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Effect of Media and Growth Hormones on the Rooting of Queen of Philippines (*Mussaenda philippica*)

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Abstract

Effects of growth media and rooting hormone on the rooting of Queen of Philippines (*Mussaenda philippica*) were investigated June to September 2015. One hundred and twenty-six trinodal cuttings were obtained from healthy growing stock. The cuttings were treated with IBA, 1-Naphthalene acetic acid, 2,4-Dichlorophenoxyacetic amine, and alternatives; Honey, Coconut water, planted in seven growth media: Top soil, Wheat offal, River sand, Top soil + Wheat offal, Top soil + River sand, Wheat offal + River sand, and Top soil + River sand + Wheat offal in a Complete Randomized Design with three replicates. Cuttings were assessed for number of days to bud break, number of leaves, numbers of branches, number of roots, length of root, and root weight. Data collected were subjected to analysis of variance ANOVA and means were separated using Duncan multiple range test at ($P < 0.05$). IBA and NAA gave the highest number of roots per rooted cuttings between 3 and 29, root length between 2.5 cm and 10.3 cm. For all the parameters considered the best performance was recorded in Top soil and River sand with rooting hormone NAA and IBA. The rooting of *M. philippica* cuttings is enhanced in Top soil and River-sand with the application of IBA and NAA.

Keywords: Difficult-to-root; Root formation; Growth; Development; Ornamental plant

Abbreviations:

M. philippica: *Mussaenda philippica;* NAA: Naphthalene Acetic Acid; IBA: Indole Butyric Acid; DPA: Dichloro Phenoxyacetic Amine; ANOVA: Analysis of Variance; TS: Top Soil; RS: River Sand; WO: Wheat Offal; CM: Centi Meter; SPSS: Statistical Package for Social Science; CRD: Completely Randomized Design; WAP: Weeks after Planting; DMRT: Duncan Multiple Range Test

Introduction

The plant *Mussaenda philippica* commonly known as "Queen of Philippines" is a deciduous shrub widespread all over the world for its aesthetic nature for beautification, fences, air purification etc. the demand for its use as landscape plants and cut flowers is undoubtedly on the increase [1]. In Nigeria's landscapes, they flower luxuriantly almost throughout the year and other shrub cannot compete favourably with Mussaenda in effectiveness of display of colour when in bloom [2].

This plant cultivated mainly for its long lasting noticeable and colourful flaggy sepals form an important focal or spot plant in the gardens whenever they are used singularly or in group. They are used to create an accent in entrance, approach to a strategic garden structure or lawn background as hedge and spot plants [3]. Their beautiful colourful flowering twigs also make good cut flower materials for vase or wreath making [4]. *Mussaenda philippica* is also used in traditional medicine for curing of dysentery and snake bites, decoction of roots and leaves used for affections of the chest and lung, the root and full-grown sepals are used in jaundice and the bark used to cure stomach ache [5].

In spite of the numerous economic uses of *Mussaenda philippica*, the population of the plant is declining due to the fact that it possesses a difficult to root morphological characteristic; only a small percentage of the stem cutting propagated develops root [6,7]. Although the plant can be traditionally propagated through stem cutting without any manipulation which yields a very low percentage, this method can be improved when rooting hormones are used to hasten root initiation [8]. Rooting hormone hastens root initiation, increase the number and percentage of cutting rooted as well as quality of root produced by cutting [9]. But the technicalities involved in proper application, availability and the impact it has on the environment alongside the fact that they are expensive and not readily available to peasant gardeners necessitate the need to find alternative means of stimulating stem cuttings to increase rooting percentage for better production. Many horticulturist prefer plant that are easily rooted after propagation, hence difficulty in rooting is seen as an undesirable trait [10]. This makes plant propagation one of the most lucrative business opportunities among small and large scale ornamental growers [11].

Growing media is another important factor in propagation studies because rooting performance depends on the type of medium used [12-14]. In the production of nursery plants, the selection and preparation of the medium is extremely important in terms of plant growth and quality. A good rooting media used alongside a rooting hormone will therefore hasten root initiation [8].

Hence, the experiment aimed at evaluating the root formation of *Mussaenda philipica* in response to type of hormone used and growth media that will enhance successful establishment of the plant in the nursery.

Materials and Methods

Location of study

The experiment was carried out in the screen house the department of Crop, Soil and Pest Management of the Federal university of technology Akure, Ondo June to September, 2015. The State lies between latitude 5°45″ north and 8°15″ north and longitudes 4°30″ east and 6° east. The climate is the West Africa monsoon with dry and wet seasons. The dry season is usually from November through March and is characterized by dry cold wind of harmattan. The wet season usually starts from April to October, with occasional strong winds and thunderstorms. Annual rainfall is about 1300 mm while mean annual temperature ranges between a maximum of 34°C and a minimum of 22°C.

Preparation of media

Top soil from the top 0 cm to 15 cm depth was collected from the forestry and wood technology plantation, river sand from the floriculture garden and the wheat offal from freshly de-hulled wheat grain. The media was prepared by mixing equal ratio of top soil, River-sand and wheat-offal in the ratio of 1:1:1 (v/v). The media formulation were; (Top soil (TS), Wheat offal (WO), River sand (RS), Top soil (TS) + Wheat offal (WO) in the ratio 1:1 (v/v), Top soil (TS) + River sand (RS) in the ratio 1:1 (v/v), Wheat offal (WO) + River sand (RS) in the ratio 1:1 (v/v), Top soil (TS) + River sand (RS) + Wheat offal (WO) in the ratio 1:1:1 (v/v).

Preparation and planting material

The *Mussaenda philippica* cuttings were obtained from actively growing stock. All cuttings were tri-nodal with the lower cut below a node at the base of each cutting. While preparing the cuttings, a smooth cut in each cutting was given on distal end and slanting cut was given at lower end just below the node. The basal ends of the cuttings were dipped in the synthetic hormones solution by quick dip method for 60 seconds before planting them in the rooting medium. The rooting hormones used were; Indole butyric acid (IBA), 1-Naphthalene acetic acid (NAA), 2,4-Dichlorophenoxyacetic amine (DPA) and the alternatives; Honey and Coconut water. However there was also an untreated i.e. control. The NAA used was prepared using the standard procedure described by Arno kings [15], by dissolving 0.095 g of the NAA powder in 250 ml of distilled water. The IBA was prepared by dissolving the compound in 95% ethanol and adding distilled water. The 2,4-D solution was prepared by reduction in the standard rate of preparation when used as an herbicide. The concentration was reduced ten times by diluting 0.1 ml in 250 ml of distilled water. Honey obtained from Songhai Farms Portharcourt was mixed with 2 cups of boiling water and allowed to cool, the mixture was placed in an airtight container until ready to use and each cutting dipped into the honey mixture for five minutes and then stuck into the selected potting media. The coconut water from young green tender coconuts was extracted by poking holes in the "eyes" located on the side of the coconut fruits so that the liquid can remain fresh and retain its essential nutrients100 ml of the fresh coconut water was measured and then poured into a clean bowl and the stem cuttings dipped in for 5 minutes. Equal volume of the media mixtures were used to fill each of the perforated polythene bags. Before cuttings were inserted into the different media, they were moistened and allowed to settle overnight. A dibber was used to create a hole for the insertion of the cuttings. Stem cuttings of about 10 cm to 15 cm length of the species were planted.

Data collection

The experiment was laid out in a Completely Randomized design and replicated three times. Data were collected on the following parameter: number of days to bud break for each sprouted cutting, number of leaves per cuttings, numbers of branches per cuttings, number of rooted plants which was counted at the end of the experiment, number of roots per rooted cuttings, longest length of root per cutting, and root weight.

Data analysis

The data obtained were subjected to analysis of variance using SPSS (Statistical package for social science) version 16 and means were separated using Duncan's Multiple Range Test.

Results

Effects of growth media on leaf number

The result indicated that the type of growth media exhibited a significant effect on the number of leaves of *Mussaenda philippica*. Table 1 showed that the use of River sand and Topsoil gave a higher value compared to wheat offal combination which gave a significant reduction in the number of leaves formed.

Weeks after planting (WAP)			
Treatment	**Week 4**	**Week 8**	**Week 12**
TS + WO + RS	0.00a	2.17a	0.28a
TS + RS	0.00a	1.00a	0.11a
TS + WO	0.00a	0.00a	0.00a
RS + WO	0.00a	0.00a	0.00a
WO	0.00a	0.00a	0.00a
TS	0.00a	2.33a	4.44ab
RS	0.00a	2.67a	2.22b

TS + WO + RS = Top Soil + Wheat Offal + River Sand; TS + RS = Top Soil + River Sand; TS + WO = Top Soil + Wheat Offal; RS + WO = River Sand + Wheat Offal; WO = Wheat Offal; TS = Top Soil; RS = River Sand

Table 1: Effects of growth media on leaf number at different weeks.

Means followed with the same letter within a treatment group are not significantly different at 5% level of probability using Duncan Multiple Range Test.

Effects of growing media on number of branches

The result indicated that the type of growth media played a vital role in the branch formation of *Mussaenda philippica*.

It was shown from Table 2 that the use of River sand and Topsoil gave a higher value compared to wheat offal combination which gave a significant reduction in the number of branches formed.

Weeks after first planting			
Treatment	**Week 4**	**Week 8**	**Week 12**
Control	0.00a	0.62ab	0.00a
Honey	0.00a	0.00a	0.00a
Coconut Water	0.00a	0.00a	0.00a
2,4-D	0.00a	0.00a	0.00a
NAA	0.00a	3.67c	3.67b
IBA	0.00a	2.71bc	2.38ab

Table 2: Effects of growing media on number of branches.

Means followed with the same letter within a treatment group are not significantly different at 5% level of probability using Duncan Multiple Range Test.

Effects of rooting hormone on number of leaves

Table 3 showed the effect of rooting hormone on the number of leaves formed at different treatment. The result revealed that the type of rooting hormone used in plant propagation impacted positively on leaf formation of *Mussaenda philippica*. NAA and IBA gave a higher value compared to other rooting hormones used which gave a significant reduction in the number of leaves.

Weeks after first planting			
Treatment	**Week 4**	**Week 8**	**Week 12**
Control	0.00a	0.62ab	0.00a
Honey	0.00a	0.00a	0.00a
Coconut Water	0.00a	0.00a	0.00a
2,4-D	0.00a	0.00a	0.00a
NAA	0.00a	3.67c	3.67b
IBA	0.00a	2.71bc	2.38ab

Table 3: Effects of rooting hormone on number of leaves.

Means followed with the same letter within a treatment group are not significantly different at 5% level of probability using Duncan Multiple Range Test.

Effects of rooting hormone on number of branches

Table 4 showed the effect of rooting hormone used on the number of branches formed at different treatment. There was an indication that the type of rooting hormone used in plant propagation played a vital role in the number of branches formed. It was shown from the table that the use of NAA and IBA gave a higher value compared to other rooting hormone used which gave a significant reduction in the number of branches formed.

Means followed with the same letter within a treatment group are not significantly different at 5% level of probability using Duncan Multiple Range Test.

Weeks after first planting			
Treatment	**Week 4**	**Week 8**	**Week 12**
Control	0.62a	0.19ab	0.00a
Honey	0.14a	0.00a	0.00a
Coconut Water	0.14a	0.00a	0.00a
2,4-D	0.10ab	0.00a	0.00a
NAA	1.05ab	1.33c	1.10b
IBA	0.76b	0.95bc	0.67ab

Table 4: Effects of rooting hormone treatments used on number of branches.

Root number, length and weight

With respect to root number, length and root weight, the rooting hormone NAA and IBA gave significantly greater root numbers, length and weight compared to the other growing media combination. However, the NAA and RS and IBA and TS gave significant greater value compared to other growing media combination as shown in Table 5.

Growing media	Rooting hormone	No of root	Root weight (g)	Root length (cm)
TS + WO + RS	NAA	12	4.70	4.00
TS + RS	IBA	3	5.00	6.67
TS	NAA	14	6.77	7.27
TS	IBA	19	7.75	4.58
RS	NAA	13	5.83	2.85
RS	IBA	4	9.09	4.44
TS	NAA	7	5.00	2.62
RS	NAA	29	5.50	3.38
RS	IBA	11	4.80	4.00
TS	NAA	11	6.66	8.09
TS	IBA	25	6.66	7.44
TS + WO + RS = Top Soil + Wheat Offal + River Sand; TS + RS = Top Soil + River Sand; TS = Top Soil; RS = River Sand				

Table 5: Effect of growing media and hormone on Root number, weight and length.

Discussion

The Top soil (TS) and River sand (RS) medium took fewer days for their buds to break than those planted on the other media types. This relates to the observation made by Adams et al. [16] that a good soil medium is the basic resource in producing healthy and thriving plants. The longer number of days taken by the plants for their buds to break may be due to the lower uptake of nutrient from the cuttings due to the absence of root hairs. Similarly, number of leaves per plant produced on Top soil and River sand media were significantly higher than the

other medium throughout the experimental period. This trend may not be unconnected with the assertion made by Olosunde and Fawusi [3] that the best medium for raising ornamental plants is the soil which has heterogeneity with regard to its physical and chemical properties. The top soil (TS) and the river sand had a very good porosity thereby promoting rapid absorption of nutrients leading to growth as reported by Olosunde et al. [3].

The Top soil and River sand media produced significantly higher leaf number compared to the other media types for all the parameters considered. This could be attributed to availability of nutrients, adequate drainage, better aeration and low bulk density in the media. Similar observation was made by Adams et al. [16] who reported for Dieffenbachia maculata that plants confined to a container needs a rich, porous medium for seedling establishment and growth. Ogbu et al. [4] also reported that the quality of container grown ornamental plants is dependent on the physical and chemical composition of the medium and the growing environment. There was visible effect observed with regard to root formation with the application of rooting hormone. The stem cutting of *M. Philippica* treated with IBA and NAA significantly increased number of root per rooted cuttings. This may be attributed to the ability of cuttings to form increased root by the application of NAA and IBA as reported by Olosunde et al. [3]. Application of IBA and NAA significantly increased the number of root per cuttings by 11-24, number of leaves per plant by 8-10, root lengths by 5 cm, root dry weight by 0.4 g to 0.7 g, This is in support with the study conducted by Blazich; De Klerk et al.; Hartmann et al. [17-19] where the application of IBA improved rooting percentage and root number as compared to untreated control. IBA has been reported to markedly increase adventitious root formation in many species. Auxin (NAA) treated cuttings had more potential in increasing rooting percentage, length of the roots and number of roots. Ogbu et al. [4] reported highest percentage of rooting, number of roots per cutting and root length from the hard wood cuttings of Bougainvillea variety Mary Plamer in response to the auxin. With the application of NAA and IBA, root dry weight were found to be higher compared to other rooting hormone used which were coconut water, honey, 2-4-D. This could be linked to the role of NAA and IBA as high graded horticultural rooting hormone in increasing root growth, root tissue differentiation and enhanced dry matter accumulation in plants as reported by Rolston; Fagge et al.; Abegunde et al.; Ersoy et al. [5,20-22]. The result from this study contradict the report of Nikki, [23] that honey can be used as natural rooting hormone since honey contain enzymes that can stimulate root growth in plants and it has antifungal and antiseptic properties which can help root growth and keep the plant strong and healthy. It is also thought that honey for cuttings help guard against bacterial or fungal problems, allowing them to remain healthy and strong. Coconut water, on the other hand while it contains growth hormones and regulators, is very unstable and variable this may suggest the reason it did not support significant root growth as reported in this study by Gbadamosi et al. [24]. Hence, cuttings rooted in Topsoil and river sand with NAA and IBA enhanced growth of *M phillipica*.

Conclusion

Root formation is very important; because it enables plant anchorage and seedling vigour. Based on the outcomes of the research, the media topsoil and river sand with NAA and IBA rooting hormones enhanced root formation of *M. phillipica*.

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