EFFECTS OF PRETREATMENTS AND GROWTH-MEDIA ON EARLY GROWTH PERFORMANCE OF *Uvariopsis tripetala* (Baker f.) G.E.Schatz. SEEDLINGS

***[1]Jeminiwa, M.S; [2]Jeminiwa, O.R; [2]Olaoti-laaro, S.O; [2]Woghiren, A.I; [2]Aina-Oduntan, O.A and Agbeje, A.M**
**1 Southern Guinea Savanna Research Station, (FRIN), Mokwa, Niger State, Nigeria*
2 Forestry Research Institute of Nigeria (FRIN), Ibadan, Oyo State, Nigeria
Corresponding Author's Email: jemsam7@gmail.com; 08030777262

ABSTRACT
The study investigated the effects of pretreatments and growth-media on early growth performance of Uvariopsis tripetala seedlings with a view to providing the silvicultural requirements for seedling production and conservation of this species. The fruits for this work were procured from Akinlaja village, Odigbo Local Government Area, Ondo State. The extracted seeds were pretreated using three pretreatment methods (Cold stratification, Mechanical scarification and H_2SO_4). The seedlings were transplanted into three growth-media (Topsoil, Sawdust and Biochar) replicated thrice using Randomized Complete Block Design (RCBD). Seedlings from cold stratification planted on topsoil had the highest mean height value (5.12±0.14). Followed by the seedlings from mechanical scarification planted on biochar with (5.03±0.14). While the least mean value was recorded from H_2SO_4 pretreatment planted on topsoil (3.95±0.14) at ($p > 0.05$).Seedlings from mechanical stratification planted on sawdust had the highest mean collar diameter (1.95±0.34). Followed by seedlings from H_2SO_4 planted on sawdust (1.88±0.34) and least value (0.75±0.34) also from H_2S0_4 seedling planted on topsoil medium. Seedlings from cold stratification planted on biochar and topsoil had the highest mean number of leaves (3.99±0.23 and 3.67±0.23) respectively. While the least mean value (3.34±0.23) from H_2SO_4 seedlings planted on biochar medium. The results showed that cold stratification pretreatment and decomposed sawdust medium were most preferred for mass seedling production for the species at nursery stage. Further studies were recommended for more silvicultural requirements and floral biology of the species for sustainable production and conservation.

***Keywords**: Pretreatment, Growth-media, seedling-growth, Conservation, Uvariopsis tripetala*

Introduction

Uvariopsis tripetala is an indigenous forest fruit species which belongs to the family Annonaceae. It is a common ethno-medicinal plant in West Africa whose fruits appears red when ripe and green when unripe with a pungent and spicy taste. In English, *Uvariopsis tripetala* is called pepper fruit, "Mmimi" in Igbo, "Nkarika" in Ibibio and Efik, "Imako" by Urhobo of Niger-Delta region and "Ata igbere" by the Yorubas in Southwestern part of Nigeria (Onefeli and Akinyele, 2014). The parts used include the leaves, fruits, seeds, roots and stem (Timothy and Okere, 2008). It is widely domesticated in the rainforest belt of West Africa especially in Ivory Coast, Cameroon and Nigeria especially in the South, East and Western part of Nigeria (Okwu and Morah, 2004). Adedayo *et al.* (2010) noted that the fruits had alkaloids, tannins, saponins, flavonoids, terpenoids, steroids and glycosides which differs from the reports obtained in 2015 (Egharevba and Edah, 2015).

The fruit of this plant is edible and has a peppery and spicy taste. It serves as a mild stimulant and as a source of some vitamins which are vital for human wellbeing. The leaves are used to treat mild fever in combination with mango leaves. The fruits are used as masticators and the unique peppery effect is explored for treating mouth sore and other digestive tract problems (Keay, 1989). The fruits are sometimes taken with kolanut, garden egg and palm wine as stimulants for local deities in some area especially in the southeastern part of Nigeria (Enwere, 1998). Some studies revealed that pepper fruits contain Dennetia essential oils, phenolic acid, ethanol, alkaloids, ethylacetate, flavonoids, tannins and glycosides (Ejechi and Akpomedaye, 2005; Adedayo *et al*., 2010; Egharevba and Edah, 2015). Hence, Elekwa *et al*. (2011) affirmed that the medicinal properties of this species could be ascribed to the varieties of secondary metabolites such as alkaloids, flavonoids, tannins and terpenoids that are present in the plant. Studies showed that the high presence of essential oil called oleoresins accounted for the aromatic flavoring, colouring and pungent properties of pepper fruits (Aderogba *et al.*, 2011). However, *Uvariopsis tripetala* exhibit epigeal germination and it has inconsistent fruiting, poor seed germination and slow seedling growth (Osaigbovo *et al.,* 2010). Thus, this species have been identified as threatened species according to 2006 IUCN red list of threatened species (IUCN, 2006). Despite the multipurpose nature of this species, information on the ecology, silvicultural requirements and conservation are limited. Therefore, urgent research attention is needed towards salvaging this multipurpose medicinal plant species from extinction. This study therefore examined the effects of pretreatments and growth-media on the early growth trends of *U. tripetala* seedlings to enhance the sustainable production and conservation of this multipurpose plant species for human benefits.

Materials and Methods

Experimental Site

The experiment was carried out in the central nursery screen house of Southern Guinea Savanna Research Station, Forestry Research Institute of Nigeria, Mokwa, Niger State. The research station is situated along Mokwa to Bida road in Mokwa Local

government area of Niger State. It is located on latitudes 9.26322 and 9.27531 N and longitudes 4.37528 and 4.38613 E with rainfall ranges between 800*mm*–1000*mm* with average temperature ranges between 25^0C – 35^0C (FRIN, 2014).

Collection of Seeds and Materials

Some mature fruits of *Uvariopsis tripetala* were collected from Akinlaja village in Odigbo Local Government Area of Ondo State. The seeds were extracted and then divided into three parts. The river sand used for seed germination was collected from Forestry Research Institute of Nigeria stream. This was thoroughly washed and sterilized by boiling at 100^0C for one hour. Plastic sieves used were purchased from Aleshinloye market in Ibadan South West Local Government area, Oyo State.

Study Design and Method

Seed Germination

Three hundred seeds (300) were used for the germination experiment. One hundred (100) seeds were selected for each pretreatment which was sown in tagged plastic sieves filled with sterilized river sand. The setup was placed under a propagator chamber for maximum protection and optimum germination condition. The pre-germination treatment methods used were cold stratification by soaking the seeds in cold water for 2 days, Seed scarification using sand paper to remove some part of the seed coat and soaking the seeds in conc. H_2SO_4 for 2 minutes. Twenty (20) seedlings of relative uniform height were selected after six weeks and transplanted into (25 x 15 x10) cm polythene pots size filled with three growth media. The seedlings were transplanted into the growth media of a cured sawdust, topsoil and biochar and the set-up was replicated three times each using Randomized Complete Block Design (RCBD). One hundred and eighty (180) seedlings of *U. tripetala* were used for this study.

Data collection and Seedling Growth

The initial data for the transplanted seedlings were recorded two (2) weeks after transplanting within which the transplanted seedlings have recovered from planting shock. This was carried out to determine the subsequent height, collar diameter and leave increment of the seedlings. The potted seedlings were arranged in the screen house to minimised the heating impact of direct sun and possible defoliators attack on the young seedlings. Further data collections were carried out every four (4) weeks due to slow growing nature of the species. The potted seedlings were tended and assessed for sixteen weeks (16wks). The variables assessed were seedlings height which was determined with meter rule (cm), Collar diameter evaluated with digital calliper and Leaf production was assessed by manual counting of the leaves on the plant.

Data Analysis

Statistical Package for Social Sciences (SPSS) for windows (version 17.0) and two-way ANOVA at 5% probability level were adopted for data analysis. Means were separated with Duncan Multiple Range Test (DMRT).

Results and Discussion

Results

Effect of Pretreatment and Growth Media on the Early Growth of *Uvariopsis tripetala* Seedlings

There were no significant differences in the effect of the growth media and the pretreatments except the H_2SO_4 which showed a significant effects on the height of *U. tripetala* seedlings (Table 1). The seedlings produced from cold stratification pretreatment which was planted on topsoil accounted for the highest mean height value of 5.12±0.14. This was followed by the seedlings produced from mechanical scarification pretreatment planted on biochar with 5.03±0.14. While the least mean value was recorded for seedlings produced from H_2SO_4 pretreatment planted on topsoil with 3.95±0.14 at 0.05 probability level.

Table 1: Effect of Pretreatment and Growth Media on the Height of *Uvariopsis tripetala* Seedlings

	Growth Media			
Pretreatment	**Topsoil**	**Sawdust**	**Biochar**	**Mean**
Cold Stratification	4.99±0.14	4.78±0.14	5.12±0.14	4.96±0.09[a]
Mechanical Scarification	4.86±0.14	4.56±0.14	5.03±0.14	4.82±0.09[a]
H_2SO_4	3.95±0.14	4.34±0.14	4.18±0.14	4.16±0.09[b]
Mean	4.60±0.09[a]	4.56±0.09[a]	4.78±0.09[a]	
P-value	0.003	0.001	0.001	

Means with similar alphabet are significantly the same ($p > 0.05$)

Effect of Pretreatment and Growth Media on Collar Diameter of *Uvariopsis tripetala* Seedlings

Significant differences were recorded in the effect of cold stratification pretreatments and sawdust growth medium on the diameter of *U. tripetala* seedlings (Table 2). The seedlings produced from mechanical stratification pretreatment which was planted on sawdust had the highest mean collar diameter of 1.95±0.34. This was followed by the seedlings produced from H_2SO_4 pretreatment planted on sawdust with 1.88±0.34. While the least collar diameter was also recorded for seedlings produced from H_2S0_4 pretreatment planted on topsoil with 0.75±0.34 ($p > 0.05$)

Table 2: Effect of Pretreatment and Growth Media on Collar diameter of *Uvariopsis tripetala* seedlings

	Growth Media			
Pretreatment	**Topsoil**	**Sawdust**	**Biochar**	**Mean**
Cold Stratification	0.86±0.34	0.89±0.34	0.84±0.34	0.86±0.18[a]
Mechanical Scarification	0.78±0.34	1.95±0.34	0.79±0.34	1.17±0.18[b]
H_2SO_4	0.75±0.34	1.88±0.34	0.82±0.34	1.15±0.18[b]
Mean	0.80±0.18[a]	1.57±0.18[b]	0.82±0.18[a]	
P-value	0.001	0.001	< 0.001	

Means with similar alphabet were significantly the same ($p > 0.05$)

Effect of Pretreatment and Growth Media on Leave Production of *Uvariopsis tripetala* Seedlings

No significant differences in the effect of all the pretreatments and growth media on the leave shoots of *U. tripetala* seedlings (Table 3). The seedlings produced from cold stratification pretreatment which was planted on biochar and topsoil had the highest mean number of leaves with 3.99±0.23 and 3.67±0.23 respectively. While the least mean value for leaves was recorded for seedlings produced from H_2SO_4 pretreatment planted on biochar medium with 3.34±0.23 ($p > 0.05$).

Table 3: Effect of Pretreatment and Growth Media on Leave Production of *Uvariopsis tripetala* seedlings

	Growth Media			
Pretreatment	**Topsoil**	**Sawdust**	**Biochar**	**Mean**
Cold Stratification	3.67±0.23	3.51±0.23	3.99±0.23	3.72±0.12[a]
Mechanical Scarification	3.46±0.23	3.43±0.23	3.57±0.23	3.49±0.12[a]
H_2SO_4	3.58±0.23	3.39±0.23	3.34±0.23	3.44±0.12[a]
Mean	3.57±0.12[a]	3.44±0.12[a]	3.63±0.12[a]	
P-value	0.001	< 0.001	< 0.001	

Means with similar alphabet were significantly the same ($p > 0.05$)

Discussion

This study shows that the seedlings produced from cold stratification pretreatment which were planted on topsoil accounted for the highest mean height value. This result corroborated the work of Osaigbovo *et al.* (2010) and Alex *et al.* (2020) who recorded the highest height value for *U. tripetala* seedlings planted on topsoil. However, the findings disagrees with Fredrick *et al*. (2020) who obtained the highest height value from *Dalium guinense* seedlings planted in sawdust potting mixtures. This work was also in accordance with the result documented by Okunomo *et al*.(2004) and Agboola *et al*.,(2018) on the mean height values of *Dacryodes edulis* and *Persia americana* seedlings planted on topsoil. The findings on collar diameter revealed that seedlings produced from mechanical stratification pretreatment which was planted on sawdust had the highest mean collar diameter. This result contradicts the reports of Aigbe *et al*. (2016) and Alex *et al.* (2020) on the least collar diameter of seedlings planted on river sand and topsoil accordingly. These findings also conformed to the observations of Omokhua *et al*. (2015) who recorded better performance in sharp river sand. Conversely, the result differs from Mathowa *et al.* (2014) who noted the highest diameter values on seedlings planted on sawdust. Undoubtedly, the number of leaves possess by seedling at the early stage determines the photosynthetic capabilities of the seedling. This in turn determines the rate of growth and development of the plant as opined by Aigbe *et al*. (2016). However, the research reported the highest number of leaves from seedlings planted on biochar growth medium. This may be attributed to the high releasable nutrients present in the biochar which boosted the flora production processes in the young seedlings.

Nevertheless, the least number of leaves was also observed on seedlings planted on the same medium. These findings conformed to the report of Okunomo (2010), with the most and the least leaf numbers on seedlings planted on potting mixtures with poultry droppings. Thus, he ascribed the result to the rich nutrient in the growth medium which enhanced the fast growth of the seedlings causing some seedlings to be suppressed, thereby limiting their leave production as evident in this study.

Conclusion and Recommendation

Conclusion

The results of this study revealed that cold stratification pretreatment had significant effect and may be suitable for raising healthy and vigorous *U. tripetala* seedlings for plantation and conservation purpose. While, well decomposed sawdust medium also had significant effects on the growth variables which may also be appropriate for raising *U. tripetala* seedlings at nursery stage. However, mechanical scarification pretreatment and biochar growth medium also had effects as evident on the growth variables observed in the experiment. These effects are indications of possibly being an alternative pretreatment and medium for mass production of this species for plantation establishment. Nevertheless, this study was part of efforts towards formulating conservation strategies to protect this threatened multipurpose species from going to extinction.

Recommendations

In line with the findings of this study, further studies on other silvicultural requirements and floral biology could be considered to enhance sustainable seedling production and conservation of this species. Also, conservation effort should be geared towards making *U. tripetala* a key agroforestry component at local and state levels in order to prevent this species from total depletion.

References

Adedayo, B. C, Oboh, G. and Akindahunsi, A. A. (2010). Changes in the total phenol content and antioxidant properties of pepper fruit (*Dennettia tripetala*) with ripening. *African Journal of Food Science,* 4(6): 403 – 409.

Aderogba, M. A., Akinkunmi, E. O. and Mabusela, W. T. (2011). Antioxidant and antimicrobial activities of flavonoids Glycosides from *Dennettia tripetala* G. Baker leaf extract. *Nigerian Journal of Natural Products and Medicine,* 15(1): 49 – 52.

Agboola O. O., Oseni O. M., Adewale, O. M. and Shonubi, O. (2018). Effect of the use of sawdust as a growth medium on the growth and yield of tomato. *Annals of West University of Timişoara: Series Biology,* 21(1): 67 – 74.

Aigbe, H. I., Fredrick, C. and Omokhua, G. E. (2016). Effect of Seed Source on Germination and Early Seedling Growth of *Heinsia crinita* (Afzel.) G. Taylor *Applied Tropical Agriculture,* 21(3): 180 – 185.

Alex, A., Owhor, P. N. and Fredrick, C. (2020). Effect of Seed Source on Seedling Growth of *Dialium guineensis* (Wild). *Journal of Research in Forestry, Wildlife and Environment,* 12(3): 20 – 24.

Egharevba, H. O. and Edah, D. A. (2015). Major Compounds from the essential oil of the fruit and comparative phyto-chemical studies of the fruits and leaves of *Dennettia tripetala* (Barker F) found in North Central, Nigeria. *International Journal of Pharmacognosi and Phyto-chemical research,* 7(6): 1262 – 1266.

Ejechi, B. O. and Akpomedaye, D. (2005). Activity of Essential oil and Phenolic extract of Pepper fruits, *Dennettia tripetala* (G. Baker) against some food born micro-organisms. *African Journal of Bio-technology,* 3: 258 – 261.

Elekwa, I., Okereke, S. C. and Chukwudoruo, C. S. (2011). Phyto chemical screening and GC-MS/Analysis of the essential oil of *Dennettia tripetala* (pepper fruits) seeds. ABSU *Journal of Environment, Science and Technology,* 1: 93 – 98.

Enwere, N. I. J. (1998). Foods of plant origin. *Afro-orbis publications Ltd,* University of Nigeria, Nsukka 1998: 169 – 180.

Fredrick, C., Chima, U. D. and Jimmy, A. O. (2020). Effect of seed size on germination and early seedling growth of *Dennettia tripetala* (G. Baker). *Publication of Nasarawa State University,* 16(1): 94 – 103.

FRIN (2014). Forestry Research Institute of Nigeria, Ibadan. Annual metrological plant *Enantia chlorantha* oliv. *Journal of Arboriculture* 31 (2): 78 – 82.

I.U.C.N (2006). International Union of Conservation of Nature red list of threatened species, *Report,* 9: 8 – 13.

Keay, R. W. J (1989). Trees of Nigeria. *Clarendron press oxford,* UK, pp. 19 – 30.

Mathowa, T., Madisa, M. E., Moshoeshoe, C. M., Mpofu, C. and Mojeremane, W. (2014). Effect of Different Growing Media on the Growth and Yield of Jute Mallow (*Corchorus olitorius* L.) *International Journal of Research Studies in Biosciences (IJRSB),* 2(11): 153 – 163.

Okunomo, (2010). Germination Response of Sour Soup (Annona muricata) to various Nursery Techniques. In the Proceedings of the 2nd Biennial National Conference of the Forests and Forest Products Society. Pp 112 – 116.

Okunomo, K., Oghenerhoro, E. O. and Ojiefo, I. M. (2004). Effect of soil type on the Germination and Seedling growth of *Dacryodes edulis* Don G. Lam H. J). *Journal of Sustainable Tropica Agricultural Research,* 12:46 – 50.

Okwu, D. E. and Morah, F. N. I. (2004). Mineral and nutritive value of *Dennetia tripetala* fruits *Paris,* 59 (6): 439 – 42.

Omokhua, G. E., Ogu, A., and Oyebade, B. A. (2015). Effects of Different Sowing Media on Germination and Early Seedling Growth of *Terminalia ivorensis* (A.Chev.) *International Journal of Scientific and Technology Research,* 4 (3): 119 – 122.

Onefeli, A. O. and Akinyele, A. O. (2014). Macropropagation of *Dennettia tripetala* Baker f. *South-east European forestry,* 5 (2): 135 – 144.

Osaigbovo, A. U, Nwaogaula, C. N. C. and Falodun, J. E. (2010). Evaluation of potting media for the production of pepper fruit (*Dennetia tripetala*) seedlings. *African Journal of General Agriculture,* 6 (2): 18 – 24.

Timothy, C. O. and Okere, C. O. (2008). Effect of *Dennetia tripetala* (mmimi) seeds intake on the top of normotensive emmetropic Nigeria Igbos. *Journal of Nigerian Opthopedic Association, 14: 14 – 17.*