

Comparative Growth Rates of Two Species of Monkey Kola Seeds Using Different Sowing Media

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Abstract— The study compared the growth rates of two species of monkey kola seeds (*Cola parchycarpa* and *Cola lepidota* K. Schum) using different sowing media between the period of March and August 2018. The experiment was laid out in 2 x 4 factorial in complete randomized design (CRD) with three treatment and top soil as the control. A total of seventy two (72) seeds and poly pots were used and one seed was sown in each poly pot and visited on daily basis. Data were collected on number of seedling germination, seedling height, leaf number, collar diameter and was recorded on weekly basis. Data were analyzed using descriptive statistics such as frequencies, percentages; LSD and analysis of variance (ANOVA). The result reveals that topsoil was the best for the propagation of *Cola parchycarpa*, with the highest seedling germination of 100%. Topsoil, sawdust and river sand treated with poultry dropping recorded 77.77%, 66.66% and 55.55% respectively. There was a significant difference in the number of leaf ($P < 0.05$) under the different sowing media. LSD test further showed that topsoil had the highest mean value of 10.6 ± 4.5 cm in leaf number and 0.43 ± 0.17 cm in collar diameter. Sawdust with poultry droppings had the highest mean value of 56.8 ± 14.35 cm in leaf area and 15.17 ± 6.18 cm in seedling height. *Cola lepidota* also revealed that topsoil was the best for its propagation with the highest seedling germination of 22.22% and river sand with poultry droppings had germination percentage of 11.11%. There was a significant difference in the collar diameter ($p < 0.05$) under the different sowing media. LSD test further indicated that the highest mean value of 22.60 ± 41.45 cm was recorded in leaf area low in collar diameter with the value of 0.29 ± 0.11 cm. Therefore, the use of topsoil and sawdust treated with poultry droppings is recommended for small and large-scale propagation of *C. parchycarpa* and *C. lepidota*.

Keywords— Comparative growth rates, Seedling, Sowing media, propagation, species, Monkey kola seeds.

I. INTRODUCTION

Tropical forests contain vast reserves of plant biodiversity, that for millennia, men used for their daily needs. The genetic resource of these plants composed of species that play fundamental roles in the satisfaction of many basic needs of local communities. Often unknown to a large people, they contribute to the economy and food security in the country (Achigan-Dako *et al.*, 2011).

Monkey kola fruits have been among the primary Non-timber products (NTFPs) of humid forest belt of Southeastern Nigeria. It is a perennial tree grown in West central African forests. Monkey kola is member of the family of *Sterculiaceae* and belongs to a group called Drupes (Pamplona-Roger, 2008). It is made up of trees varieties; red (*Cola laterita*

K.Schum), yellow (*Cola lepidota* K.Schum) and white (*Cola parchycarpa*) (Singh *et al.*, 2010), all these yield edible fruit of varying characteristics and sweetness (Agro-biodiversity, 2011). The pod of the yellow variety is roundish while the white variety has more cylindrical shape. Monkey kola is identified by various local names in southern Nigeria (Achicha or Ohiricha in Igbo and Ndiyah in Efik). It is cultivated throughout the months of June to November (Ogbu *et al.*, 2007). Monkey kola is mostly consumed fresh and like most fruits and vegetables and it is commonly found in local markets like other fruits, it has a very short life span probably due to its high moisture content. Monkey kola has nutritional and medicinal values for examples essential amino acid, vitamins and mineral elements (Pamplona-Roger, 2008, Singh *et al.*, 2010, Caleb, 2017; Finelib, 2017). The tree increases the fertility of the soil and has the ability to sequester carbon (Agroforestry, 2018).

The mature tree of *Cola parchycarpa* can attain a height of 20ft to 60ft (6m-18m), girth up to 3ft (0.9m) with very few or no branches and leaves crowded at the top of the stem. It flowers from January to June borne in clusters on the stem below the leaves extending right down to the base. Each carpel is 4.8 to 8 inch long and 2.4inch broad with short stalk, a pronounced beak and three rather knobby longitudinal ridges. (Keay *et al.*, 1989) while *Cola lepidota* can grow up to 60ft high with a twisted trunk and calciferous lumps. The caulescent follicle is comprised of one or two seed hinge on the fruit length (3.2 to 8.2cm), oval or semi-spherical shape. The seed are reddish brown or green in colour, obliquely ovate with two flattered rough surfaces. The fruit carpel's are about 20cm long and 5cm broad, sub-cylindrical, shortly acuminate and roughly scaly (Ogbu and Umeokechukwu, 2014).

However, monkey kola is mostly found in the wild, cultivated by farmers and sparingly seen in home gardens still, it is an underutilized fruit with paucity of information on the germination and growth conditions of the species since little or no effort has been made for its domestication. The objectives of the study are to determine the germination rate of the two species and to compare the growth rates of the two species using different sowing media.

A. The Study Area

The research was carried out between the period of May to August 2018 at the Botanical Garden of the department of Forestry and Wildlife Technology, Federal University of

Technology, Owerri, located in Owerri West Local Government Area of Imo State, South-East, Nigeria. Owerri West Local Government is bounded on the North by Oguta and Mbatoli Local Government Areas, on the East by Owerri Municipal Council, on the South by Ngor Okpala and West by Ohaji/Egbema Local Government Areas. Owerri has a tropical wet climate according to the Koppen-Geiger system. Rain falls most months of the year with a short dry season period. The area lies in the forest zone and it is characterized by the growth of tall trees that have luxuriant foliage. The annual

rainfall of the area is between 2000-2040mm while the relative mean range of temperature is between 30-35°C, while the relative humidity of the area is between 95% and 100% at dawn and decrease to between 70% and 80% during the maximum temperature (NIMET, 2014). The least amount of rainfall occur in January with an average of 17mm, in June the precipitation reaches its peak with an average of 363mm. the temperature are highest on March with an average of 27.9°C and 25°C on August.



Figure 1: Map of Imo State Showing Owerri West Local Government Area

Source: A.E. Ibe et al. (2014) Published in International Journal of Natural and Applied Sciences

The area supports the cultivation of crops and the major occupation of the people is farming which also involves rearing of livestock. Resourceful trees mainly grown in the area are breadfruit, oil bean, palm tree and bamboo. The crops mostly cultivated in the area include yam, cassava, *relfeiria*, groundnut, maize, water melon, plantain, breadfruit, cashew, walnut and the livestock include goat, sheep and poultry.

II. MATERIALS AND METHODS

2.1 Seed Source and Procurement

The monkey kola fruits (*Cola parchycarpa* and *Cola lepidota*) were bought from markets in Owerri, Imo State and Umuahia, Abia State respectively. Purchasing of the sample

was done from at least five randomly selected vendors in the market. Mature and undamaged fruits were selected and any fruit that was moldy were sorted and removed. Sorting was done by hand and the fruit washed to remove dirt. Grading of the fruit was based on firmness, size, maturity, colour and shape, freedom from foreign matters, insect damage and mechanical injury. The fruit were opened longitudinal with a knife to extract the seed from the mesocarp for planting.

2.2 Experimental Design

The experiment was laid out in 2 x 4 factorial in completely randomized design (CRD) with three treatment and top soil as the control. The seed of two varieties of monkey kola were used for the study. Poly pots of uniform

sizes were used in this experiment. The poly pots were filled with top soil, river sand and saw dust, mixed with treatment (Poultry dropping) and watered before sowing the seed. Seventy two (72) poly pots were used for the study. One seed in each poly pot making a total of 72 seeds.

2.3 Data Collection

The poly pots were visited daily to ascertain the time and period of seedling emergence. Number of germination seeds was recorded weekly. The seedling height and leaf number were assessed. The heights of seedlings were measured from the medium level to the tip of the plants. The number of leave on each seedling were counted and recorded including tips of new leave just beginning to emerge. The leaf areas were measured using a leaf area meter. The collar diameter was measured using a veneer caliper. Data collected were recorded on weekly basis.

2.4 Data Analysis

Data on the seedling emergence were used to compute the percentage seed germination:

$$\% \text{ Germination} = \frac{\text{number of seed germinated}}{\text{number of seed sown}} \times \frac{100}{1} \quad (1)$$

Data on seedling growth were analyzed using of variance (ANOVA) and mean was separated using Least Significance Difference (LSD) test at 5% probability level.

III. RESULTS AND DISCUSSION

Observations made during the study revealed that *Cola parhycarpa* seeds sprouted 7 days after planting under the topsoil medium (control) and with 9 days under the sawdust and topsoil treated with poultry droppings respectively. Seeds sown in the river sand with poultry dropping medium sprouted 11 days after planting. Table 1 shows the number of days it took *C. parhycarpa* seedlings to germinate under the four different sowing media. For topsoil, it took 31 days for the seedlings to emerge, 33 days under sawdust with poultry droppings, and 34 days under river sand with poultry droppings. The result also shows that the highest germination percentage was recorded under the control which had 100%, followed by 77.77% under sawdust with poultry droppings, 66.66% under topsoil with poultry droppings and 55.55% in river sand with poultry droppings sowing medium. The high germination rate that was recorded under topsoil was as a result of its higher nutrient contents. this is in line with the finding of Okunomo *et al* (2000) and Okunomo and Orji (2004), who reported higher germination percentages in

topsoil with *Dacryodes edulis* and *Persea americana* respectively and also Agboola *et al.*, (2001) who reported highest germination in topsoil for *Terminalia ivorensis* The study also corroborates with the work of Okunomo (2010), who reported a higher germination percentage in topsoil of *Parkia bicolor*. This may be due to the fact that some conditions such as nutrients, microbial activates and moisture content play important roles in the germination of species especially in topsoil. Sawdust with poultry droppings recorded the highest mean leaf area. The best medium for propagation of *C. parhycarpa* was topsoil in terms of leaf number and collar diameter. The analyzing of variance for seedling development compared under four different sowing media shows significant difference at (P>0.05) for the leaf number. Other growth parameters (collar diameter, leaf area and seedling height) were not significantly different under the four different sowing media at P>0.05. Also LSD test for mean seedling growth parameter was highly significant between topsoil and topsoil with droppings poultry at P < 0.05.

Furthermore, after planting, *Cola lepidota* seeds sprouted in 10day in topsoil medium, 22days in river sand with poultry droppings. The percentage germination for *C. lepidota* seedlings under the four sowing media shows that topsoil had the highest germination percentage of 22.22% and 11.11% of river sand with poultry droppings and no germination was recorded under the sawdust with poultry droppings and topsoil with poultry droppings. However it took 33 days for seedlings to emerge in the topsoil medium and 39 days under the river sand with poultry droppings medium. The result indicated that *C. lepidota* seed have low germination percentage. The inability to germinate in all the treated media was because of the fact that the species is not commonly found in Owerri and the environmental conditions were not favorable for its growth. This is in consonance with the work of Ene-Obong *et al.*, (2016), who noted that *C. parhycarpa* and *C. lepidota* grow in different geographic and environmental conditions. The highest mean seedling height for leaf number, leaf area and collar diameter for *C. lepidota* was recorded under the topsoil medium which indicates the best medium for the propagation. Also there was a significant difference at P<0.05 for the collar diameter under the four different sowing media. Other growth parameters (seedling height, leaf number and leaf area), were not significant. The LSD test for mean growth parameters for *C. lepidota* under difference sowing media shows significant difference in the mean collar diameter between topsoil, river sand with poultry droppings.

TABLE 1: Germination Percentage under Different Sowing Media

Plants	Sowing media	Number of seeds sown	Number germinated	Germination percentage %	Number of days of seedling germination
<i>Cola parhycarpa</i>	Topsoil	9	9	100.00	31
	Sawdust with poultry droppings	9	7	77.77	33
	Topsoil with poultry droppings	9	6	66.66	33
	River sand with droppings	9	5	55.55	34
<i>Cola lepidota</i>	Topsoil	9	2	22.22	33
	Sawdust with poultry droppings	9	0	0	
	Topsoil with poultry droppings	9	0	0	
	River sand with droppings	9	1	11.11	39

TABLE 2: ANOVA for Seedling Growth Parameter under Different Sowing Media

Plants	Source of variation	Sun of squares	Df	Mean square	F cal	P-value	Remark
<i>Cola parhycarpa</i>	Leaf number	80.80	3	26.93	3.420	0.043	*
	Error	126.00	16	7.88			
	Total	206.80	19				
	Collar number	0.047	3	0.016	0.707	0.574	Ns
	Error	0.176	8	0.022			
	Total	0.223	11				
<i>Cola parhycarpa</i>	Leaf area	1700.137	3	566.713	1.755	0.192	Ns
	Error	5108.600	16	319.288			
	Total	6808.738	19				
	Seedling height	39.203	3	13.068	0.568	0.647	Ns
	Error	276.055	12	23.005			
	Total	315.258	15				
<i>Cola lepidota</i>	Leaf number	2.150	3	0.717	1.509	0.250	Ns
	Error	7.600	16	0.475			
	Total	9.750	19				
	Collar number	0.176	3	0.059	14.941	0.001	*
	Error	6.031	8	0.064			
	Total	0.208	11				
<i>Cola lepidota</i>	Leaf area	1797.538	3	599.179	1.370	0.288	Ns
	Error	6997.700	16	437.356			
	Total	8795.238	19				
	Seedling height	61.242	2	30.621	0.994	0.42	Ns
	Error	184.927	9	30.821			
	Total	246.169	8				

*= significant difference; ns = not significant

TABLE 3: Mean Seedling Growth of under Different Sowing Media

Plant	Treatment	Leaf Number	Collar Diameter (cm)	Leaf Area (cm ²)	Seedling Height (cm)
<i>Cola parhycarpa</i>	Topsoil	10.60 ^{ab} ±4.5	0.43 ^a ±0.17	42.40 ^a ±15.66	13.57 ^a ±6.61
	Sawdust with poultry droppings	7.80 ^{ab} ±2.28	0.34 ^a ±0.14	31.20 ^a ±15.01	13.20 ^a ±2.68
	Topsoil with poultry droppings	5.00 ^b ±2.00	0.27 ^a ±0.14	31.20 ^a ±15.01	13.20 ^a ±2.68
	River sand with poultry droppings	7.00 ^{ab} ±1.41	0.28 ^a ±0.13	39.70 ^a ±24.50	10.80 ^a ±1.65
<i>Cola lepidota</i>	Topsoil	0.80 ^a ±1.30	0.29 ^a ±0.11	22.60 ^a ±41.45	13.46 ^a ±7.65
	Sawdust with poultry droppings	0.00 ^a ±0.00	0.00 ^b ±0.00	0.00 ^a ±0.00	0.00 ^b ±0.00
	Topsoil with poultry droppings	0.00 ^a ±0.00	0.00 ^b ±0.00	0.00 ^a ±0.00	0.00 ^b ±0.00
	River sand with poultry droppings	0.20 ^a ±0.44	0.15 ^c ±0.49	2.20 ^a ±5.59	7.90 ^a ±2.98

Means with the same alphabets as superscripts are not significantly different from each other

IV. CONCLUSION

The study reveals that among the sowing media used, topsoil is the best medium in term of seed germination rate and early growth for *C. parhycarpa* and *C. lepidota*. The germination and growth rates of *C. parhycarpa* improved significantly especially under topsoil and sawdust with poultry droppings sowing media where as *C. lepidota* performed poorly under the four different sowing media. The poor growth performance was due to geographic and environmental conditions that were not favourable for its germination and growth.

V. RECOMMENDATIONS

An understanding of some aspects of biology of the species (*C. parhycarpa* and *C. lepidota*.) through this study is vital for large scale production of seedlings of these underutilized species to meet agroforestry program. The use of topsoil and sawdust with poultry droppings sowing media is recommended for small and large scale propagation of *C. parhycarpa*. This will play an important role in ensuring uniform and maximum germination of the species in the nursery.

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