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Assessment pre-treatment, germination and growth performance of *Detarium microcarpum* (Guill. & Perr.) seeds in three planting media

Grace Dachung, Aondolumun Bartholomew Tyolumun and David Oriabure Ekhuemelo
Department of Forest Production and Products, Federal University of Agriculture Makurdi, Nigeria
davidekhuemelo@gmail.com

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Abstract

Effect of sulphuric acid pretreatment of Detarium microcarpum seeds on germination and different media on seedling growth was studied. Viable seeds were soaked in H_2SO_4 20%, 40% and 60% concentrations for 10min, 20min and 30mins, respectively. Treated seeds were sown on media replicated four times. Data on seedlings' growth parameters were collected and analyzed. First germination of seedlings occurred on 14th day after planting on river sand. Highest (9) germination of D. microcarpum seeds occurred 17th DAP. Seeds treated with 40% H_2SO_4, 60% H_2SO_4 and untreated seeds had highest (4) germination. Germination percentage of D. microcarbon was highest (80%) with 40% H_2SO_4 treated seeds for 10 and 30 mins planted; 20% H_2SO_4 for 10 mins planted and 60% H_2SO_4 for 30 mins. Emergence index and emergence rate index of D. microcarbon seeds followed same trend as germination percentage. Highest mean (16cm) height of was recorded among seeds raised in river sand control. Means of collar diameter, leaf area and number of leaves also follow same trend with 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. In conclusion, 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 D. microcarbon growth.

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

Introduction

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* is a tree species that occurs naturally in in dried region of West and Central Africa ranging from Senegal, Gambia 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[1,2]. In Nigeria, it is locally called '*Ofor*' in southwest Nigeria and '*Agalien*' in Tiv people of north-central part of Nigeria. It is called '*abu laila'* in Sudan while in Senegal and Mali, they are called *dank* and *tambadala* respectively[3]. *D. microcarpum* 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* is alternate having paripinnately compound between 14 and 20 cm in length having short and hairy 3 - 4 pairs of leaflets when they are young[1]. This species is profound in wooded and shrub savannahs and in amosaic dry forest. *D. microcarpum* thrives well in sandy soils, dry/hard soils which has lofty iron mineral where corrhizal fungi are present. The plant can be propagated by both seeds (sexual) and by vegetative part (asexual) as shown by many literatures[1.]

D. microcarpum is very important source of food and medicines to locals. The fruit of *D. microcarpum* is edible either raw or cooked. Traditionally, the fruit pulp can be processed into flour that can be used for baby food, bread, couscous, and local beer making. The kernels of the seed could be mixed with melon (Egusi) and used for soup preparation. Condiment and vegetable are produced from the leaves and flowers of the plant[2]. Fruit of *D. microcarpum* is seasonal and can be eaten in huge quantity during dry hot season. *D. microcarpum* is an important foundation of nutrition when other foods are less available during the year. The fruit is edible and it is rich in vitamin C[4,5]. Many products such as food and medicinal are gotten from different parts of the tree species. In indigenous healthcare domain, *D. microcarpum* leaves, tuberculosis, meningitis, itching, syphilis, diarrhea among others were reportedly treated by extracts from the bark, stem and roots of *D. microcarpum*[6].

Pharmacological and nutritional studies of this species reported that both stem bark and roots of *D. microcarpum* contain effective antioxidants such as flavonoids inhibit human immunodeficiency virus 1 or 2 infection[7]. *D. microcarpum* fruit pulp have been applied in treating dizziness, meningitis, and stomach diseases, and other numerous magical treatments[3]. The

root, leaf and wood of *D. microcarpum are* used for the treatment of diarrhea, meningitis, tuberculosis, hemorrhoids and other fungi infections[1] the bark and root are use as bio-insecticide (as mosquito repellant). The wood of *D. microcarpum* is very useful for construction and carpentry. The wood also produces high-quality firewood and charcoal. Ethanol extract from bark of *D. microcarpum* exhibited antimicrobial properties on some bacteria such as *L. monocytogenes, S. aureus, K. pneumoniae, S. pyogenes, C. freundii,* and*P. aeruginosa*. Extracts from this species possesses some anti-tumour action on cancer cells of the breast. The methanol extract of *D. microcarpum* revealed the presence of flavanes which was effective in the treatment of HIV1 and HIV2 disease. Extract from the stem bark revealed strong molluscicidal properties on *L. natalensis*. *D. microcarpum* is reported to possess 2-tetranorditerpenes, coumarin (1%), cis-2-oxokolavenic acid (0.5%), clerodane diterpenes catechine, the diterpene copalic acid (1.7%). *D. microcarpum* leaves methanol extract demonstrated active feeding restrictive action against *R. speratus* termite. Also, four active components of clerodane diterpenes isolate was reported to possess active antifeedant properties at 1% [8, 9.]

To ensure sustainable utilization of *D. microcarpum* species for its various uses, it is very important to improve the growth of the plant because of the increasing degradation of vegetation in Nigeria that result from deforestation, agricultural practices and grazing of farm animals on forested land. Some of the strategies need to be employed in improving *D. microcarpum* include; identification collection of seeds, pre-testing and treatment of seeds, preparation of planting media, propagating and watering of seeds, management of seedlings in nursery, preparation of planting site and transplanting and plantation management. Seeds of some plant species are dominant meaning that they have difficulty in germination. As a result, their germination is adversely influenced by the seed coat which leads to poor germination and growth. Majority of plant species like *D. microoocarpum* have hard seed coat which requires several approaches for seed germination and survival in different environment. In numerous plant species, germination of seeds is very slow and sometimes the seeds may even fail to germinate.

Deforestation or degradation forest in Nigeria, are serious factors threatening raising of forest, forest management and its sustainability. Also, there is looming and growing demand for forest use and forest products because of the swelling world population. Continuous overexploitation of forest can snowball into destruction of forest products which subsequently leads to resource depletion and extinctions. Propagation is the act reproducing offspring by trees through seeds and cuttings. Propagation of *D. microcarpum* can be vegetative (stem or root cuttings) and 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 *Detarium microcarpum* seeds in three planting media.

Materials and methods

Study area: The experiment was carried out at the Forestry Nursery, Joseph Sarwuan Tarka University Makurdi. Located adjacent the University's Water Works, South Core. Makurdi, the capital of Benue State covers an area of 804 square kilometers and lies between Latitude 07^{o} 45'N to 07^{o} 46'N, Longitude 08^{o} 37'E to 08^{o} 25'E, 98m above sea level.

Benue State has a tropical sub-humid climate with two distinct seasons: wet season and dry seasons. The wet season starts from April to October and the dry season from November to March. The annual rainfall ranges from 1,200mm - 1, 500mm. Benue State lies in the southern Guinea Savannah. Persistent clearance of the vegetation has led to the development of re-growth at various levels of development making it favorable for animal grazing during their early growth of the vegetation. These succulent grasses can be cut, dried and stored for dry season livestock feeding. The grasses however grow very tall, coarse and tough on maturity. The scattered trees are mainly those of economic value and include locust bean, shear butter, mango, silk cotton, African iron, *Isoberlinia Tomentosa*, cashew, oil palm, African mahogany, Gmelina and Sweet Detar among others. These tree species produce valuable fruits, wood and fibre which can be utilized 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 10min, 20min and 30min, 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: 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 (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:

$$GPS = \frac{NSG}{TNSP} \times \frac{100}{1} \quad (1)$$

$$EI = \frac{NSGPD \times DAP}{TNSG} \quad (2)$$

$$ERI = \frac{EI}{GP} \quad (3)$$

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 32nd DAP (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.* who noted that H_2SO_4 treatment was most effective in improving of *Luecina leucocephala* seed coat. Aliero[10] 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[1] reported that *D. microcarpum* germination in the nursery from 8 - 10 days after sowing and after 47 days, 71–100% of seeds sown in polythene bags germinated. Since natural germination *D. microcarpum* is hindered by bush fires and dry weather Kouyaté and van Damme[1] efforts should be intensified in raising the seeds in the nursery.

Germination percentage, emergence index and germination indices of *D. microcarbon:* Germination percentage of *D. microcarbon* 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. microcarbon* seeds also followed same trend as germination percentage of *D. microcarbon* 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*[11] 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. The porosity of river sand medium may allow imbibitions the seeds which gives tolerable aeration for seeds to germinate very fast. River sand possesses good aeration and drainage with low water holding capacity[11].

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

Media	Acid	T	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		
RS	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
TS	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
RS+TS	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: RS= River Sand; TS=Top Soil; RS+TS=River Sand +Top Soil; Acid= Conc H_2SO_4 (%); T=Time (mins); 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 microcarbon.*

Media	Conc of H_2SO_4 (%)	Time (mins)	Germination Percentage (%)	Emergence index	Emergence rate index
River Sand	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
	60	10	40	7.5	0.2
		20	60	15	0.3
		30	0	0	0
		Control	80	7.5	0.1
Top Soil	20	10	40	15	0.4
		20	40	15	0.4
		30	0	0	0
	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
River Sand + Top Soil	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
	60	10	60	10	0.2
		20	60	10	0.2
		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 (16cm) height of *D. microcarpum* seedlings 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 (12cm) and river sand + top soil (10cm) 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 4.00cm. 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 study showed there was increase in height of *D. microcarpum* seedlings across the panting media with no significant difference among planting media. This agrees with Mathowa[12] who noted that growth media significantly affects plant growth. The highest mean height was recorded in those planted river sand. This agrees with the findings of Dickens[13] who recorded better growth of *Persea americana* seedlings in river sand. The least height was recorded in top soil this was in contrast with the findings of Okunomo[14] who recorded better *Persea americana* seedling height with top soil as media. The result agrees with Okunomo *et al*[14] who reported a higher growth potential of *Parkia bicolor* height in topsoil; Agboola and Adedire[16] observed highest growth of *Terminalia ivorensis* seedling height, collar diameter raised with in topsoil. The finding disagrees with Dickens[13] finding with apparent high of *Irvingia wonbulu* height in river sand.

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[17]. However, the finding disagrees with the result of Omokhua *et al*[18]. who reported plant diameter was better in top soil. Akinlade *et al*[19] 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[20]. 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*[21]. and also slightly agrees with the finding of Okunomo *et al*[21]. In general, there is no significant difference within groups of planting media and between planting media.

Figure-1: Nursery and data collection from *D. microcarpum* seedlings.

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±Sdv	Collar Diameter (cm)Mean±Sdv	Leaf area (cm) Mean±Sdv	Number of leaves Mean±Sdv
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.

Conclusion

First recorded germination of *D. microcarpum* seeds occurred on 14th day after planting (DAP) and the last germination was on 32nd DAP. The highest (9) germination of*D. microcarpum* seeds occurred on the 17th DAP. Seeds treated with 40% H_2SO_4 and plated in river sand had the highest number of germinations. Germination percentage, emergence index and emergence rate index of*D. microcarbon* was highest with 40% H_2SO_4 treated seeds planted in river sand and control. Highest mean height of *D. microcarpum* seedlings was recorded among seeds raised in river sand without H_2SO_4 seed treatment (control). Mean values of collar diameter, leaf area and number of leaves follow same trend of *D. microcarpum* seedling height. *D. microcarpum* seedlings can best be raised with 40% H_2SO_4 seeds pretreatment and river sand as medium. 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.

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