Effect of Growth Promoting Substances on Selected Three Ornamental Plants

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Abstract
An experiment was conducted in the nursery, the department of Crop, Soil and Pest management the Federal University of Technology, Akure, on stimulation of rooting of three ornamentals; Euphorbia milii, Adenium obesum, and Murraya paniculata, (Christ thorn, Desert rose and Murraya respectively) using some rooting substances; Indole-3-butyric acid (IBA), Top soil, Coconut water and Tetracycline from July to September, 2013. The experiment was laid out in a Completely Randomized Design (CRD) and replicated four times. Data were collected on number of branches, the number of leaves per cutting, root weight, number of roots and length of roots. The results from the study showed that each of the treatment had significance (P<0.05) with respect to a specific plant. Tetracycline was found the best for rooting Christ thorn cuttings. Indole-3-Butyric Acid (IBA) was found the best for rooting Roses cuttings. Coconut water treatment was found the best for rooting Muraya cuttings. The different treatments produced significant variation while there was no significant variation among the three different plant cuttings, but in the interaction between the plant cuttings of the different treatments.

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

Introduction
Ornamental plants are essential object of environmental aesthetic beautification and management; they make up the component of urban green spaces, public parks and houses more for relaxation and enjoyment [1,2]. They are grown for the display of aesthetic features including flowers, leaves, scent and overall foliage texture- fruit, stem and bark. They are a valuable tool for the harmonious and practical resolution of many physical site problems, and they provide durable aesthetic satisfaction [3]. Generally, most perennial ornamental plants are multiplied and propagated through asexual means of reproduction such as cuttings, layering or grafting [4]. The cuttings from stems, leaves, roots or terminal buds were the commonly used techniques, due to their ability to retain the characters of the parent and also, for breeding seedless hybrid. Success of rooting ornamental plant cuttings depend on their growth responses, based on nutrient present with the aid of growth promoting substances before planting [5].

Euphorbia milii, Adenium obesum, and Murraya paniculata were known as ‘difficult to root’ ornamental plants, this difficulty led to research on propagating their stem cuttings in different growth promoting substances to observe their responses [6]. Studies have shown that physiological state of the mother plant, the prevailing environmental conditions in the nursery i.e., light, temperature and humidity play important role in rooting and developmental stages of cuttings.

According to McGregor [7] root promoting hormones like cytokinins, gibberellins, ethylene, abscisic acid, brassinosteroids, jasmonic acids and auxins play major role in the success of rooting the cuttings. Synthetic growth treatments had these phytohormones naturally present in some plants, as active ingredients produced for commercial production. Formation of adventitious root ensure survival of the vegetative stage, this prompted several researchers to investigate the artificial means of initiating roots of stem cuttings, planted for optimum growth [8].

Although, in the production of nursery crops in containers, the selection and preparation of the medium is extremely important and could pay great dividends in terms of plant growth and quality. There is no universal or ideal rooting mix for cuttings [9] an appropriate propagation medium depends on the species, cutting type and propagation system [10]. To this end, different growth treatments and stem cuttings were explored to optimize the rooting of the ornamentals. Thus, the objective for this research was to determine the most effective growth treatment that would facilitate root development and promote rooting of each stem cutting and also to determine the best treatment that enhance vegetative growth in the stem cutting.

Materials and Methods
The experiment was stationed at the nursery of the department of Crop, Soil, and Pest management, Federal University of Technology, Akure with (7°16’N, 5°12’E) located in the rain forest vegetation zone of Nigeria between July and September 2013. The rainfall pattern of Akure is bimodal with a wet season of about seven months occurring during April to October/November and through February to March. The mean daily temperature ranges between 25°C and 37°C.

The materials used were stem cuttings of Euphorbia milii, Adenium obesum, and Murraya paniculata, (Christ thorn, Desert rose and Murraya respectively) collected from mother plant (stock plant) at Winpool garden, Exotic garden and Lucado horticultural garden within the state, also perforated plastic containers, Top soil, Tetracycline, IBA, Coconut water from matured green fruit and Distilled water. Stem cutting of apical plant cutting with leaf nodes for new root production, within range of 5 cm-10 cm of the different ornamental plants, was partly buried into the soil. Fertile top soil mixed with sandy soil in ratio

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The soil analysis was done using the procedure in the CSP laboratory manual booklet. Soil pH was determined. Magnesium was determined with an atomic absorption spectrophotometer. Exchange acidity was determined by Cabonoglu et al. [11] titration method. Soil organic C was determined by the procedure of Walkley and Black using the dichromate wet oxidation method, total N was determined by micro-Kjeldahl digestion method, available P was determined by Bray-1 extraction followed by molybdenum blue colorimetry. Exchangeable K, Ca and Mg were extracted using 1.0 N ammonium acetate. Thereafter, K was determined using flame photometer and Ca and Mg were determined using the EDTA titration method while sodium (Na) was determined by flame emission photometry. Particle size distribution was determined with a hydrometer.

The experiment was arranged in a completely randomized design (CRD) with four replicates. The data obtained were subjected to analysis of variance (ANOVA) and treatment mean were compared using Duncan’s multiple range test (DMRT) at p=0.05 probability level [12].

**Results**

Initial soil analysis before the experiment showed the nutrient contents of the soil which contains higher percentage of organic matter, phosphorus, nitrogen and potassium and other nutrients in adequate proportions as shown in Table 1. However there were significant differences in the effects of each treatment on the nutrients contents of the soil with coconut water having higher significance and the control showing no significant difference (Table 2). The Table 3 showed the effect of different growth treatment on leaves number of different ornamental plants. Significant (p<0.05) differences were not observed between the plants cuttings used for the experiment. However, it was observed that the plants treated with coconut water had the highest number of leaves followed by Tetracycline, and IBA while the control had the lowest. Table 4 showed the response of ornamental plants within the twelve weeks of planting to number of leaves sprouting. Significant (p<0.05) differences were observed during the 4th and 12th week of the experiment. However, the Murraya plant had the highest number of leaves (Table 5), followed by Christ thorn while Roses had the lowest number of leaves.

The combine effect of different growing media and different ornamental species on leaves number were also analyzed as significant (p<0.05) differences were observed during the 1st and 3rd month of the experiment. However, Murraya plant grown with coconut water had the highest number of leaves while the Roses grown in the control experiment had the lowest number of leaves. The response of the ornamental plants to different growth treatment through number of branches per plant as evaluated in Table 6 Significant (p<0.05) differences were not observed throughout the months of the experiment. However, it was observed that the plants treated with coconut water had the highest number of branches while the control had the least. Table 7 showed the response of different ornamental plant to different growth treatment on number of branches. Significant (p<0.05) differences were

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### Table 1: Soil chemical analysis before planting and treatment with growth substances.

| Substance          | Initial reading before planting |
|--------------------|---------------------------------|
| Sodium (C mol/kg)  | 29.80                           |
| Phosphorus (mg/kg) | 0.45                            |
| Nitrogen (%)       | 4.60                            |
| Potassium (C mol/kg)| 39.70                          |
| Magnesium (C mol/kg)| 8.20                           |
| Calcium (C mol/kg) | 45.8                            |
| Organic matter (%) | 26.8                            |
| pH                 | 5.94                            |

**Treatments**

| Species          | N   | P  | K   | Ca  | Mg  | Na  | OM  | pH  |
|------------------|-----|----|-----|-----|-----|-----|-----|-----|
| Tetracycline     |     |    |     |     |     |     |     |     |
| Murraya          | 1.60| 0.15a | 25.40a | 14.40a | 5.00a | 13.50a | 11.70a | 6.39a |
| Christ thorn     | 3.20b| 0.07b | 27.40a | 14.00a | 5.60a | 13.40a | 12.50a | 6.15a |
| Roses            | 3.50b| 0.13a | 29.40a | 34.80b | 4.00a | 15.20b | 14.10a | 5.87a |
| Coconut water    |     |    |     |     |     |     |     |     |
| Murraya          | 2.30a| 0.14a | 21.60a | 43.40b | 4.60a | 9.50a  | 10.10a | 6.49a |
| Christ thorn     | 2.70ab| 0.12a | 26.60b | 21.00a | 4.60a | 12.50c | 11.40a | 6.25a |
| Roses            | 3.00b| 0.09a | 24.20b | 38.60b | 5.40b | 11.60b | 13.20a | 4.87b |
| IBA              |     |    |     |     |     |     |     |     |
| Murraya          | 3.10c| 0.10a | 22.80b | 20.70a | 4.80a | 10.60a | 11.70a | 6.69a |
| Christ thorn     | 1.80a| 0.10a | 25.00b | 24.30b | 5.80b | 12.30a | 12.60a | 6.25a |
| Roses            | 2.50b| 0.14a | 15.00a | 44.00c | 5.20b | 15.00a | 13.10a | 5.37a |
| Control          |     |    |     |     |     |     |     |     |
| Murraya          | 2.90a| 0.09a | 27.00a | 4.10a  | 4.10a | 14.60b | 11.60a | 6.79a |
| Christ thorn     | 2.50a| 0.12a | 20.40b | 4.80a  | 4.80a | 9.20a  | 12.60a | 6.55a |
| Roses            | 2.20a| 0.24b | 27.20a | 5.40a  | 5.40a | 13.90b | 13.10a | 5.77a |

Mean in same column followed by the same letter (s) are not significantly different (p ≤ 0.05) by Duncan’s multiple range tests.

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Table 2: Effect of the treatments on soil nutrient after planting the stem cuttings.

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Table 3: Response of stem cuttings on number of leaves to treatments for 12 weeks.

| Treatments | 4     | 8     | 12    |
|------------|-------|-------|-------|
| Tetracycline | 4.79a | 5.75a | 6.96a |
| Coconut water | 4.88a | 5.58a | 7.04a |
| IBA       | 4.54a | 5.38a | 6.63a |
| Control   | 4.38a | 5.00a | 6.40a |

Effect of the treatments on number of branches of each stem cutting.

| Treatments | 4     | 8     | 12    |
|------------|-------|-------|-------|
| Murraya     | 5.25b | 6.25b | 7.38a |
| Christ thorn | 4.94b | 5.88ab| 6.54a |
| Roses       | 4.56ab| 5.19ab| 5.56a |

Mean in same column followed by the same letter (s) are not significantly different (p ≤ 0.05) by Duncan’s multiple range test.

Table 4: Stem cuttings by treatment interaction effect on number of leaves for 12 weeks.

| Treatments | Species   | 1     | 2     | 3     |
|------------|-----------|-------|-------|-------|
| Tetracycline | Murraya | 5.25ab | 6.75a | 7.45ab |
| Christ thorn | 4.50ab | 5.75a | 6.75ab |
| Roses       | 4.00ab   | 5.25a | 5.75ab |
| Coconut water | Murraya | 6.50b | 7.50a | 9.50b |
| Christ thorn | 4.75ab | 6.00a | 7.50ab |
| Roses       | 3.75ab   | 4.00a | 5.40b |
| IBA         | Murraya  | 4.75ab | 5.75a | 7.75ab |
| Christ thorn | 5.25b   | 5.75a | 7.00ab |
| Roses       | 5.50b    | 6.00a | 7.50ab |
| Control     | Murraya  | 4.50b | 5.00a | 7.50ab |
| Christ thorn | 5.25b   | 6.00a | 6.50ab |
| Roses       | 5.00b    | 5.50a | 5.00a |

Mean in same column followed by the same letter (s) are not significantly different (p ≤ 0.05) by Duncan’s multiple range test.

Table 5: Effect of the treatments on number of leaves of each stem cutting.

| Treatments | 1     | 2     | 3     |
|------------|-------|-------|-------|
| Tetracycline | 2.13a | 2.79a | 3.68a |
| Coconut water | 2.29a | 2.92a | 3.47a |
| IBA         | 2.33a | 2.67a | 3.67a |
| Control     | 2.17   | 2.65a | 3.25a |

Mean in same column followed by the same letter (s) are not significantly different (p ≤ 0.05) by Duncan’s multiple range test.

Table 6: Response of stem cuttings on number of branches to treatments for 12 weeks.

| Treatments | 1     | 2     | 3     |
|------------|-------|-------|-------|
| Murraya     | 2.38a | 2.89a | 3.46a |
| Christ thorn | 2.06a | 2.56a | 3.23a |
| Roses       | 2.31a | 2.94a | 3.34a |

Mean in same column followed by the same letter (s) are not significantly different (p ≤ 0.05) by Duncan’s multiple range test.

Table 7: Stem cuttings by treatment interaction effect on number of branches for 12 weeks.

| Treatments | Species | 1     | 2     | 3     |
|------------|---------|-------|-------|-------|
| Tetracycline | Murraya | 2.25a | 3.00ab| 3.75ab |
| Christ thorn | 1.75a  | 2.75a | 3.75ab |
| Roses       | 1.75a   | 2.75a | 3.50b |
| Coconut water | Murraya | 2.50a | 2.90ab| 3.25ab |
| Christ thorn | 2.25a  | 2.25a | 3.50b |
| Roses       | 2.75a   | 3.50b | 4.10b |
| IBA         | Murraya  | 2.50a | 2.75ab| 3.75ab |
| Christ thorn | 2.25a  | 2.50a | 3.75ab |
| Roses       | 2.50a   | 2.75a | 3.15ab |
| Control     | Murraya  | 2.25a | 2.75ab| 3.25ab |
| Christ thorn | 2.00a  | 2.75a | 3.50b |
| Roses       | 2.25a   | 2.75a | 3.75ab |

Mean in same column followed by the same letter (s) are not significantly different (p ≤ 0.05) by Duncan’s multiple range test.

Table 8: Effect of the treatments on number of branches of each stem cutting.

| Treatments | Root no | Root length | Leaf area | Net dry weight |
|------------|---------|-------------|-----------|----------------|
| Tetracycline | 8.00a  | 14.32a      | 13.54a    | 4.23a          |
| Coconut water | 8.23a  | 14.35a      | 13.54a    | 4.55a          |
| IBA         | 7.50a   | 13.77a      | 12.15a    | 4.27a          |
| Control     | 7.00a   | 11.30a      | 11.52a    | 3.88a          |

Mean in same column followed by the same letter (s) are not significantly different (p ≤ 0.05) by Duncan’s multiple range test.

Table 9: Response of root cuttings to different treatments for 12 weeks.

| Treatments | Root no | Root length | Leaf area | Net dry weight |
|------------|---------|-------------|-----------|----------------|
| Murraya     | 8.25ab  | 15.30bc     | 7.75ab    | 5.20b          |
| Christ thorn | 7.00a   | 6.33a       | 15.20bc   | 3.35a          |
| Roses       | 5.50a   | 13.03bc     | 12.23ab   | 5.41b          |

Mean in same column followed by the same letter (s) are not significantly different (p ≤ 0.05) by Duncan’s multiple range test.

Table 10: Root cuttings by treatment interaction on parameters taken for 12 weeks.
Table 11: Effect of the treatments on parameters taken for each root cutting.

| Treatments | Species     | Root no | Root length | Leaf area | Net dry weight (%) |
|------------|-------------|---------|-------------|-----------|--------------------|
| Tetracycline | Murraya     | 16.00a  | 21.00bc     | 12.20ab   | 5.20a              |
|             | Christ thorn| 10.00ab | 7.00a       | 16.80d    | 3.30ab             |
|              | Roses       | 9.00a   | 19.00c-e    | 14.40ab   | 6.12bc             |
| Coconut water | Murraya     | 17.00cd | 16.50c-e    | 12.50ab   | 5.90c              |
|            | Christ thorn| 11.00ab | 6.00a       | 15.00cd   | 3.10ab             |
|              | Roses       | 7.00a   | 13.20bc     | 14.00ab   | 5.70bc             |
| IBA         | Murraya     | 12.00ab | 18.90ab     | 10.50ab   | 4.50ab             |
|            | Christ thorn| 8.00a   | 7.00a       | 10.40ab   | 3.12a              |
| Control     | Murraya     | 6.00a   | 11.00bc     | 12.50ab   | 6.90c              |
|            | Christ thorn| 10.00bc | 12.30a      | 10.60ab   | 3.00ab             |
|             | Roses       | 6.00a   | 8.90ab      | 10.00ab   | 4.90b              |

Mean in same column followed by the same letter (s) are not significantly different (p ≤ 0.05) by Duncan’s multiple range test.

Conclusion

Cuttings treated with Tetracycline, Coconut water and IBA induced maximum sprouting and plant growth. Tetracycline was found the best for rooting Christ thorn cuttings. Indole-3-Butyric Acid (IBA) was found the best for rooting Roses cuttings [17].

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