecting at the centre bottom of the petri dish. Linear mycelia growth was taken along predetermined lines and the rate of growth was determined.

In vivo test was carried out by determining the effect of the extract concentrations on rot depth as follows. With sterile cork borer, 5.0 mm diameter hole was made on each potato tuber. A disc of each fungus culture (5.0mm diameter) was soaked for 30 seconds in 3ml of 20%, 3ml of 40%, and 3ml of 60% of plant extract in sterile Petri-dish; and immediately introduced into the hole, using sterile mounting needle and forceps; the tissue previously removed from the hole was replaced after about 2.0mm had been cut off to compensate for the thickness of the inoculums (Taiga, 2011). The point of inoculation was sealed with Vaseline and the inoculated tubers was incubated on clean laboratory table for 14 days at room temperature (25±2 °C). Daily record of tuber rot was measured and recorded. Each treatment was replicated three times. A control experiment was set up while distilled water was used instead of inoculums.

Statistical Analysis

The results obtained from the *in vitro* analysis was evaluated SAS for the analysis of variance (ANOVA).

RESULTS AND DISCUSSION

Incidence of Fungal Rot Pathogens on Sweet Potato

The study was carried out on survey on fungal rot pathogens of sweet potato while testing the efficacy of four parts of Desert date tree on the isolated organisms between 2020 and 2022. Dry and soft rots were encountered. Pathogenicity test on these isolates proved them to be postharvest rot fungal pathogens of sweet potatoes in the four locations. The study revealed the incidence of sweet potato diseases from the four Local Governments Areas of Southern Borno State (Biu, Bayo, Kwayay-kusae and Hawul). Dry and soft rots were encountered and three organisms were responsible for the rots: (*Aspergillus niger, Aspergillus flavus* and *Rhizopus stolonifer*. Rot incidence was of universal occurrence in all the four locations sampled with an average of 9.06%. Biu had the highest incidence of 13.75%, followed by Hawul with 8.75% while Kwaya-kusar had 7.5%, with the least in Bayo 6.25%. (Watanabe, 2002), as on Table 1.

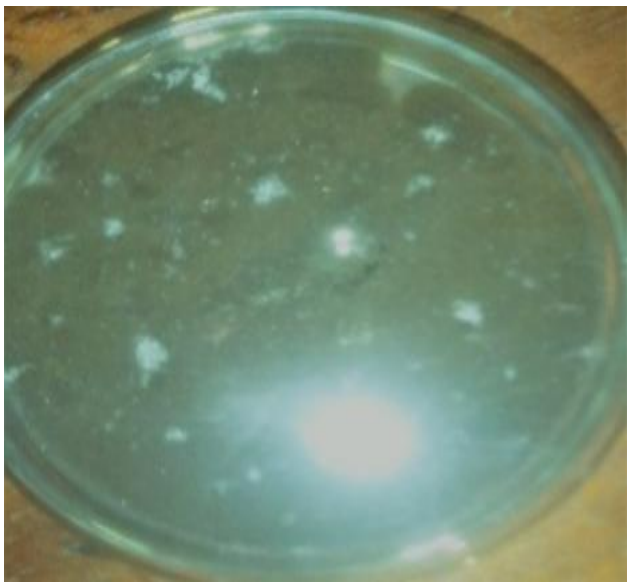
Table 1: Disease Incidences (%) of Sweet Potato Rot from four selected local government areas

Location	Incidence of rot (%)
Bayo	6.25
Biu	13.75
Hawul	8.75
Kwaya-kusar	7.5
Average	9.06

The isolates were identified based on colonial and morphological characteristics, as could be seen on plates 1, 2 and 3 A, B and C. *Aspergillus niger, Aspergillus flavus* and *Rhizopus stolonifer*. Were identified as the pathogens that causes sweet potato rot in the

DOI: 10.56892/bima.v8i2B.732

study area: (Biu, Bayo, Kwaya-kusar and Hawul) Borno State. These were identified based on colonial and morphological characteristics. Out of the three fungal pathogens sampled, *Aspergillus niger* had the highest level of occurrence with the average of 5 pathogens per sample location, while *Rhizopus stolonifer* had average of 4 pathogens per sample location while *Aspergyllus flavus*. Nsofor (2020).



|Plate 1 A

Plate 1 B

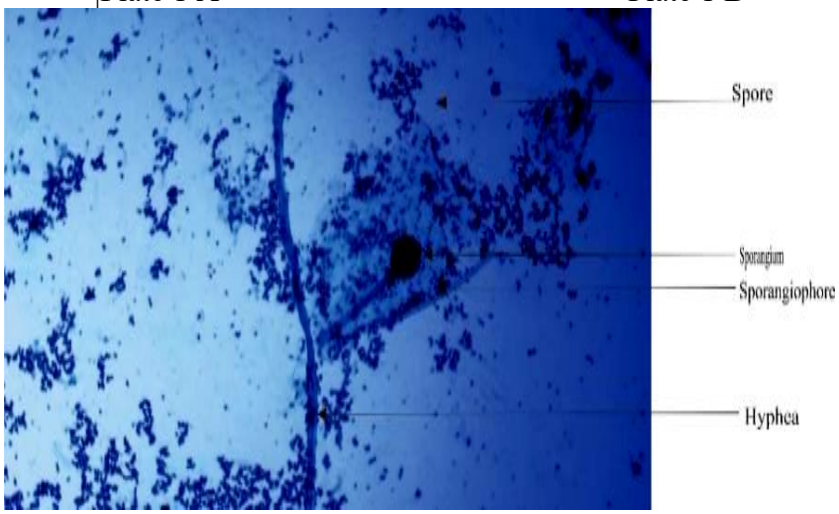


Plate 1C

Plate 1: Cultural and morphorlogical characteristics of seven days *Aspergyllis niger.* A front plateshowig mycelial growth, B reverse plate, C: hypha, sporangium, sporangiophre and spores at x10 objective. *A.niger* (micrograph)

Bima Journal of Science and Technology, Vol. 8(2B) July, 2024 ISSN: 2536-6041

DOI: 10.56892/bima.v8i2B.732

Plate 2A

Plate 2B

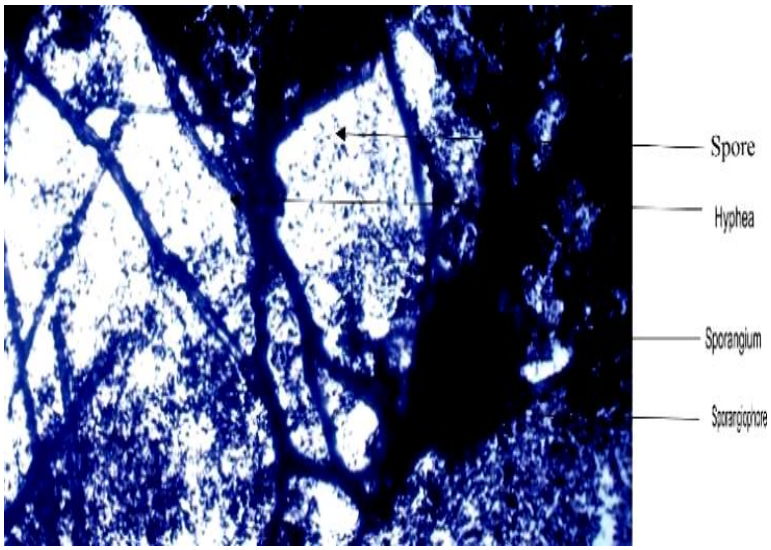


Plate 2C

Plate 2: Cultural and morphorlogical characteristics of seven days *Aspergyllis flavus.* A front plateshowig mycelial growth plate, B reverse plate, C: hypha, sporangium, sporangiophre and spores at x10 objective *Aspegyllus.flavus*

Bima Journal of Science and Technology, Vol. 8(2B) July, 2024 ISSN: 2536-6041

DOI: 10.56892/bima.v8i2B.732

Plate 3A Plate 3B

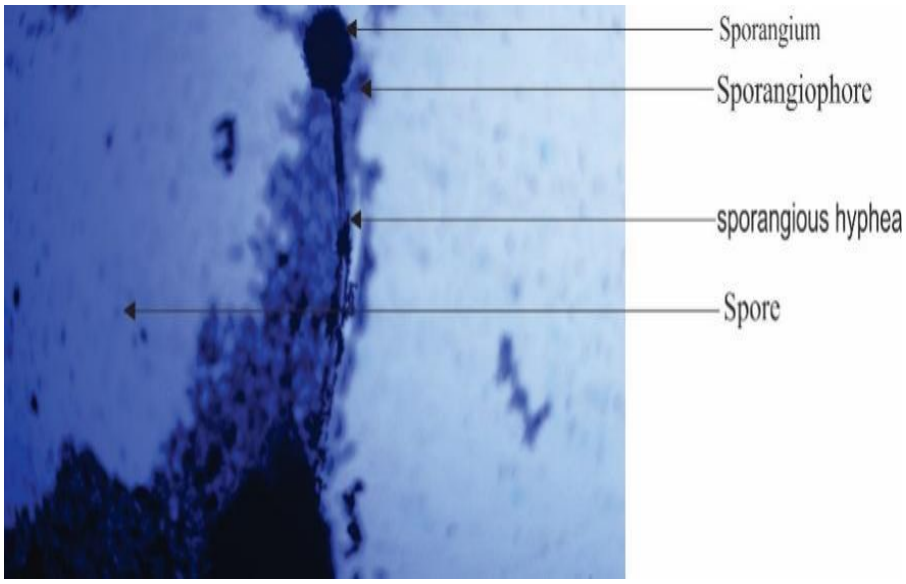


Plate 3C

Plate 3: Cultural and morphorlogical characteristics of seven days *Aspergyllis niger.* A front plate showig mycelial growth plate, B reverse plate, C: hypha, sporangium, sporangiophre and spores at x10 objective. *Rhizopus.stolonifer.*

Aspergillus niger had the highest level of occurrence with the average of 5 pathogens per sample location, while *Rhizopus stolonifer* had average of 4 pathogens per sample location while *Aspergillus flavus* had the least average level of occurrence of 3 organism per sample location as seen on Table.

Bima Journal of Science and Technology, Vol. 8(2B) July, 2024 ISSN: 2536-6041

DOI: 10.56892/bima.v8i2B.732

Table 2: Frequency of Occurrence of isolates from Infected Sweet potatoes

Location	% frequency		
	Aspergyllus niger	***Apergyllus flavus***	***Rhizopus stolinifer***
Bayo	2	2	1
Biu	10	5	6
Hawul	6	4	4
Kwaya-kusar	2	1	3
Total	20	12	16
Average	5	3	4

Aqueous extracts of Desert date (*Balanite aegyptica)* pulp, leaf, stem and root bark were tested for their efficacy in the controlling of fungal rot pathogens of sweet potato. Aqueous extracts of plant parts were active in reducing infection caused by *Aspergyllus flavus, Aspergyllus niger* and *Rhizopus stolonifer* in sweet potatoes to the bearest minimum level. Among the two plants with four parts each studied, all were found to have inhibitory effects on mycelial growth of all the three fungal pathogens (*Aspergyllus flavus, Aspergyllus niger* and *Rhizopus stolonifer) invitro* and *invivo.* Hayat, Akodad, Moumen, Baghour, Skalli, Ezrari, and Belmalha (2020.) ; Ojo *et al*.,2023). Treatment *of Aspergyllus flavus* with different concentrations aqueous extracts of Desert date showed significant (P<0.001) reduction in growth of *Aspergyllus flavus.* The effect is also shown by the ANOVA analysis of minimum inhibition concentration (Table 3) Maximum inhibition was recorded in 60% concentration of Desert date leaves (5.74).

Table 3: Effects of the different concentrations of aqueous extracts of Desert date parts on the mycelial growth of *Aspergyllus flavus invitro.*

Plant parts	**% Concentration**			
	0.0	20%	40%	60%
DD pulp	25.44	14.96	11.66	8.40
DD leaves	25.74	14.45	11.52	5.74
DD roots	25.21	16.11	13.56	10.45
DD stem	26.02	16.95	13.80	11.31
P-value				0.001
LSD-0.974		0.615		

DD = Desert date

Treatment *of Aspergyllus niger* with different concentrations aqueous extracts of Desert date showed significant (P<0.001) reduction in growth of *Aspergyllus niger.* The effect is also shown by the ANOVA analysis of mini mum inhibition concentration (Table 4) Maximum inhibition was recorded in 60% concentration of Desert date leaves (6.74).

Table 4: Effects of the different concentrations of aqueous extracts of Desert date parts on the mycelial growth of *Aspergyllus niger invitro.*

Plant parts	**% Concentration**			
	0.0	20%	40%	60%
DD pulp	25.54	10.62	9.89	6.92
DD leaves	25.38	14.95	11.23	6.74
DD roots	25.87	10.62	11.82	9.81
DD stem	25.12	15.41	14.23	11.55
P-value				0.001
LSD-0.974		0.615		

DOI: 10.56892/bima.v8i2B.732

DD = Desert date

Table 5 shows the treatment of *Rhizopus stolonifera* with different concentrations of aqueous extracts of Desert date showed significant (P<0.001) reduction in mycelial growth. The effect is also shown by the ANOVA analy sis of minimum inhibition concentration. maximum inhibition was recorded in 60% con centration of Desert date leaves (7.54).

Table 5: Effects of t different concentrations of aqueous extracts of Desert date parts on the mycelial growth of *Rhizopus stolonifer invitro.*

Plant parts	**% Concentration**			
	0.0	20%	40%	60%
DD pulp	25.62	15.07	12.03	7.67
DD leaves	25.96	14.80	10.69	7..54
DD roots	26.28	15.07	12.63	11.70
DD stem	26.31	16.87	14.75	11.54
P-value				0.001
LSD-0.974		0.615		

DD = Desert date

Treatment *of Aspergyllus flavus* with different concentrations of aqueous extracts of Desert date *invivo* showed significant (P<0.001) reduction in mycelial growth of *Aspergyllus flavus.* The effect is also shown by the ANOVA analysis of minimum inhibition concentration (Table 6) Maximum inhibition was recorded in 60% concentration of Desert date leaves (6.07).

Table 6: Effects of the different concentrations of aqueous extracts of Desert date parts on the mycelial growth of *Aspergyllus flavus invivo.*

Plant parts	**% Concentration**			
	0.0	20%	40%	60%
DD pulp	25.23	15.14	11.49	6.96
DD leaves	25.44	14.96	11.66	6.07
DD roots	25.08	15.36	12.86	10.72
DD stem	26.02	14.83	12.51	11.62
P-value				0.001
LSD-1.946		1.445		

DD = Desert date

Treatment *of Aspergyllus flavus* with different concentrations aqueous extracts of Desert date showed significant (P<0.001) reduction in mycelial growth of *Aspergyllus niger.* The effect is also shown by the ANOVA analysis of minimum inhibition concentration (Table 7) Maximum inhibition was recorded in 60% concentration of Desert date leaves (6.26).

Table 7: Effects of the different concentrations of aqueous extracts of Desert date parts on the mycelial growth of *Aspergyllus niger invivo.*

Plant parts	**% Concentration**			
	0.0	20%	40%	60%
DD pulp	25.44	15.62	10.61	6.26
DD leaves	25.54	10.62	9.86	6.92
DD roots	25.58	15.02	13.22	11.33
DD stem	24.98	17.33	13.65	11.46
P-value				0.001

DOI: 10.56892/bima.v8i2B.732

LSD-1.946	1.445

DD = Desert date

Table 8 shows the Treatment of *Rhizopus stolonifera* with different concentrations aqueous extracts of Desert date *invivo* showed significant (P<0.001) reduction in mycelial growth.The effect is also shown by the ANOVA analysis o f minimum inhibition concentration. Maximu m inhibition was recorded in 60% concentratio n of Desert date pulp (6.25).

Table 8: Effects of the different concentrations of aqueous extracts of Desert date parts on the growth of *Rhizopus stolonifer invivo.*

Plant parts	**% Concentration**			
	0.0	20%	40%	60%
DD pulp	25.57	14.17	9.28	6.25
DD leaves	25.62	15.07	12.03	7..67
DD roots	26.11	15.20	13.40	9.88
DD stem	26.10	15.23	12.66	11.74
P-value				0.001
LSD-1.946		1.445		

DD = Desert date

Aqueous extracts of Desert date (*Balanite aegyptica)* pulp, leaf, stem and root bark were tested for their efficacy in the controlling of fungal rot pathogens of sweet potato. Aqueous extracts of plant parts were active in reducing infection caused by *Aspergyllus flavus, Aspergyllus niger* and *Rhizopus stolonifer* in sweet potatoes to the bearest minimum level. Among the four parts each studied, all were found to have inhibitory effects on mycelial growth of all the three fungal pathogens (*Aspergyllus flavus, Aspergyllus niger* and *Rhizopus stolonifer) invitro* and *invivo.* However, the relative intensity of the antifungal
effects varies with the plant parts and concentration of the extract. (Hayat *et al.,*2020; Ojo *et al*.,2023). The Desert date leaf extract recorded the maximum inhibtion of mycelial growth of *Aspergyllus flavus, Aspergyllus niger* and *Rhizopus stolonifera invitro* at the concentration of 60%. It also reduced the activities of *Aspergyllus flavus* at 60% concentrion *invivo.* Desert date pulp reduced mycelial growth of *Aspergyllus niger* and *Rhizopus stolonifer invivo* at the same 60% concentration. This finding is in consonant with the study carried out by Sunil *et al.,*2016 and Bidawat, Nagnd, and Nag, (2011) who studied the antifungal properties of Desert date plant and reported that the spore germination of fungus was withheld, (Al Ashaal, 2010; Panghal, Kaushal, Yadav,2011). Meda, amien, Meda, Kiendrebeogo, Lamien, Coulibaly, and Millogo-Rasolodimby (2010) Previous studies have revealed that Desert date have multiple p harmacological properties including antibacterial, antifungal, antiparasites, antimal aria, antihelmentic, anticancer,antidiabetic antiviral and host of others Zarroug, Nugud,

Bashir, Mageed 1990, Anto Aryeetey Anyorig Asoala Kpikpi 2005 .

CONCLUSION

It may be concluded from this study that there are prevalence and severity of soft and dry rot disease of sweet potato in the study areas. Most farmers and sellers are low income earners and
may not be formally educated who obtained their seedlings and tubers from uncertified sources and farmers, while no proper storage was done to increase the self-life of the sweet

DOI: 10.56892/bima.v8i2B.732

potatoes. All the four parts were effective against the fungal pathogens tested *invitro* and *invivo*. Desert date pulp, leaves were found to be the most effective plant extract for controlling fungal diseases. They have alkanoid, tanins, flavonoid and saponins which could be highly responsible for the high antifungal activity displayed in this study.

REFERENCES

Agu, K.C,1., Nweke, G.U., Mgbemena, I.C.C., Okigbo, R. and Ngenegbo U.C. Fungi,20 15. Associated with the Post-Harvest Loss of Sweet Potato *International Journal of Research Studies in Biosciences* (IJRSB) Volume 3, Issue 9, September 2015, PP 33-38 ISSN 2349-0357 (Print) & ISSN 2349-0365 (Online) www.arcjournals.org

Anto F., Aryeetey ME, Anyorigiya T., Asoala V., Kpikpi J. 2005 The relative susceptibilities of juvenile and adult Bulinus globosus and Bulinus truncatus to the molluscicidal activities in the fruit of Ghanaian Blighia sapida, Blighia unijugata and *Balanites aegyptiaca*. *Ann Trop Med Parasitol.* 200 5; 99:211–7. [PubMed] [Google Scholar]

Al Ashaal HA, Farghaly AA, Abd El Aziz MM, Ali MA. Phytochemical investigation and medicinal evaluation of fixed oil of Balanites aegyptiaca fruits (Balantiaceae). J Ethnopharmacol, 2010; 127: 495–501.

Baskin, C.C., and Baskin, J. M., (2014). *Seed: ecology, biogeography, and evolution of dormancy and germination.* Elsevier academic press, San Diego

Bidawat, S. R., Nagnd, T.N., Nag, 2011. Antimicrobial principles from tissue cultures of *Balanites aegyptiaca*. Biotechnol. Lett; 16: 6120-6124

Bock, C. H., Poole, G. H. Parker, P. E. Gottwald, T. R. (2010a). *Plant disease severity estimated visually, by digital photography and image analysis, and by hyperspectral imaging*. *Crit Rev Plant Sci*. 2010a; 29:59–107.

Chothani, D. L. & Vaghasiya, H. U. (2011). A Review on Balanites aegyptiaca (L) Del (desert date): Phytochemical constituents, traditional uses, and pharmacological activity. Pharmacognosy Review, 5, 9, pp. 55-62. Chua, L. S., Lau, C. H., Chew, C. Y. & Dawood,

Fenta, L. Mekonnen, H. Kabtimer, N. (2023). The Exploitation of Microbial Antagonists
against Postharvest Plant Pathogens. Micr oorganisms, 11(4),1044. MDPI AG. Retrieved from http://dx.doi.org/10.3390/ microorganisms11041044

Food and Agricultural Organization (FAO) (2 016). Corporate document repository: wil dedible fungi: a global overview of their i mportance to people.http://www.fao.org.d ocuments. Accessed 4 Dec.

Gambari, U. O. B and Okinedo, J. I. (2020). Aetiology ofF ungal Diseases of Sweet Potato (Ipomoea Batatas (L)) During Post Harvest Storage in Offa Kwara State, Nigeria. *Journal of Agriculture and Veterinary Sciences* Volume 12, Number 2, ISSN: 2277-0062 http://www.cenresinjournals.com

Hayat, J. Akodad, M., Moumen, A, Baghour, M, Skalli, A, Ezrari, S. and Belmalha, S. (2020.) Phytochemical Screening, Polyphenols, Flavonoids and Tannin Content, Antioxidant Activities and FTIR Characterization of Marrubium vulgare L. from 2 Different Localities of Northeast o f Morocco. Heliyon, 6, E05609. https://do i.org/10.1016/j.heliyon.2020.e05609

Khatoon, A, Mohapatra, A and, Satapathy, K. B. (2016). Fungi Associated with Storage Rots of *Colocasia esculenta* L. Tubers in

DOI: 10.56892/bima.v8i2B.732

Bhubaneswar City, Odisha. *British Micr obiology Research Journal,* 12(3), 1-5.

Khatoon, K.R., Jahan. N. Ahmad. S. and Shabzad A. (2014). in vitro evaluation of antifungal activity of aerial parts of medicinal plants Balanites aegyptiaca Del. And Splilanthes acmella Murr. *Journl Applied Pharm sci.* 4 (01):23-127.

Kumar, D. and Kalita, P. (2017). Reducing Postharvest Losses during Storage of Grain Crops to Strengthen Food Security in Developing Countries. Foods (Basel, S witzerland), 6(1), 8. https://doi.org/10.33 90/foods6010008.

Kumawat, B. K, Gupta, M. Chand, T and Sing h, Y. (2023). Preliminary phytochemical i nvestigation on leaves of *Balanites aegyptiaca* (L.) Delile. *Research Journal of Pharmaceutical, Biological and Chemical Sciences.* 2012; 3:762-768.

Laveriano-Santos, E. P., López-Yerena, A., Jaime-Rodríguez, C, González-Coria, J, Lamuela-Raventós, R. M, Vallverdú-Queralt, A, Romanyà, J. and Pérez, M. (2022). Sweet Potato Is Not Simply an Abundant Food Crop: A Comprehensive Review of Its Phytochemical Constituents, Biological Activities, and the Effects of Processing. Antioxidants (Basel, Switzerl and), 11(9), 1648. https://doi.org/10.3390 /antiox11091648

Lewthwaite, S.L, Wright, P.J and Triggs, C.M. (2019). Sweet Potato Cultivar Susceptibility to Infection by *Ceratocystis fimbriata. New Zealand Plant Protection,* 64: 1-6.

Mathur, S. B and Konsdal, O. (2003). Commo n laboratory seed health testing methods f or detecting fungi. Bassersdorf, Switzerland, ISTA, 425pp

Meda, NT, Lamien Meda, A, Kiendrebeogo, M, Lamien, CE, Coulibaly, AY and Millo go-Rasolodimby J, (2010) *In vitro* antioxidant, xanthine oxidase and acetylcholinesterase inhibitory activities of *Balanites aegyptiaca* (L.) Del. (Balanit aceae) *Pak J Biol Sci.* 2010;13:362–8.

Nsofor, G. C. (2020). Fungal and bacterial pathogens associated with soft rot disease of sweet potato (ipomoea batatas, l. Lam). *Nigerian agricultural journal.* ISSN:0303 68X Volume 51 Number 3, December 20 20 Pg. 213-218, Available online at: http://www.ajol.info/index.php/naj

Odeyemi, O. Adeniyi, M. A and Odeyemi, Y. (2015). Introduction to tropical mycology. Universal Academic Press, Nigeria

Ojo O. O, Nadro, M. S, and Tella, I. O. (2023). Protection of Rats by Extracts of Some Common Nigerian Trees Against Acetaminophen-Induced Hepatotoxicity. *African Journal of Biotechnology.;* 5:755-760.

Smith, D. and Onions, H. S. (1994). Preservation Techniques for fungi, IMI Publication.Ppzp. Sweet Potato on Weevil Damage in the Lake Zone of Tanzania, In:

Sunil, K. N. Sangeetha, B. Suchitra, P. Ravishankar, B. Yashovarma. (2016). Pharmacognosy and Quality Characterization of Balanites aegyptiaca (L.) Delile Fruits. *Indian Journal of Natural Products and Resources;* 7:40-50.

Paul, O. 2021 Fungal species associated with the spoilage of some edible fruits in Maiduguri North Eastern Nigeria.

Panghal M, Kaushal V, Yadav JP. In vitro antimicrobial activity of ten medicinal plants against clinical isolates of oral cancer cases. Ann Clin Microbiol Antimicrob, 2011; 10: 21-32.

Peter, J. C. Lees, A. K. Cullen, D.W. Sullivian, L. Stround, G. P. and Cunning ton, A. C.(2008a). Characterization of Fusarium spp. Responsibility for causing dry rot potato in great Britian *Plant Pathol*57:26 2-271.

DOI: 10.56892/bima.v8i2B.732

Peter, J. C. Lees, A. K. Cullen, D. W. Sullivian, L. Stround, G. P. and Cunning ton, A.C. (2008b) Characterization of Fusarium spp. Responsibility for causing dry rot potato in great Britian Plant Pathol.57:262-271.

Taiga, A. (2011). Effect of Azadirachta Indica Leaf Extract on Fungi Associates with Ipomoea Batatas Tuber Rot in Anyigba, Kogi State. *International Journal of Science and Nature.* 2(2): 409-410

Talba, U. and Zakari, B. G. (2018). Identificati on and Control of Seed Born Fungal Pathogens of Maize Seed (*Zea mays*) Using Plant Extracts International Journal of Science and Research (IJSR) ISSN: 2319-7064

Tena, N., Martín, J., Asuero, A. G. (2020). State of the Art of Anthocyanins: Antioxidant
Activity, Sources, Bioavailability, and Th erapeutic Effect in Human Health. Antiox idants (Basel, Switzerland), 9(5), 451. https://doi.org/10.3390/antiox9050451

Tolani, B. Lurwanu, Y. Sunusi, M. and Aliyu, S. (2019). Effect of Storage Methods and Management of Sweet Potato on the Incidence of Tuber Rot Induced by Rhizopus stolonifer in Kano, Nigeria. 10.29244/jtcs.6.01%25p.

Watanabe T., (2002). *Pictorial Atlas of Soil and Seed Fungi:* Morphologies of Cultured Fungi and Key to Species. 2nd ed. CRC Press Boca Raton 2002.

Weber, D. J. and Rutala, W. A. (2012). Self-disinfecting surfaces: Rsvabovaeview of current methodologies and future prospects. *Am. J. Infect.* Control. 2013; 41:31–35. doi: 10.1016/j.ajic.12.005.

Zarroug IM, Nugud AD, Bashir AK, Mageed AA. *Balanites aegyptiaca* as a Mosquito Larvicide. *Pharma Biol.* 1990; 28:267–71. [Google Scholar]

Zehiroglu, C., Ozturk Sarikaya, S. B. (2019). The importance of antioxidants and place in today's scientific and technological studies. *Journal of food science and technology,* 56(11), 4757–4774. https://doi.org/10.1007/s13197-019-03952-x.