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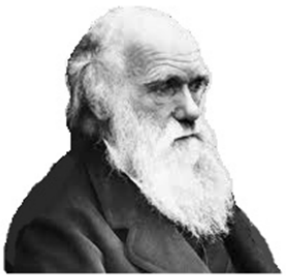

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Effects of rooting hormones on the juvenile stem cuttings of *Annona muricata* Linn. (Annonaceae)

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ABSTRACT

Annona muricata is a recognized medicinal plant species. Despite its usefulness, adequate attention has not been given to its propagation and cultivation. Therefore, this study investigates the effect of some rooting hormones on juvenile stem cuttings of *Annona muricata*. Uniform, healthy, single node leafy stem cuttings were obtained from eighty (80) uniformly growing seedlings. The cuttings were treated with 1mg/ml of Indole Acetic Acid (IAA), 1 mg/ml of Indole Butyric Acid (IBA), coconut water and distilled water as control, using the quick dip method. The percentage survival of the cuttings, percentage of die back, number of new roots formed per cutting, length of new roots formed, and number of new shoot were assessed after 60 days. Results obtained revealed that the species responded differently to the four treatments. Coconut water had the highest survivor percentage (100%) and IBA had the lowest (25%). Coconut water had the highest mean number of roots (5.25) and IBA had the least (1.75), but there was no significant difference between the values obtained from IBA and distilled water. IAA had the highest mean value (1.80) for new shoots, while IBA had the least value and there was no significant difference between the values obtained from coconut water and distilled water. Significant differences, however, did abound in the root length. Coconut water had the highest mean root length value (4.70 cm), followed by distilled water (1.95 cm), while IBA had 1.55 cm and IAA had the least value (0.80 cm). Thus the use of coconut water might enhance the development of stem cuttings of *Annona muricata*.

***Keywords*:** Medicinal plant, Rooting Hormones, Juvenile Stem Cuttings, *Annona muricata*

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1. INTRODUCTION

Vegetative propagation technique by stem cutting has been recognized as a method of mass propagate ion of desirable plants for clonal plantation, reforestation and for commercial purposes (Follosco - Edminston 2002). Propagation by vegetative means is often the best way to preserve selected traits in tree species. It is also a mean of securing pathogen free plants. Other advantages that assure by this method include large number of plant production in shorter time period, irrespective of the season (Mulabagal & Tsay, 2004). Plant cell culture has been increasingly used as an alternative to the generation of conventional plant material (Robinson, 1996, Awodele, 2009, 2013; Takahashi, 2006; Liaw, 2002; Chang, 2003; Coria-Téllez, 2018).

Auxins are known to promote adventitious root development of stem cuttings, through their ability to promote the initiation of lateral root primodia and enhance transport of carbohydrates to cuttings' bases (Hartmann et al., 2000). Local rooting hormone (Coconut water) has been used as a supplement in many laboratories to improve regeneration of plant cells (Maddock et al., 1983). Coconut water contains mainly water (94%) and growth promoting substances that can influence *in vitro* cultures including inorganic ions, amino acids, organic acids, vitamins, sugars, alcohols, lipids, nitrogenous compounds and phytohormones (Yong, et al., 2009). Also, Acha, et al., 2004 Agele, et al., 2010 asserted coconut water contains sugar, amino acid, myo-inositol, and micro constituents of phenyl urea for tree development. Hence this explains the reason why Cocogro, an extract of coconut water, that is less expensive than imported growth hormones but equally effective is usually utilized.

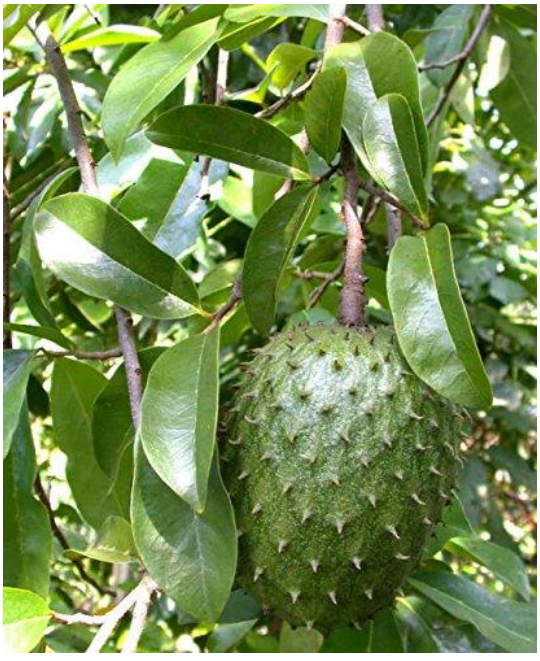

Figure 1. *Annona muricata* Linn. (Annonaceae)

Annona muricata is a plant with acceptable nutritional value as food products, source of medicinal and industrial product as well as contributing directly to food security and supplementary household income for small- and medium-scale farmers. The bark, leaves, fruits,

roots, and seeds of this tree are known since long for various medicinal uses. The fruit and juice is used against worms and parasites, to cool down fevers, to increase lactation after childbirth.

The seeds can be crushed and then used against internal or external parasites, head lice, and worms .The tea prepared from the leaves are used as a sedative and a soporific (inducer of sleep) in the West Indies and Peruvian Andes (Schultes and Raffau, 1990). Traditionally *A. muricata* is used in medicinal herbal drugs to cure various diseases such as diarrhea, cough, hypertension, rheumatism, tumors, cancer, asthma, lactagogue (fruit), malaria, tranquilizer, skin rashes, parasites, liver problems, arthritis (seed) etc. (Mortor, 1980). The roots and bark can be of aid for diabetes, but can also be used as a sedative.

Despite the medicinal values of *Annona muricata*, information on its cultivation is scanty, scattered and mostly beyond the reach of farmer's community. Hence, this study investigated the effect of some rooting hormones on the juvenile stem cuttings of *Annona muricata*.

2. MATERIALS AND METHODS

2. 1. Study site

The study was conducted in the green house of the Department of Plant Science and Biotechnology, Ekiti State University, Ado Ekiti, Nigeria. The University is located between latitude 24°33'S and longitude 25°54'E and elevated 994 m above sea level.

2. 2. Experimental design

The study was carried out in a completely randomized design (CRD) with four treatments via: Indole Acetic Acid (IAA), Indole Butyric Acid (IBA), coconut water and distil water as control. The experiment was replicated four times.

2. 3. Procedure, planting and cultural practices

Coconut water from fresh mature fruits was extracted by drilling holes through the two micropyles according to the method of Nasib *et al*., (2008). The water was then filtered using Whatman filter paper. Seedlings of *A. muricata* were raised in the green house of the Department of Plant Science and Biotechnology, Ekiti State University, Ado-Ekiti, Nigeria. Uniform, healthy, two node leafy stem cuttings were obtained, at two months old, from eighty (80) uniformly growing seedlings. The cuttings were treated with 1mg/ml of IBA, 1 mg/ml of IAA, coconut water (according to Olaniyan *et al.,* 2006) and distil water (control). The quick dip method, according to the standard procedure described by Hartman *et al.,* (1997) was used. The single node cuttings were dipped into the hormones at the basal portion (0.5 cm) of the cuttings for about five (5) seconds and set in washed in sterilized river sand medium filled into experimental pots of 3 kg size perforated at the bottom. Watering was done twice daily with a knapsack sprayer. Manual weeding was carried out weekly to remove unwanted plants.

2. 4. Data collection

The cuttings were assessed for the following parameters after 60 days: percentage survival which was determined as the number of living plants per total cutting planted per treatment; percentage of die back, number of new roots formed per cutting, length of new roots formed, and number of new shoot.

2. 5. Statistical Analysis

The data collected were subjected to one-way analysis of variance (ANOVA) and the means were separated at $P \leq 0.05$ using Duncan's Multiple Range Test (DMRT). All statistical analyses were done using SAS software, 1999 version.

3. RESULTS

3. 1. Percentage survival and mortality of *A. muricata*

Table 1. Percentage survivor and mortality of *Annona muricata* treated with rooting hormones

Treatments	Percentage Survivor (%)	Percentage Mortality (%)
1AA	50	50
IBA	25	75
COCONUT WATER	100	0
DISTIL WATER	75	25

Values with the same letter within the column are not significantly different at $P \leq 0.05$

Table 1 shows the effect of hormone type on percentage survival and mortality of *A. muricata* stem cuttings. The results revealed that significance differences abound among all the treatments on percentage survivor and mortality. The highest survivor percentage (100%) was recorded in cuttings treated with coconut water. This was followed by those treated with distil water (75%), cuttings treated with IAA had mean value for percentage survival of 50% while the least mean value for percentage survival of 25% was recorded in cuttings treated with IBA.

3. 2. Effects of rooting hormone on early growth of *Annona muricata* stem cutting

Table 2. Effects of rooting hormones on early growth of *Annona muricata*

Treatments	Number of roots	New shoot	Root length (cm)
IAA	4.00	1.80	0.80
IBA	1.75	1.00	1.55
COCONUT WATER	5.25	1.25	4.70
DISTIL WATER	2.00	1.25	1.95

Values with the same letter within the column are not significantly different at $P \leq 0.05$

Results of rooting hormone on early growth of *Annona muricata* in terms of number of roots, new shoots and root length were shown in Table 2. The highest mean value for number of roots (5.25) was recorded in coconut water treatment; IAA has an appreciable value of 4.00. While the least mean value of 1.75 was recorded in IBA which was not significantly different from distil water with mean value of 2.00. IAA had the highest mean value (1.80) for new shoot. Coconut water and distil water had the same mean value of 1.25 for new shoot, while the least mean value (1.00) for new shoot was recorded in cuttings treated with IBA. There was significant difference in root length as coconut water treatment had the highest mean value of 4.70 cm, this was followed by distil water (1.95 cm), cuttings treated with IBA had mean value of 1.55 cm while IAA treatment recorded the least mean value of 0.80 cm.

4. DISCUSSION

The results revealed that coconut water-treated seeds have the highest percentage of survival. Thus supporting the previous assertions of Yoon, *et al*., (2007); Aktar, *et al*., (2008); Nasib, *et al*., (2008); Baskaran, *et al* ., (2009); Cheong, *et al*., (2009); Pena-Ramirez, *et al*., 2010 and Bhattacharya, *et al*., (2010) that coconut water can be used as a supplement in many laboratories to improve regeneration of plant cells. The findings also agree with Trevisan *et al*. (2005) who demonstrated the advantage of coconut water for stem elongation and plant development in fruit species.

Distil water treatment (control) had a competitive value to that of coconut water and seeds treated with distilled water had better percentage survival than those one treated with synthetic hormones. Similar finding was reported by Adekola and Akpan (2012) that untreated cuttings performed better than those treated with hormones on survival and sprouting of *J. curcas*.

The results of this study also revealed that highest number and length of roots were recorded in stem cuttings treated with Coconut water. Previous study revealed that coconut water contained sugar, amino acid, myo-inositol, and micro-constituents of phenyl urea that aid tree development (Acha *et a*l., 2004 and Agele *et al*., 2010). Similarly Komamine *et al*., (1990) and Agele *et al*., (2010) asserted that that coconut water promotes root formation.

This study revealed that new shoots were greatly influenced in cuttings treated with IAA than cuttings treated with other hormone. The study showed that IAA supported stem cutting development of this species to a certain degree. This agrees with previous assertion of Hartmann *et al*., (2000) who reported that auxins are known to promote adventitious root development of stem cuttings, through their ability to promote the initiation of lateral root primodia and enhance transport of carbohydrates to cuttings' bases.

5. CONCLUSION

Vegetative propagation serves as the best way to preserve selected traits in tree species. Though some synthetic hormones were known to promote adventitious root development of stem cuttings, the present study revealed that cuttings treated with natural hormone (coconut water) responded better than cuttings treated with other hormones, which is an indication that natural hormone is enough to initiate rooting in *Annona muricata*. Thus, the use of natural hormone to enhance the best development of the stem cuttings of this species is recommended.

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