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RESEARCH ARTICLE

Effects of Seed Pretreatments and Growth-Media on Early Growth Performance of *Uvariopsis tripetala* (Baker f.) G.E.Schatz. Seedlings

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Abstract

This study investigated the effects of seed pretreatments and growth-media on early growth performance of Uvariopsis tripetala seedlings with a view to investigating the silvicultural requirements for seedling production and conservation of this species. The fruits of Uvariopsis tripetala were procured from Akinlaja village, Odigbo Local Government Area, Ondo State. The extracted seeds were pretreated using three pre-germination treatment methods (Cold stratification, Mechanical scarification and Conc. H_2SO_4). Seeds pretreated with cold stratification had the highest germination percentage (92%), mechanical scarification (79%), while the lowest (55%) from conc. H_2SO_4 pretreatment. Seedlings of the species from the germination experiment were transplanted into three growth-media (topsoil, sawdust and biochar) and replicated thrice. The experiment was arranged in Randomized Complete Block Design (RCBD). Seedlings from cold stratification planted on topsoil had the highest mean height growth value (5.12 ±0.14cm). This was followed by the seedlings from mechanical scarification planted on biochar with growth height of (5.03±0.14cm). While the lowest mean height value was recorded for seedlings from H_2SO_4 pretreated seeds planted on topsoil (3.95±0.14cm). Seedlings from mechanical scarification seeds planted on sawdust had the highest mean collar diameter (1.95±0.34mm). This was followed by seedlings from H_2SO_4 pretreated seeds and planted on sawdust (1.88±0.34mm). While the lowest value (0.75±0.34mm) was obtained from seedling from H_2SO_4 pretreated seeds planted on topsoil. Seedlings from cold stratification pretreated seeds planted on biochar and topsoil had the highest mean number of leaves (3.99±0.23 and 3.67± 0.23) respectively. The lowest mean value (3.34±0.23) was obtained from H_2SO_4 seedlings planted on biochar medium. The results showed that cold stratification pretreatment and sawdust medium were most suitable for mass production of U. tripetala seedlings in the nursery. 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*

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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 appear green when unripe and red when ripe 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 for various purposes include the leaves, fruits, seeds, roots and stem (Timothy and Okere, 2008). The species 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 have alkaloids, tannins, saponins, flavonoids, terpenoids, steroids and glycosides which differ from the reports obtained by Egharevba and Edah (2015), who found only flavonoids and glycosides as the only constituents of the fruits.

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 various 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). *Uvariopsis tripetala* has been noted to epigeal germination, inconsistent fruiting, poor seed germination and slow seedling growth (Osaigbovo *et al.,* 2010). This species has been identified as threatened species according to 2006 IUCN red list of threatened species (IUCN, 2006). Despite the multipurpose uses of this species, information on the ecology, silvicultural requirements and conservation are limited. Therefore, urgent research attention is needed towards salvaging this multipurpose 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 its sustainable production and conservation 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 between latitudes 9.26322° and 9.27531° N and longitudes 4.37528° and 4.38613° E. Mean annual rainfall ranges between 800*mm* and 1000*mm* with average temperature ranges between 25°C – 35°C (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's stream at Jericho hill, Ibadan. The sand 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. However, the sterilized sand and other materials used were transported to Southern Guinea Savanna Research station, Mokwa where the experiment was sited.

Experimental Design and Method

Seed Germination

Three hundred seeds (300) were used for the germination experiment. One hundred (100) seeds were selected for each pre-germination treatment. The pre-germination treatment methods used were cold stratification by soaking the seeds in cold water for 2 days, mechanical scarification using sand paper to remove some part of the seed coat and soaking the seeds in conc. H_2SO_4 for 2 minutes. The setup was placed under a propagator chamber for maximum protection and optimum germination condition 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 following growth media: cured sawdust, topsoil and biochar and the set-up was replicated three times. The experiment was laid in 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 seeds sown were watered and observed daily for possible germination. The number of germinated seeds for each pretreatment was counted daily and recorded. Subsequently, the germination percentage was calculated and documented for each treatment. The initial data for the transplanted seedlings were recorded two (2) weeks after transplanting during which period the transplanted seedlings have recovered from planting shock. The potted seedlings were arranged in the screen house to minimise 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 the slow growing nature of the species. The potted seedlings were tended and assessed for sixteen weeks (16weeks). The variables assessed were seedlings height which was determined with meter rule (cm), collar diameter evaluated with digital caliper (mm), while 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) software was used for the statistical analysis. Two-way ANOVA (at 5% probability level) was adopted for data analysis. Significant means were separated using Duncan Multiple Range Test (DMRT).

RESULTS

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

The germination pattern of *U. tripetala* showed that seeds pretreated with cold stratification had the highest germination percentage (92%). This was followed by mechanical scarification (79%), while the lowest (55%) was recorded for conc. H_2SO_4 pretreatment (Figure 1).

There were no significant differences in the effect of the growth media and the pretreatments on the early growth of *U. tripetala* seedlings except the H_2SO_4 that had a significant effect on the height growth of seedlings of the species (Table 1). The seedlings produced from cold stratification pretreatment which was planted on topsoil accounted for the highest mean height value of 5.12 ± 0.14cm. This was followed by the seedlings produced from mechanical scarification pretreatment and planted on biochar with 5.03 ± 0.14cm. While the lowest mean value was recorded for seedlings produced from H_2SO_4 pretreatment and planted on topsoil with 3.95 ± 0.14cm ($p > 0.05$).

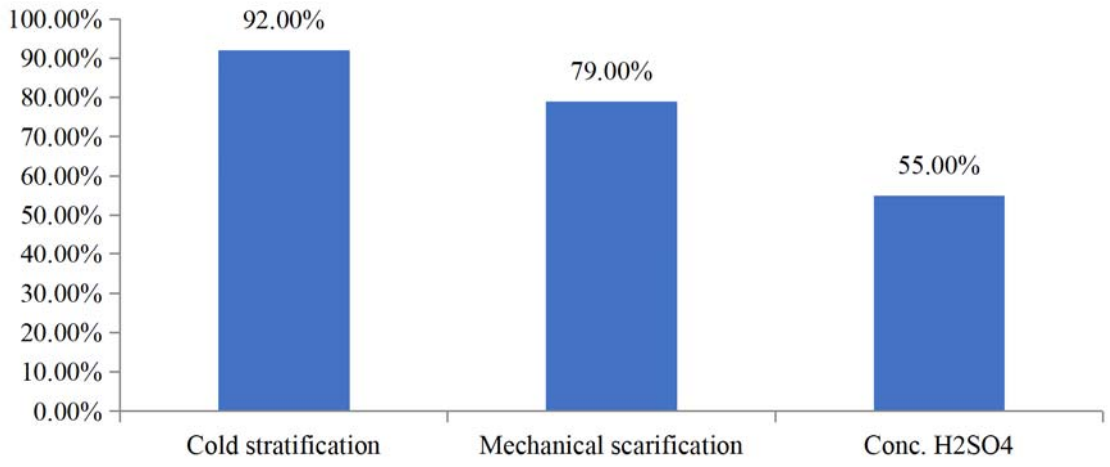

Figure 1: Germination pattern of *Uvariopsis tripetala* Seeds

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 statistically similar ($p > 0.05$)

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± 0.34mm. This was followed by the seedlings produced from H_2SO_4 pretreatment planted on sawdust with 1.88 ± 0.34mm. While the lowest collar diameter was also recorded for seedlings produced from H_2S0_4 pretreatment planted on topsoil with 0.75 ± 0.34mm ($p > 0.05$)

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 are statistically similar ($p > 0.05$)

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

No significant difference was observed in the effect of all the pretreatments and growth media on the leaf production of *U. tripetala* seedlings (Table 3). The seedlings produced from cold stratification pretreatment and 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 lowest mean number of leaves was recorded for seedlings produced from H_2SO_4 pretreatment and planted on biochar medium with 3.34**±**0.23 leaves ($p > 0.05$).

Table 3: Effect of Pretreatment and Growth Media on Leaf 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 are statistically similar ($p > 0.05$)

DISCUSSION

This study showed that the seedlings that emanated from cold stratification pretreatment and planted on topsoil had the highest mean height value. This result corroborated the work of Osaigbovo *et al.* (2010) and Alex *et al.* (2020) who recorded the highest mean height values (13.33cm) and (12.8cm) for *U. tripetala and Dalium guineense* seedlings planted on topsoil. However, the findings disagrees with the results of Fredrick *et al*. (2020) who obtained the highest mean height value (5.34cm) from *Dalium guinense* seedlings planted in sawdust potting mixtures. In related studies, Okunomo *et al.* (2004) and Agboola *et al.,* (2018) obtained mean height values (15.81cm) and (13.92cm) for *Persia americana* and *Dacryodes edulis* seedlings planted on topsoil.

The findings on collar diameter revealed that seedlings produced from mechanical scarification pretreatment which were planted on sawdust had the highest mean collar diameter. This result contradicts the reports of Aigbe *et al*. (2016) and Alex *et*

al. (2020) who reported low collar diameter (1.17mm) and (0.63mm) for *Heinsia crinita* and *D. guineense* seedlings planted on river sand and topsoil respectively. These findings are in consonance with the observations of Omokhua *et al*. (2015) who recorded better performance (1.08mm) for *Blighia sapida seedlings* on sharp river sand. Mathowa *et al.* (2014) reported the highest diameter growth (0.69mm) for *Chorchorus olitorius* seedlings planted on sawdust which is different from the results of this study.

Undoubtedly, the number of leaves produced by seedlings at their early stage of development determines the photosynthetic capabilities of the seedlings. This in turn determines the rate of growth and development of the plant as opined by Aigbe *et al*. (2016). However, this research reported the highest number of leaves from seedlings planted on biochar growth medium. This may be attributed to the high potential to release 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. Similarly, Okunomo (2010) observed that the seedlings with the highest (13) and the lowest (6) number of leaves were obtained from *Annona muricata* seedlings planted on potting mixtures with poultry droppings. Okunomo (2010) attributed 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 leaf production as evident in this study. This finding conformed to Omokhua *et al.* (2015), who posited that suppression occurs to plants at various stages of their development.

CONCLUSION

The results of this study revealed that cold stratification pretreatment had significant effects on the seed germination and the seedling growth. Hence, it may be a suitable pre-germination treatment for the seeds and for raising healthy and vigorous *U. tripetala* seedlings for plantation and conservation purposes. Similarly, with the significant effects that the sawdust as a sowing media had on the growth variables, it may also be appropriate for raising *U. tripetala* seedlings in the nursery. Also, biochar growth medium was found to have effect on the growth of the species which may be an indication of possibly using it as an alternative growth medium for mass production of this species for plantation establishment. However, in line with the findings of this study and in order to deepen the understanding of *U. tripetala*, it is recommended that further studies on other silvicultural requirements and floral biology should 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 to prevent this species from extinction.

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