ROOTING POTENTIALS OF LEAFY STEM CUTTINGS OF PEPPER FRUIT (*Dennettia tripetala)* Baker, F.

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ABSTRACT

The effect of some post severance treatments on the rooting potentials of juvenile stem cuttings of Dennettia tripetala were assessed in an experiment conducted at the Physiology and Tree breeding Section's Nursery of the Forestry Research Institute of Nigeria, Jericho, Ibadan, Oyo State, Nigeria. A total of 160 single node cuttings of D. tripetala were collected, using a Complete Randomized Design (CRD), assigned to 4 treatments namely 200 part per million (ppm) gibberellic acid (GA_3), 200 ppm naphthalene acetic acid (NAA), 200 ppm indole-3-butyric acid (IBA) dissolved in industrial alcohol and a control (with no plant growth regulator) applied by dipping the base of the cuttings for 10 seconds. Although the results showed no pronounced effect of the treatments on the leaf abscission and cutting mortality at 0.05 level of probability, there was however, a significant difference in shoot formation with NAA showing a mean of 2.50 followed by control (1.75), IBA (1.50) and GA_3 (1.0) respectively. Also, there were significant differences ($p<0.05$) in root formation, number of roots and root length with the control recording higher values than the rest of the treatments. The results, therefore, showed that it may not be necessary to use synthetic plant growth regulators used in this experiment [Indole-3-Butyric Acid (IBA), Gibberellic Acid (GA_3), and Naphthalene Acetic Acid (NAA)] that is quite expensive to induce root in the cuttings of D. tripetala for mass clonal propagation as this can easily be achieved and even better without the use of any hormones.

Keywords: *D. tripetala*, Indole-3-Butyric Acid (IBA), Gibberellic Acid (GA_3), Naphthalene Acetic Acid (NAA)

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INTRODUCTION

Dennettia tripetala Baker f. belongs to the family Annonaceae. It is a tropical small tree that abounds throughout the rainforest zone of Africa. It is found in the tropical rainforest region of Nigeria and sometimes in Savana areas (Okwu *et al.*, 2000). This tree flourishes at the onset of rain, from April to June (Umoh, 1998).

The fruits of the tree are edible and have a peppery and spicy taste. It serves as mild stimulant and may also serve as a source of some soluble vitamins such as ascorbic acid, thiamine, riboflavin and niacin which explain its uses for the treatment of the common cold and the control of other diseases such as prostate cancer (Muhammed *et al.,* 2021). The leaves in combination with mango leaves are used to treat mild fever. Pharmacologically, the oil extracted from the fruit of *D. tripetala* is used in the manufacture of mouth wash (Nwinuka and Nwiloh, 2009). Some of the fruit extracts have been shown to be active as antifungal agents against *Candida sp., Crytococeus sp., Geotrichum sp., Rhizopus stolonifer, Aspergillus sp. and Fusarium sp*. (Ejechi *et al.,* 1999). The fruit of *D. tripetala* also contains an essential oil, which is also used as an effective preservative for stored grains such as cowpea and maize without negatively affecting their viability (Akinwumi, 2011).

Also, the screening of the ethanolic extract revealed the presence of tannins, alkaloids, steroids, flavonoids, cardiac glycosides, saponins, and terpenoids (Elekwa *et al.,* 2011). These constituents provide a scientific basis for the use of *D. tripetala* in traditional medicine. Saponins, tannins, and flavonoids, for instance, are effective against diabetes. They also possess antimicrobial and anti-inflammatory properties (Sparg *et al.,* 2004). Cardiac glycosides can be used in the treatment of asthma (Trease *et al.,* 1989). Alpha-linoleic acid has been shown to reduce the risk of cardiovascular disease (William, 2000) as well as prostate cancer in men (Koralek *et al.,* 2006).

Few preliminary studies have attempted to determine the nutritive value of *D. tripetala*.

Researches have shown that the fruit of *D. tripetala* when dry, majorly consists of carbohydrates (Okwu and Morah, 2004; Ihemeje *et al.,* 2013). *D. tripetala* also contains protein, fiber, ash, lipids, and moisture. In fresh fruits, this moisture increases with ripening (Ihemeje *et al.,* 2013). *D. tripetala* also contains trace elements, minerals, and water-soluble vitamins (Okwu and Morah, 2004; Ihemeje *et al.,* 2013). These vitamins A and C tend to increase significantly with ripening (Ihemeje *et al.,* 2013). Another study (Ihemeje *et al.,* 2013) also revealed that, with ripening, the number of phytochemicals, including phenols, saponins, tannins, flavonoids, and alkaloids, in *D. tripetala* changes. Also, on the antimicrobial properties of *Dennettia tripetala*, studies have shown that the essential oil and phenolic acid extract of *D. tripetala* can inhibit the growth of food-borne microorganisms such as *Staphyloccocus aureus*, *Salmonella* sp., *Escherichia coli*, and a host of others (Ejechi and Akpomedaye, 2005). This points to a role for pepper-fruit in the preservation of food substances such as meat which is prone to rapid decomposition in places without constant electricity. More recently, the leaves of *D. tripetala* were found to be effective in inhibiting the growth of the rot-causing fungus *Sclerotium rolfsii* in cocoyam both *in vitro* and *in vivo* (Nwachukwu and Osuji, 2008). Several other reports show the antimicrobial activity of *D. tripetala* (Ejechi, *et al.,* 1999).

Despite this great potential of *D. tripetala* and its economic importance, the species has been rendered threatened in the forest due to the pressure exerted on the seed by both animals and humans for their survival (Onofeli and Akinyele, 2014).

Different authors have worked on the sexual propagation of *D. tripetala* (Mapongmetsem, 2007; Orwa *et al.,* 2009; Udo, 2011) and it has also been reported that *D. tripetala* has inconsistent fruiting, poor seed germination and slow seedling growth (Osaigbovo *et al.,* 2010). There is dearth of information on the vegetative propagation of *D. tripetala*.

Therefore, its vegetative propagation will be very significant as there is too much pressure on the seed of the species, which is the only alternative for achieving inexpensive domestication.

Based on this fact, this study examined the vegetative propagation of *Dennettia tripetala* in order to domesticate and ensure its continuous availability for human utilization.

In vegetative propagation, two of the important factors that influence the rooting of cuttings in tree crops is the types of plant hormones and hormone concentrations (Atangana *et al.,* 2006). Tree species vary considerably in the optimal application of hormone and there is also much intraspecific variation (Alejandro *et al.,* 2009).

Considering the diversity of use of *D. tripetala*, together with its threatened conservation status in the forest, this study investigated the possibility of domesticating the species from cuttings as its source of germplasm.

MATERIALS AND METHODS

The experiment was carried out at the Nursery of the Physiology and Tree Breeding Section, Forestry Research Institute of Nigeria, Ibadan, Nigeria. The climate is typically dominated by rainfall pattern ranging between 1400mm – 1500mm and the average temperature of 32^{o}C with two distinct seasons: Dry season (usually between November and March) and Rainy season (from April to October) (FRIN Annual Metrological Report 2011).

Experimental Layout

A propagation unit was established at the Physiology and Tree Breeding Section's Nursery, Department of Sustainable Forest Management for the experiment. The propagator consisted of a wooden frame enclosed in a clear polyethylene with a water-tight block work base. The base of the propagator was covered by a thin layer of sand (10 cm depth) and then successive layers of small and medium size granite (0.5–5 cm, to a depth of 25 cm) and then filled with water. The non-mist propagation unit was placed in a screen-house.

Seedlings Collection and Application of Treatments

The fruits of *Dennettia tripetala* were collected from the Arboretum of the Forestry Research Institute of Nigeria (FRIN), Oyo State. The seeds were extracted from the fruits and planted in the germination trays. One hundred (100) seedlings were selected among the germinated seedlings and used for the experiment. The stock plants were sprayed with a systemic fungicides and insecticides prior to severance.

Plate 1: Fruits of *Dennettia tripetala*

A total of 160 single nodal cuttings were harvested from the stock seedlings. Ten (10) cuttings each were randomly assigned to the 4 treatments namely 200 ppm Gibberellic Acid (GA_3), 200 ppm Naphthalene Acetic Acid (NAA), 200 ppm Indole-3-Butyric Acid (IBA) dissolved in industrial alcohol and a Control. The base of the cuttings was quickly dipped in the plant hormones, evaporated in a gentle air before been set in washed and sterilized river sand in the propagator in a Completely Randomized Design with 4 repetitions (*Plate* 2) making 160 cuttings in all.

Plate 2: Leafy stem cuttings of *D. tripetala* newly set in the Propagator

Cuttings were assessed weekly for leaf abscission, cutting mortality and shoot formation, while the presence and number of roots (≥ 2 mm in length), rooting percentage, and root length were assessed at the end of the experiment. Numbers of leaves abscised were determined by physically counting the number of dead leaves. Cuttings mortality was determined by physically counting the number of dead cuttings. Shoot formation was done by physically counting the number of new shoots from the cuttings. Presence and number of roots were determined at the end of the experiment by physically checking the presence of roots and counting the number of roots from each of the cuttings, while root length was determined using meter rule.

Data collected were subjected to one-way analysis of variance (ANOVA) and significant means were separated using Duncan Multiple Range Test (DMRT) at 5% level of probability with the use of Minitab 17.

RESULTS

The result showed that leaf abscission and cutting mortality were not significantly affected by the treatments (Table 2). Treatments effect on shoot formation was highly significant (Table 2) with NAA showing a mean of 2.50 followed by the control (1.75), IBA (1.50) and GA_3 (1.0) respectively (Table 1) Root formation, number of roots and root lengths were all assessed at the end of the experiment.

The effect of treatments on root formation was highly significant (Table 2) with the control recording a higher root formation (2.75) than the rest of the treatments. The effect of treatments on number of roots was also highly significant (Table 2) with the control (10.25) higher than NAA (5.75), which in turn was higher than the rest of the treatments, which were not different from each other (Table 1). Treatment effect on root length was highly significant (Table 2) with the control recording highest value of 7.30 followed by IBA (4.02). The rest of the treatments were not significantly different from each other (Table 1).

Table 1: Effect of Hormones on Shoot Formation, Number of Root, Root Formation and Root Length of *D. tripetala*

Variable	Planting Media	Mean	± SE	DMRT Rating
	GA_3 200	1.00	0.70	D
Shoot Formation	IBA 200	1.50	0.50	C
	Control	1.75	0.83	B
	NAA 200	2.50	1.32	A
	GA_3 200	3.00	2.38	C
	IBA 200	3.75	1.93	C
Number of Root	Control	10.25	5.50	A
	NAA 200	5.75	3.14	B
	GA_3 200	1.25	0.75	B
	IBA 200	0.75	0.25	C
Root Formation	Control	2.75	0.62	A
	NAA 200	1.50	0.64	B
	GA_3 200	2.95	1.92	C
Root Length (cm)	IBA 200	4.02	1.04	B
	Control	7.30	2.69	A
	NAA 200	2.15	1.04	C

Means followed by the same alphabet are not significantly different at 0.05 level of probability.

Table 2: Analysis of Variance for Comparing Effects of Hormones on Leaf Abscission, Cutting Mortality, Shoot Formation, Root Formation, Number of Roots and Root Length.

Source of variation	df	Leaf Abscission	Cutting mortality	Shoot formation	Root formation	Number of roots	Root length
Media	3	4.16	2.50	1.52*	3.84*	46.27*	23.69*
Error	12	15.54	3.70	4.20	1.13	28.65	11.43
Total	15						

**significant at 5% probability level*

Plate 3: Root Length of *D. tripetala* cuttings formed at the end of the experiment with control (without any plant growth regulator)

DISCUSSION

The results from the experiment revealed that *Dennettia tripetala* can be successfully propagated by leafy stem cuttings in a mist propagation system, which suggests that vegetative multiplication of this species is feasible. This result agrees with the work of Adebusuyi *et. al.,* (2017), who also successfully propagated the stem cuttings of *Dialium guineense* using a mist propagation system. The result also indicated that there is no need to use synthetic hormones [Indole-3-Butyric Acid (IBA), Gibberellic Acid (GA_3), and Naphthalene Acetic Acid (NAA)] which are quite expensive as the control performed significantly better than the rest of the treatments.

Tchoundjeu and Leakey (2009), reported the presence of auxins at a toxic level in *D. tripetala* and other indigenous medicinal trees when synthetic hormones were applied which inhibited their physiological processes resulting into poor root formation. The decrease in the formation of roots, number of roots and root lengths of *D. tripetala* in the synthetic hormones as compared to the control may also be attributed to this fact.

The profound effect of root formation, number of roots and root length by control in comparison with other treatments is not clear. Further studies may be needed to clarify this reason. This study carried out, suggests that there is no need to apply any synthetic hormones to *Dennettia tripetala* to enhance its root formation and the number of roots it produces.

CONCLUSION AND RECOMMENDATION

The results from the experiment revealed that *Dennettia tripetala* can be successfully propagated by leafy stem cuttings in a mist propagation system, which suggests that vegetative multiplication of this species is feasible.The present study has also demonstrated that there is no need to add any expensive growth hormones [Indole-3-Butyric Acid (IBA), Gibberellic Acid (GA_3), and Naphthalene Acetic Acid (NAA)] to the base of *Dennettia tripetala* in order to enhance its ability to root for mass clonal propagation as this could be achieved (was achieved from this study) without the introduction of any synthetic hormones. It is therefore recommended that for the vegetative propagation of *Dennettia tripetala*, there is no need to use any synthetic hormones.

REFERENCES

Adebusuyi G.A., Ojo D.K., Oyedeji O.F., Amadi J.O. and Sowunmi I.L. (2017): Effect of Seed Extracts and Indole-3-butyric Acid on the Rooting Potential of *Dialium guineense* Willd Stem Cuttings. *Environtropica – An International Journal of the Tropical Environment.* June 2017, Vol. 14, 105-115. http www.environtropica.com/publications/volume-14

Akinwumi F.O. (2011): Evaluation of some plant materials for the control of smoked fish pest, Dermestes maculatus degeer (Coleoptera: Dermestidae) in Clarias gariepinus Burchell (Pisces: Clariidae). *ARPN Journal of Agriculture and Biological Sciences*, 6 (7): 65-69

Alejandro A., Mario P.B., Alejandro M., Leonardo G. (2009): Vegetative propagation of patagonian cypress, a vulnerable species from the subantarctic forest of South America. Bosque 30 (1): 18-26. DOI: http://dx.doi.org/10.4067/S0717-92002009000100004

Atangana A.R., Tchoundjeu A.Z., Asaah A.K., Simons C.A.J., Khasa B.A. (2006): Domestication of Allanblackia floribunda: Amenability to vegetative propagation. Forest Ecol Manag 237 (1-3): 246-251. DOI: http://dx.doi.org/10.1016/j.foreco.2006.09.081

Ejechi, B.O.; Akpomedaye, D.E. (2005): Activity of essential oil and phenolic acid extracts of pepperfruit (*Dennetia tripetala G.* Barker; Anonaceae) against some food-borne microorganisms. *African Journal of Biotechnology*, *4*, 258–261.

Ejechi, B.O.; Nwafor, O.E.; Okoko, F.J. (1999): Growth inhibition of Tomato-rot fungi by phenolic acids and essential oil extracts of pepper fruit. *Food Res. Int*. *32*, 395–399.

Elekwa, I.; Okereke, S.C.; Chukwudomo, C.S. (2011): Phytochemical screening and GC-

MS analysis ofthe essential oil of *Dennettia tripetala* (Pepperfruit) seeds. *ABSU Journal of Environmental Science and Technology*, *1*, 93–98.

FRIN (2011): Forestry Research Institute of Nigeria (FRIN) Annual Metrological Report, 2011.

Ihemeje, A.; Ojinnaka, M.C.; Obi, K.C.; Ekwe, C.C. (2013): Biochemical evaluation of Pepperfruit (*Dennettia tripetala*) and its use as substitute for ginger in zobo drink production. *Academic Research International*, *4*, 513–521.

Koralek, D.O.; Peters, U.; Andriole, G. (2006): A prospective study of dietary α-linoleic acid and the risk of prostate cancer. *Cancer Causes Control*, *17*, 783–791.

Mapongmetsem P.M. (2007): Pycnanthus angolensis (Welw.) Warb. In: van der Vossen HAM, Mkamilo GS (eds). PROTA 14: Vegetable oils/ Oléagineux. PROTA, Wageningen, Netherlands, pp 38-44

Muhammed D., Adebiyi Y.H., Odey B.O., Alawode R.A., Lawal A., Okunlola B.M., Ibrahim J. and Berinyny E.B. (2021): *Dennettia tripetala* (Pepper fruit), A Review of its Ethno-Medicinal Use, Phyto-Constituents, and Biolofical Properties. GSC Advanced Research and Review 2021, 06 (03) 035-043. https://10.30574/gscarr.2021.63.0024

Nwachukwu, E.; Osuji, J. (2008): Evaluation of Plant Extracts for Antifungal Activity against *Sclerotium rolfsii* Causing Cocoyam Cormel Rot in Storage. *Research Journal of Agriculture and Biology 4*, 784–787.

Nwinuka N.M., Nwiloh B.I. (2009): Physico-chemical Properties and Fatty Acid Composition of *Dennettia tripetala* Fruit Oil (Pepper Fruit). Nigerian Journal of Biochemistry and Molecular Biology 24 (1): 42-46

Okwu D.E., Morah F.N.I, Anam E.M. (2000): Isolation and characterization of phenanthrenic alkaloid uvariopsine from *Dennettia tripetala* fruits. *Journal of Medicinal Aromatic Plant Sciences*, 27: 496-498.

Okwu, D.E.; Morah, F.N.I. (2004): Mineral and nutritive value of *Dennettia tripetala* fruits. *Fruits*, *59*, 437–442.

Onofeli A.O. and Akinyele A.O. (2014) Macropropagation of *Dennettia tripetala* Baker f. *South-east Eur for* 5 (2): 135-144. DOI: http://dx.doi.org/10.15177/seefor.14-09

Orwa C., Mutua A., Kindt R., Jamnadass R., Simons A. (2009): Agroforestree Database: a tree reference and selection guide version 4.0. World Agroforestry Centre, Kenya. URL: http://www. worldagroforestry.org/resources/databases / agroforestree (20 February 2014)

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

Sparg, S.G.; Light, M.E.; Stadan, J.V. (2004): Biological activities and distribution of plant saponins. *Jouirnal of Entnopharmacology*, *94*, 219–243.

Tchoundjeu Z., Leakey R.R.B. (2006): Vegetative propagation of African mahogany: effects of auxin, node position, leaf area and cutting length. New Forest 11 (2): 125-136. DOI: http://dx.doi. org/10.1007/BF00033408

Trease, G.E.; Evans, W.C. (1989): Bralliar Tirideln Can. In *Pharmacognosy*, 11th ed.; Macmillian Publishers: New York, NY, USA, 1989.

Udo I.O. (2011): Potentials of Zanthoxylum xanthoxyloides (LAM.) for the control of stored product insect pests. Journal of Stored Products and Postharvest Research 2 (3): 40-44

Umoh I.B. (1998): Commonly used fruits in Nigeria. In: Osagie AU, Eka OU (eds) Nutritional quality of plant foods. University of Benin, Trinity press, Benin City, Nigeria, pp 84-120.