PRINT ISSN 1119-8362
Electronic ISSN 2659-1502

Full-text Available Online at
https://www.ajol.info/index.php/jasem
http://www.bioline.org.br/ja

J. Appl. Sci. Environ. Manage.
Vol. 27 (2) 367-373 February 2023

Pre-treatment, Germination and Growth Performance of *Detarium microcarpum* Seeds in three Planting Media

DACHUNG, G; TYOLUMUN, AB; EKHUEMELO, DO

Department of Forest Production and Products, Federal University of Agriculture Makurdi, Nigeria
(Now Joseph Sarwuan Tarka University, Makurdi), Nigeria

*****Corresponding Author Email: davidekhuemelo@gmail.com; Tel: +123 703 133 2803*
Co-Authors Email: graceilya@yahoo.co.uk; tyolumunbart08@gmail.com

ABSTRACT: Effect of 20%, 40% and 60% sulphuric acid concentrations on the pretreatment of *Detarium microcarpum* and seedling growth was studied using standard techniques. Seeds were collected and tested by floating. Results showed that seeds treated with 40% H_2SO_4 for 10 and 30 mins planted in river sand; 60% H_2SO_4 for 30 mins planted in top soil and those planted in untreated seeds had the highest (4) germination. Germination percentage of was highest (80%) with 40% H_2SO_4 treated seeds for 10 and 30 mins planted in river sand; control (river sand, river sand + top soil); 20% H_2SO_4 for 10 mins planted in top soil and 60% H_2SO_4 for 30 mins planted in river sand. Emergence index and emergence rate index of seeds followed same trend as germination percentage of seeds. The highest mean (16 cm) height of *seedlings* was recorded from river sand without H_2SO_4 seed treatment (control).Mean values of collar diameter, leaf area and number of leaves also follow same trend of*seedling* height. There were no significant differences ($p > 0.05$) in seedling height, collar diameter, leaf area and number of leaves among seeds grown in different media and control. Seeds treated with 40% H_2SO_4 and plated in river sand had the highest number of germinations and river sand was the best media of growth.

DOI: **https://dx.doi.org/10.4314/jasem.v27i2.27**

Cite this paper as: DACHUNG, G.; TYOLUMUN, A. B.; EKHUEMELO D.O. (2023). Pre-treatment, germination and growth performance of *Detarium microcarpum* seeds in three planting media. *J. Appl. Sci. Environ. Manage.* 27 (2) 367-373

Dates: Received: 26 January 2023; Revised: 11 February 2023; Accepted: 14 February 2023
Published: 28st February 2023

Keywords: *Dearium microcarpum*, sulphuric acid, planting media, germination, seedlings

Trees are very important to both human and the environment wherever they are found. The careful use or misuse of trees determines whether or not they can sustainably offer their irreplaceable services to man and the environment. *Detarium microcarpum* (Guill. & Perr)is a tree species that occurs naturally in dried region of West and Central Africa ranging from Senegal and Gambia east to Sudan. It belongs to the family Caesalpiniaceae (Leguminosae - Caesalpinioideae). The species common names in English and France are Sweet dattock and Dankh, petit détar (Kouyaté and van Damme 2006). In Nigeria, it is locally called '*Ofor*' in southwest Nigeria and '*Agalien*' in Tiv people of north-central part of Nigeria. It is called '*abulaila'* in western Sudan, **'**dank**'** in Senegal, and 'tambadala' in Mali (Adedeji, *et al.*, 2012). *D. microcarpum* is a small tree which grows up to 10 m tall with a horizontal root system. It usually has straight and cylindrical bole of about 30 cm in diameter. The bark of the tree is scaling on older branches with colour ranging from grey to brown or reddish with irregular crown. The leaves of *D. microcarpum* are alternately having paripinnately compound between 14 and 20 cm in length, having 3 - 4 couples of leaflets that are short and have hairs when they are young (Kouyaté and van Damme, 2006). The species is very widespread in wooded and shrub savannahs and in a semi-cleared dry forest area. Normally, the trees thrive in sandy or hard soils that has high iron content and in the presence of my corrhizal fungi. *D. microcarpum* can be raised by both seeds (sexual) and

cuttings (asexual) as shown by many literatures (Kouyaté and van Damme, 2006).

The indigenous people of Nigeria and some West Africa countries use *D. microcarpum* for local medicines and as source of food. They eat the fruit either cooked or in raw state. Traditionally, the fruit pulp is sometimes made into flour used in baking cakes, couscous, baby food, bread and local drink. The locals also add seed kernels of *D. microcarpum* to melon to prepare soup, while condiments and vegetables are prepared from leaves and flowers (Cavin *et al.,* 2006).

Deforestation and forest degradation have become serious factors that threaten forest productivity and sustainability in Nigeria. Also, the prevailing and increasing demand for forest products and resources because of ever increasing population have heightened the decreased of *D. microcarpum* in the wild.

If overexploitation of *D. microcarpum* is sustained without its propagation, the situation may lead to extinction of the species. The propagation of *D. microcarpum* may either be in form of vegetative (stem or root cuttings) or from seeds. The International Union for the conservation of Nature (IUCN) (2012) red list has shown that *D. microcarpum* is one among the threatened species of the world due to deforestation and high demand for the tree for different uses.

Therefore, efforts need to be made to conserve, improve or manipulate the population of *D. microcarpum* from going into extinction. Hence, propagating methods of some highly exploited trees species need to be known rather than depending on their natural ways of propagation, trees such as *D. microcarpum* whose status is already threatened which in the nearest future may go into extinction

To the best our knowledge, there is no much data on the plantation of *D.microcarpum* anywhere in Africa. This means that only the population found in the wild is been exploited. Owning to this fact and with recent discoveries of the uses of *D. microcarpum*, the best ways of propagating this tree must be figured out in other to maintain it perpetuity hence the aim of this study. Therefore, the objective of this study was to investigate the pre-treatment, germination and growth performance of *D. microcarpum* seeds in three planting media

MATERIALS AND METHODS

Study area: This study was carried out at the Forestry Nursery, Joseph Sarwuan Tarka University Makurdi. Makurdi is capital of Benue State covers an area of 804 square kilometers and lies between Latitude 07º 45'N to 07º 46'N, Longitude 08º 37'E to 08º 25'E, 98m above sea level.

Benue State has a tropical sub-humid climate with two different seasons which are wet season and dry season, respectively. The wet season commences from April to October while the dry season if from November to March. The annual rainfall ranges from 1,200mm - 1, 500mm.Benue State is located within the southern Guinea Savannah of Nigeria. Continuous destruction of the vegetation has resulted in the development of re-growth of grasses different levels of development making it favorable for animal grazing. These juicy grasses maybe harvested and prepared for livestock feeding. The scattered trees in this region are mostly used for economic value and include locust bean, shear butter, mango, silk cotton, African iron, *Isoberlinia tomentosa*, cashew and oil palm, African mahogany, Gmelina and Sweet Detar among others. These tree species produce important fruits, wood and fibre which can be employed for small scale cottage industries.

Seed collection materials: Seeds of *D. microcarpum* were collected late February in Tse-Gondu village in Buruku Local Government Benue State, from different mother trees. Seeds were dried and stored under normal room temperature until the planting period. Sulphuric acid was purchased from Agbeh Science Shop High Level Makurdi. Water sachet bags were used as poly pots. Top soil was collected in front of the University Nursery and river sand collected from River Benue.

Pretreatment of D. microcarpum seeds: Seeds viability was tested by floating and the viable seeds were soaked in sulphuric acid (H_2SO_4) of different concentrations of 20%, 40% and 60%, at time intervals of 10 min, 20 min and 30 min, respectively for each concentration. At every time interval per concentration, the soaked seeds were thoroughly rinsed with running water from tap, to removed traces of acid and then air dried for 30 minutes before sowing.

Experimental Design: The experiment was laid in Complete Randomized Design (CRD). Three planting media were used: A - tops soil, B - river sand and C - mixture of river sand/ top soil. Twenty-seven treatments 27 were used and replicated four (4) times.

Procedure for pretreatment: The procedures include (i) Soaking of seeds in sulphuric acid (H_2SO_4) of 20% concentration at 20, 40, and 60 minutes (3 treatment) (ii) Soaking of seeds in sulphuric acid (H_2SO_4) of 40% concentration at 20, 40, and 60 minutes (3 treatment) (iii) Soaking of seeds in sulphuric acid (H_2SO_4) of 60% concentration at 20, 40, and 60 minutes (3 treatment) (iv) Untreated seeds sown in three media served as control

Data collection: The experiment was monitored for thirteen (13) weeks (77 days); germination data was

collected daily for five (5) weeks starting from the first day of emergence after thirteen days from the day sowing was done. Then data for growth parameters collected for eight (8) weeks.

Germination data collected include the following: (i) The number of seeds germinated from various growth media. Germination percentage, Emergence index and Emergence rate index were calculated thus:

$$GPS = \frac{NSG}{TNSP} x \frac{100}{1} \quad \text{…….} [1]$$

$$EI = \frac{NSGPD \times DAP}{TNSG} \quad \text{……} [2]$$

$$ERI = \frac{EI}{GP} \quad \text{……..} [3]$$

Where: GPS = Germination percentage of seedling; NSG =Number of seeds germinated; TNSP = Total number of seeds planted; EI = Emergence index; ERI = Emergence rate index; NSGPD = Number of seedlings germinated per day; DAP = Days after planting; TNSG = Total number of seedlings germinated; GP = Germination percentage

Measurement of growth parameters: The growth parameters measured includes: (i) The height of seedlings using a meter rule (ii) The number of leaves formed on different growth media at different treatment and replicates. (iii) Leaf area using graph sheet to trace size and the shape of the leaf (iv) Measurement of the collar diameter of seedling using a digital veneer caliper

Data analysis: The data collected were computed and subjected to analysis of variance (ANOVA), using SPSS statistical package. Mean separation was carried out to determine the best suitable acid pretreatment for the germination and early growth of *D. microcarpum* using Duncan's Multiple Range Test (DMRT) at > 0.05 level of significance.

RESULTS AND DISCUSSION

Germination of D. microcarpum seeds after planting: The result of this study shows that the first recorded germination of *D. microcarpum* seeds occurred on 14th day after planting (DAP)and the last germination was on 32ndDAP (Table 1). The highest (9) germination of *D. Microcarpum* seeds occurred on the 17th DAP followed by 8, 7 and 6 seeds on 18th, 16th and 19th DAP, respectively. Seeds treated with 40% H_2SO_4 for 10 and 30 mins planted in river sand; 60% H_2SO_4 for 30 mins planted in top soil and those planted in untreated seeds had the highest (4) germination each. The result in Table 1 also showed that seeds treated with 40% $H_2SO_4$and plated in river sand had the highest number (11) of germination.

This study revealed that sulpuric acid had no significant effect on the seeds of *D. microcarpum* pretreated before sowing for this experiment. This was because both the treated seeds at different concentrations of H_2SO_4 and the untreated (control) seeds germinated within same DAP. This result is at variance with the finding of Dugama *et al.,* (1998) who noted that H_2SO_4 treatment was most effective in improving of *Luecina leucocephala* seed coat. Aliero (2004) reported that treatment of seeds of *Parkia biglobosa* with H_2SO_4 induced germination of seeds. Although literatures have revealed that H_2SO_4 has great effect on the germination of seeds, the result of this research showed that H_2SO_4 had no significant effect on the germination of *D. Microcarpum* seeds. *D. microcarpum* germination occurred on 14th day after planting (DAP) and the last germination was on 32nd DAP. Kouyaté and van Damme (2006) noted that the germination of *D. microcarpum* in the nursery was from 8 - 10 days after sowing. After 47 days of planting, the 71–100% of seeds planted in polythene bags germinated. Natural germination *D. microcarpum* is reportedly hindered by bush fires and dry weather (Kouyaté and van Damme, 2006) efforts should be intensified in raising the seeds in the nursery.

Germination percentage, emergence index and germination indices of D. microcarpum: Germination percentage of *D. microcarpum* was highest with 40% H_2SO_4 treated seeds for 10 and 30 mins planted in river sand; control (river sand, river sand + top soil); 20% H_2SO_4 for 10 mins planted in top soil and 60% H_2SO_4 for 30 mins planted in river sand. Emergence index and emergence rate index of planted *D. microcarpum* seeds also followed same trend as germination percentage of *D. microcarpum* seeds. Amongst the planting media used (top soil, river sand and top soil + river sand) river sand was seen to support germination more, followed by top soil/ river sand and least by top soil. This agrees with Amonum *et al.,* (2019) who reported that overall germination rate of *D. Edulis* was highest under river sand planting medium. This they said could be because of high porosity of river sand. Seeds are inhibited by porosity of river sand.

Table 1: Germination of *D. microcarpum* seeds after planting

Media	Conc of H_2SO_4 (%)	Time (mins)	Date of germination after planting																			TNGSW	TGPAC
			14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32		
River Sand	20	10	-	1	-	-	2		-	-	-	-	-	-	-	-	-	-	-	-	-	3	5
		20	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0	
		30	-	-	1		-	-	-		1	-	-	-	-	-	-	-	-	-	-	2	
	40	10	-	-	-	2	-	-	-	2		-	-	-	-	-	-	-	-	-	-	4	11
		20	1	-	-		2	-	-			-	-	-	-	-	-	-	-	-	-	3	
		30	-	-	-	1		-	-	1		1	1	-	-	-	-	-	-	-	-	4	
	60	10	-	-	1	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	2	4
		20	-	-	-	-	-	1	1	-	-	-	-	-	-	-	-	-	-	-	-	2	
		30	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0	
		Control	-	1	1	1	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	4	4
		Total	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	**24**	**24**
Top Soil	20	10	-	-	1	-	-	-	-	-	-	-	-	1	-	-	-	-	-	-	-	2	3
		20	-	-	-	-	-	-	1	-	-	-		-	-	-	-	-	-	-	-	1	
		30	-	-	-	-	-	-	-	-	-	-		-	-	-	-	-	-	-	-	0	
	40	10	-	-		1	-	-	-		2		-	-	-	-	-		1	-	-	4	6
		20	-	-	-	-	-	-	-	-	-	1	-	-	-	-	-	1		-	-	2	
		30	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0	
	60	10	-	-	-	-	-	-	-	-	-	-		2				-	-	-	-	2	9
		20	-	-	1	-	-	-	-	1	-	-	-	-	-	-	-	-	-	1		3	
		30	-	-	-	-	-	1	-	-	-	2		-	-	-	-	-	-	-	1	4	
		Control	-	-	-	1	-	-	-	-	-	-	1	-	-	-	1	-	-	-		3	3
		Total	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	**21**	**21**
River Sand + Top Soil	20	10	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	6
		20	-	-	1	-	-	1	1	-	-	-	-	-	-	-	-	-	-	-	-	3	
		30	-	-		-	2			-	-	-	-	-	-	-	-	-	-	-	-	2	
	40	10	-	-	-	-	-	-	-	-	-	-	-	-		2	-	-	-	-	-	2	5
		20	-	-	-	-	-	-	-	-	-	-	-	-			-	-	-	-	-	0	
		30	-	2	-	-	-	-	-	-	-	-	-	-	1		-	-	-	-	-	3	
	60	10	-	-				1	-	-	1	-	-	-	-	-	-	-	-	-	-	2	5
		20	-	-	1	-	1	1	-	-		-	-	-	-	-	-	-	-	-	-	3	
		30	-	-	-	-	-	-	-	-		-	-	-	-	-	-	-	-	-	-	0	
		Control	-	-		3	-	-	-	1		-	-	-	-	-	-	-	-	-	-	4	4
		Total	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	**20**	**20**
	TNGSD		**1**	**5**	**7**	**9**	**8**	**6**	**3**	**5**	**4**	**4**	**2**	**3**	**1**	**2**	**1**	**1**	**1**	**1**	**1**	**65**	**65**

Key:*TNGSD = Total Number Germinated seeds per day; TNGSW = Total Number Germinated seeds in 3 weeks; TGPAC = Total Germination per Acid Concentration*

Table 2: Germination percentage, Emergence index and Germination indices of *Deterium microcarpum*

Media	Conc of H_2SO_4 (%)	Time (mins)	Germination Percentage (%)	Emergence index	Emergence rate index
	20	10	60	10	0.3
		20	0	0	0
		30	60	15	0.3
	40	10	80	15	0.4
		20	60	10	0.2
		30	80	10	0.2
River	60	10	40	7.5	0.2
Sand		20	60	15	0.3
		30	0	0	0
		Control	**80**	**7.5**	**0.1**
	20	10	40	15	0.4
		20	40	15	0.4
		30	0	0	0
Top Soil	40	10	80	7.5	0.1
		20	40	15	0.4
		30	0	0	0
	60	10	40	7.5	0.2
		20	60	10	0.2
		30	80	7.5	0.1
		Control	**60**	**15**	**0.3**
	20	10	40	15	0.4
		20	60	5	0.1
		30	40	10	0.3
	40	10	40	15	0.4
		20	0	0	0
		30	60	15	0.3
River	60	10	60	10	0.2
Sand +		20	60	10	0.2
Top Soil		30	0	0	0
		Control	**80**	**11.3**	**0.1**

Growth paraments of D. microcarpum seedlings observed for 8 weeks on three planting media: In Table 4, the highest mean (16 cm) height of *D. microcarpum seedling*s was recorded among seeds raised in river sand without H_2SO_4 seed treatment (control).

D. microcarpum seedling heights were also high in top soil (12 cm) and river sand + top soil (10 cm) that had no H_2SO_4 seed treatment.

Seeds sown in river sand with 40% H_2SO_4 seeds treatment for 10, 20 and 30 mins had seedling mean height of 2.40, 3.80 and 4.00 cm.

This was followed by seeds treated by 40% H_2SO_4 and sown in mixture of river sand + top soil and top soil, respectively. There was no significant difference ($p > 0.05$) in seedling height among seeds grown in different media and control.

Mean values of collar diameter, leaf area and number of leaves follow same trend of *D. microcarpum seedling* height.

There were no significant differences ($p > 0.05$) among collar diameter, leaf area and number of leaves grown in different media and control. Figure 1 shows *D. microcarpum* Nursery and data collection from grown seedlings. The highest collar diameter was recorded from mixture of top soil and river sand. This could be the soil mixture was a type of soil it is found in its natural habitat Sidzabda *et al.,* (2011). However, the finding disagrees with the result of Omokhua *et al.,* (2015) who reported plant diameter was better in top soil. Akinlade *et al.,* (2021) reported better performance of collar diameter of *P. thonningii* seedlings in top soil amongst Topsoil, Sawdust and River sand. The highest leaf area was recorded in the mixture of top soil/river. This could be as a result of the organic manure deposited on the top soil and a good aeration which may be as a result of the sand texture giving it an idea of a nature environment (Mathowa *et al.,* 2014). The number of leaves recorded in this result shows that the leaves of *D. microcarpum* increased in number as the height increased. Thus, the panting media had significant on the effect on the number of leaves formed. The highest number of leaves was recorded in the mixture of top soil + river sand. This agrees with the finding of Ndor *et al.,* (2012) and also slightly agrees with the finding of Okunomo *et al.,* (2009). In general, there is no significant difference within groups of planting media and between planting media.

Table 4: Mean of growth of *D. microcarpum* observed for 8 weeks on three planting media

Media	Conc of H_2SO_4(%)	Time (mins.)	Height (cm) Mean±Sd.	Collar Diameter (cm) Mean±Sd.	Leaf area (cm) Mean±Sd.	Number of leaves Mean±Sd.
River Sand	20	10	4.20±5.76^{ab}	2.40±3.29ab	5.60±7.67^{ab}	8.00±10.95^{abc}
		20	0.00±0.00^{a}	0.00±0.00a	0.00±0.00^{a}	0.00±0.00^{a}
		30	1.00±2.24^{a}	1.20±2.68a	2.20±4.92^{ab}	2.00±4.47^{a}
	40	10	2.40±5.37^{a}	1.20±2.68a	3.60±8.05^{ab}	2.80±6.26^{a}
		20	3.80±5.22^{ab}	2.40±3.29ab	5.20±7.26^{ab}	4.60±6.39^{a}
		30	4.00±5.66^{ab}	2.20±3.03ab	7.00±9.59^{abc}	5.80±7.95^{ab}
	60	10	1.20±2.68^{a}	1.60±3.58a	4.00±8.94^{ab}	3.20±7.16^{a}
		20	1.40±3.13^{a}	1.40±3.13a	2.40±5.37^{ab}	3.60±8.05^{a}
		30	0.00±0.00^{a}	0.00±0.00a	0.00±0.00^{a}	0.00±0.00^{a}
		Control	**16.00±0.00^{b}**	**5.50±0.58^{bc}**	**7.00±0.00^{d}**	**15.50±0.58^{c}**
Top Soil	20	10	1.00±2.24^{a}	0.00±0.00a	0.00±0.00^{a}	0.00±0.00^{a}
		20	0.00±0.00^{a}	0.00±0.00a	0.00±0.00^{a}	0.00±0.00^{a}
		30	0.00±0.00^{a}	0.00±0.00a	0.00±0.00^{a}	0.00±0.00^{a}
	40	10	1.60±3.58^{a}	1.20±2.68a	4.00±8.94^{ab}	3.00±6.71^{a}
		20	3.20±7.16^{a}	1.20±2.68a	2.60±5.81^{ab}	3.60±8.05^{a}
		30	0.00±0.00^{a}	0.00±0.00a	0.00±0.00^{a}	0.00±0.00^{a}
	60	10	0.00±0.00^{a}	0.00±0.00a	0.00±0.00^{a}	0.00±0.00^{a}
		20	4.80±6.61^{ab}	2.80±3.83abc	6.40±8.76^{abc}	8.20±11.37^{abc}
		30	2.00±4.47^{a}	1.40±3.13a	1.00±2.24^{a}	1.20±2.68^{a}
		Control	**12.00±2.31^{b}**	**6.50±0.58a**	**3.00±6.79^{cd}**	**14.00±0.00^{bc}**
River Sand + Top Soil	20	10	2.00±4.47^{a}	1.20±2.68a	4.00±0.00^{ab}	2.00±4.47^{a}
		20	4.80±6.57^{ab}	2.80±3.90abc	2.20±4.91^{ab}	6.20±8.50^{a}
		30	1.00±2.24^{a}	1.40±3.13a	3.20±7.16^{ab}	3.60±8.05^{ab}
	40	10	4.40±6.19^{ab}	2.60±3.58abc	9.00±12.92^{abc}	7.60±10.43^{abc}
		20	0.00±0.00^{a}	0.00±0.00a	0.00±0.00^{a}	3.60±8.05^{a}
		30	1.60±3.58^{a}	0.00±0.00a	1.80±4.03^{ab}	0.00±0.00^{a}
	60	10	1.20±2.68^{a}	1.20±2.68a	3.80±8.50^{ab}	0.00±0.00^{a}
		20	3.20±4.60^{ab}	2.40±3.29ab	3.20±7.16^{ab}	8.20±11.37^{abc}
		30	0.00±0.00^{a}	0.00±0.00a	0.00±0.00^{a}	1.20±2.68^{a}
		Control	**10.00±0.00^{b}**	**6.00±0.00c**	**11.00±0.00^{bcd}**	**15.00±0.00^{ab}**
		Total	**2.46±4.60**	**1.50±2.70**	**3.41±6.58**	**3.73±6.90**
Significant level			ns	ns	ns	ns

Means with different letters are significantly different at p≤0.05 using Duncan's multiple range: NS=not significant

Fig 1: Nursery and data collection from *D. microcarpum seedling*s

Conclusion: Seeds treated with 40% H_2SO_4 and planted in river sand had the highest number of germinations. Germination percentage, emergence index and emergence rate index of *D. microcarpum* was highest with 40% H_2SO_4 treated seeds planted in river sand and control. Highest mean height of *D. microcarpum seedling*s was recorded among seeds raised in river sand without H_2SO_4 seed treatment (control). *D. microcarpum seedling*s can best be raised with 40% H_2SO_4 seeds pretreatment and river sand as medium.

REFERENCE

Adedeji, AA; Alakali, J; Adewale, PO; Ngadi, MO (2012). Thermophysical properties *of Detarium microcarpum* seed flour. Lwt-Food Science and Technology, 47(2), 233-237

Agboola, PA; Adedire, M.O. (2002). Response of dormant seeds of tropical tree Species to germination promoter. *Nig. J. Bot.* 11:103-110.

Akinlade MS; Agbeja, AO; Olaifa, KA; Asinwa, IO; Olaitan AO (2021). The influence of sowing media on the growth performance of *Piliostigma thonningii* (Schum) Milne-Redh. J. *Res. in For. Wild. Environ.* 13(2): 13 – 19.

Amonum, JI; Niambe, OK; Japheth, HD (2019). Effect of Planting Media on the Germination and Early Growth of *Dacryodes Edulis* (G. Don) H. J. Lam. *Int. J. For. Horticul.* 5(1): 6 -11.

Cavin, AL; Hay, AE; Marston, A; Stoeckli-Evans, H; Scopelliti, R; Diallo, D; Hostettmann, K (2006). Bioactive Diterpenes from the Fruits of *Detarium microcarpum. J. Nat. Prod.* 69(5), 768–773

Dickens, D (2011). Effect of propagation media on the germination and seedling Performance *of Irvingia wombulu* (Vermoesen). *Amer. J. Biot. Mol. Sci.* 2159-3701.

Duguma, B; Kaiw, BT; Okali, DDU (1988). Factors affecting germination of *Leucaena leucocephala*. *Seed Sci. Tech.*16: 489 - 500.

Kouyaté, AM; van Damme, P (2006). *Detarium microcarpum* Guill. &Perr. [Internet] Record from PROTA4U. Schmelzer, G.H. & Gurib-Fakim, A. (Editors). PROTA (Plant Resources of Tropical Africa/Ressources végétales de l'Afriquetropicale), Wageningen, Netherlands.

Mathowa, T; Madisa ME; Moshoeshoe; CM; Mojeremane, W (2014). Effect of Different Growing Media on the Growth and Yield of Jute Mallow (*Corchorus olitorius* L.). *Inter. J. Res. Stud. Biosci.* 2(11): 153-163.

Ndor, E; Dauda, NS; Chamming HD (2012). Effects of germination media and seed size on germination and seedling vigor of Fluted pumpkin (*Telferiaaccidentalies*). *Adv. Environ. Biol.* 6(1. 0)2758-2761.

Okunomo, K (2010). Germination and Seedling growth of *Parkia bicolor* (A. Chev)a Influenced by nursery technique. *Afri. J. Gen. Agric.* 6(4): 22 – 27.

Omokhua, GE; Ogu, A; Oyebade, BA (2015). Effects of different Sowing Media on Germination and Early Seedling Growth of *Terminalia ivorensis* (A.Chev.). *Inter. J. Sci. Techn. Res.* 4(03): 119 – 122