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Rooting response of eugenia stems cutting to different growing condition

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Abstract
Eugenia plants is equatorial, evergreen, indigenous shrub which found anywhere in the Philippines. A research was conducted to determine the best growing condition that will favor the rooting of Eugenia stem cuttings. The study was laid in a 2x4 factorial in Completely Randomized Design. Treatments consisted of the following: Factor A was stages of Eugenia cuttings categorized into, A1 – Young cuttings; A2 – Mature cuttings, Factor B deal with the Growing Conditions; B1 – Polyethylene bag (PEB) without cover (control), B2 – Polyethylene bag (PEB) with transparent plastic cover, B3 – Polyethylene bag (PEB) with Black plastic cover, B4 – Rooting chamber with transparent plastic cover. The findings of the study indicated that both stages of Eugenia cuttings whether young or mature, as well as the different growing conditions did not significantly affect the rooting response in terms of the rooting percentage, number and length of roots, and percentage survival within 45 days after planting of Eugenia stem cuttings. The young and/or mature stem cuttings can be used as planting materials which can be grown in any growing conditions except in black plastic cover.

Keywords: eugenia, cuttings, growing condition

Introduction
Eugenia is a significant group of plants, involving evergreen trees and bushes, some indigenous and some non-native, some of which were reclassified to the Syzygium genus. The leaves are evergreen, solid and shiny, and the flowers are white. It is also the dried buds that become the fragrant 'herb' cloves of Eugenia aromatica (Syzygium aromaticum). The production of berries, some varieties of which are edible, accompanies the flowers (Gilman, E. F and Watson D. G, 1993) [2]. This species is usually propagated by seeds, but cuttings are also frequently used, particularly for specific cultivars such as “Verlaine” or “Newport” in order to keep the true-to- type character (Lebrun *et al*. 1998) [5]. Ontogenetic aging (juvenile or adult) is essential in vegetative propagation (e.g., cutting), since buds and cuttings perpetuate their ontogenetic age in the progeny plant when separated from the mother plant (Hartmann H.T, *et al* 2002) [3].
The method most widely used to propagate many woody ornamental plants is propagation by stem cuttings. It is fairly easy to root stem cuttings of several favorite shrubs. Stem cuttings of tree species are usually harder to root. But it is possible to root cuttings from trees such as crape myrtles, some elms, and birch trees. A greenhouse is not needed for the effective propagation of stem cuttings; however it is important to maintain high humidity around the cutting. If you just root a few leaves, you can use a flower pot. By covering the pot with a bottomless milk jug or by throwing the pot into a transparent plastic bag, maintain high humidity. Cuttings may also be mounted in plastic trays spread over a wire frame filled with clear plastic. For drainage, trays must have holes in the bottoms (Hartmann, H. T, *et al*., 1996) [4]. In the present study was conducted in order to evaluated the effect of different growing conditions on the rooting and determine the best treatment and growing condition ha will favor he rooting of Eugenia stem cutting.

Materials and Methods
Experimental design and Treatments
The study was carried out in Complete Randomized Design (CRD) in factorial arrangement. There were (8) eight treatment combinations replicated (3) three times. Twenty samples were used per treatment. The stage of Eugenia cuttings served as factor A while the different growing conditions served as factor B.

Factor A (Stage of Eugenia cuttings)
A1-Young cuttings
A2-Mature cuttings

Factor B (Growing Conditions)
B1-Polyethylene bag (PEB) without cover (control)
B2-PEB with transparent plastic cover
B3-PEB with Black plastic cover
B4-Rooting chamber with transparent plastic cover

The treatment combinations used were as follows
A1B1-Young cuttings under control/ambient condition
A1B2-Young cuttings inside transparent plastic cover
A1B3-Young cuttings inside black plastic cover
A1B4-Young cuttings inside rooting chamber
A2B1-Mature cuttings under control/ambient condition
A2B2-Mature cuttings inside transparent plastic cover
A2B3-Mature cuttings inside black plastic cover
A2B4-Mature cuttings inside rooting chamber

Preparation of Rooting Chamber
The rooting chamber was constructed in a partially shaded area. This was done using hollow blocks and cement. The bottom portion of the chamber was filled up with about one foot pebbles and one foot level of sterilized fine sand for

better drainage. Then, it was filled up with one foot layer of the previously prepared soil media and this was covered with a transparent plastic sheet.

Preparation of Rooting Media
The soil media were composed of garden soil and fine sand in 1:1 ration. The two media were mixed and sieved through a wire screen to have a degree of soil homogeneity. The mixed materials were sterilized by heat or baking method.

Bagging of Media
For the vacuum treatments, the previously prepared soil medium was bagged using polyethylene bags with the dimension of 4x6 inches and was provided with 4 puncher holes at the basal portion to drain excess water during watering. For the rooting chamber, previously prepared soil media were filled up directly inside the chamber.

Preparation of Stem Cuttings
Stem cuttings of Eugenia were selected and taken from healthy and damage-free mother plant. The selected stems were carefully and properly cut nine (9) cm long using pruning shear.
The cuttings used as samples were cut based on the stage of cuttings, young and mature cuttings. The shoot tips with at least three nodes were considered as young cuttings while the lower section of cuttings was considered as mature cuttings (Figure 1). The lower leaves were removed while the upper leaves were cut half.

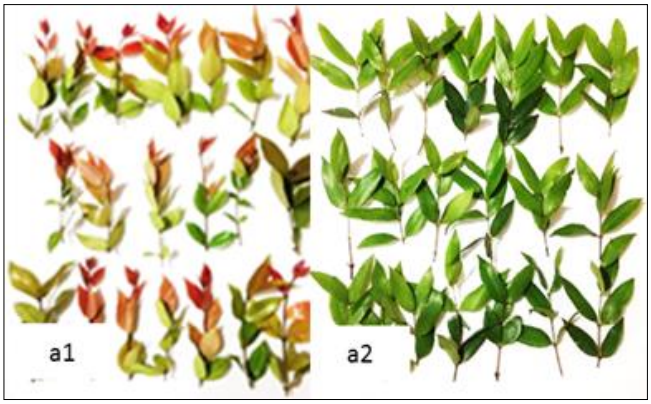

Fig 1: a1-Young cuttings and a2-Mature cuttings

Planting of Cuttings
The previously prepared stem cuttings were inserted into the soil media at least 3 cm depth such that the first node was covered with the media. The media were pressed firmly to hold the cuttings in place. For chamber, cuttings were placed depending on the size of the rooting chamber.

Care and Maintenance of Cuttings
Regular observation was done to make sure that the experiment was secured from any destructive animals or falling twigs since the experiment was placed under the shade of a tree.

Data Gathered
Rooting percentage: The rooting percentage was determined at 45 days after planting. The percentage was computed using the formula:

$$\text{Rooting Percentage (\%)} = \frac{\text{Number of rooted cuttings}}{\text{Total number of cuttings planted}} \text{x } 100$$

Number of Roots: The number of roots per cuttings was counted 45 days after planting. This was done by uprooting the cuttings and carefully washes in tap water during the termination of the study.

Length of Roots (cm): The length of roots was measured from the base of the cuttings to the tip of the longest roots during termination.

Percentage survival: Number of cuttings alive were counted during the termination. The percentage survival was determined using the formula:

$$\text{Percentage Survival (\%)} = \frac{\text{Number of cuttings alive}}{\text{Total number of cuttings planted}} \text{x } 100$$

Statistical Data Analysis
The data collected were analyzed using Analysis of Variance (ANOVA) technique. Means were separated using multiple means comparison technique.

Results and Discussions
Rooting Percentage
The rooting percentage of Eugenia stem cuttings as affected by different stages of cuttings showed no significant difference where the treatment means ranged from 1.25 % for the young cuttings to 2.09 % rooting for the mature cuttings (Table 1). Similarly, the rooting percentage of Eugenia stem cuttings as affected by different growing conditions showed no significant difference among treatments where the treatment means ranged from 0 to 4.17 %. Only numerical differences were noted wherein cuttings planted in PEB covered with transparent plastic cover had 4.17 % rooting percentage. Those cuttings planted in PEB without cover or under open condition had rooting percentage of 1.80 %, while those planted in the rooting chamber had 1.67 % rooting percentage. Numerically lower rooting percentage was noted in cuttings planted in PEB covered with black plastic cover with 0 % rooting percentage. Further observation also showed no significant interaction effects on the different types of cuttings and the different growing conditions on the rooting percentage of Eugenia stem cuttings. The result indicates that the different growing conditions used did not significantly influence the development of roots of both young and mature Eugenia stem cuttings. The result further implies that 45 days duration might be short enough for the root development of Eugenia stem cuttings. Poliquit1, D. & Ramos, A,. (2018) [7] observed that all cutting of Eugenia regeneration parameters and horticultural characteristics of parameters of planted regenerated cuttings significantly influenced by the interaction effect of rooting medium temperature manipulation and type of cuttings.

Table 1: Rooting percentage (%) of Eugenia stem cuttings as affected by different growing conditions at 45 days after planting.

Growing Condition	Type of cuttings		Mean^{ns}
	Young^{ns}	Mature^{ns}	
PEB without cover (control)	00.0	1.67	0.84
PEB with transparent plastic cover	3.33	5.00	4.17
PEB with black plastic cover	0.00	0.00	0.00
Rooting chamber with transparent plastic cover	1.67	1.67	1.67
Mean^{ns}	1.25	2.09	

Number of Roots

The number of roots of Eugenia stem cuttings as affected by different growing conditions showed no significant difference among the treatment means on the different stages of Eugenia cuttings used where the treatment means ranged from 0.03 (young cuttings) to 0.05 (mature cuttings). On the other hand, significant differences were noted in terms of the growing conditions where cuttings planted in PEB covered with transparent plastic cover produced an average of 0.12 which were comparable with those cuttings planted in the rooting chamber covered with transparent plastic cover with an average of 0.03 as well as those of the control condition with an average of 0.02. Cuttings planted in PEB covered with black plastic cover did not produced roots as well as survived due to the absence of sunlight (Table 2).

Cameron *et al*., 2005 reported on their study about the type of cuttings, retention of more leaves/branches in cuttings have promoted rooting of *Cotinus coggygria cv.*

Further observation showed no significant interaction effect of the different stages of cuttings and different growing conditions on the rooting of Eugenia stem cutting. The result can still be possibly attributed to the short duration that the 45 days may not be enough for the root development of Eugenia stem cuttings.

Table 2: Number of roots of Eugenia stem cuttings as affected by different growing conditions at 45 days after planting.

Growing Condition	Type of cuttings		Mean**
	Young^{ns}	Mature^{ns}	
PEB without cover (control)	00.0	0.03	0.02^{ab}
PEB with transparent plastic cover	0.10	0.13	0.12^{a}
PEB with black plastic cover	0.00	0.00	0.00^{b}
Rooting chamber with transparent plastic cover	0.03	0.03	0.03^{ab}
Mean^{ns}	0.03	0.05	

Length of Roots (cm)

The length of longest roots of Eugenia stem cuttings as affected by different growing conditions showed no significant difference between the treatment means of the different stages of Eugenia cuttings used which have the same treatment mean of 0.01 for both young and mature cuttings. Similarly, no significant difference was also observed in terms of the different growing conditions where the length of longest roots ranged from 0 to 0.02 cm. further observations also showed no significant interaction effect on the stages of Eugenia cuttings and different growing conditions (Table 3).

The above result indicates that both the stages of cuttings and growing conditions did not have significant influence on the root development of Eugenia stem cuttings for the period of 45 days which might be short enough to enhance root development.

Table 3: Length (cm) of root of Eugenia stem cuttings as affected by different growing conditions at 45 days after planting.

Growing Condition	Type of cuttings		Mean^{ns}
	Young^{ns}	Mature^{ns}	
PEB without cover (control)	00.0	0.01	0.01
PEB with transparent plastic cover	0.02	0.02	0.02
PEB with black plastic cover	0.00	0.00	0.00
Rooting chamber with transparent plastic cover	0.01	0.01	0.01
Mean^{ns}	0.01	0.01	

Percentage Survival

The percentage survival of the experiment is presented in Table 4. The statistical analysis showed no significant difference between the treatment means of the different stages of Eugenia cuttings used where the treatment means ranged from 39.17 (young cuttings) to 46.23 (mature cuttings). On the other hand, the percentage survival was significantly affected by the different growing conditions where cuttings planted in PEB covered with transparent plastic cover produced more alive cuttings with 87.50 %. These were followed by the cuttings planted in the rooting chamber with 47.50%. The control/ambient condition had 35.84 % survival. In contrast, those cuttings planted in PEB covered with black plastic cover had 0% survival. This can be attributed to the absence of light under dark condition which affects the photosynthetic process needed for the growth and development of cuttings. McMullen, 2011 observed that percent regeneration of Eugenia stem cuttings is generally low and often cuttings require longer time to form adventitious roots compared to other plant species.

Table 4: Percentage survival (%) of Eugenia stem cuttings as affected by different growing conditions at 45 days after planting.

Growing Condition	Type of cuttings		Mean**
	Young^{ns}	Mature^{ns}	
PEB without cover (control)	40.0	31.67	35.84^{b}
PEB with transparent plastic cover	83.33	91.67	87.50^{a}
PEB with black plastic cover	0.00	0.00	0.00^{c}
Rooting chamber with transparent plastic cover	33.33	61.67	47.50^{b}
Mean^{ns}	39.17	46.23	

Conclusion

The findings of the study showed that both stages of cuttings, whether young or mature cuttings as well as the different growing conditions did not significantly affect the rooting response in terms of the rooting percentage, number and length of roots, and percentage survival within 45 days after planting. It was indicated that either young or mature stem cuttings can be used as planting materials. This insignificant result however, can be attributed that 45 days period may be short enough to enhance the rooting performance of Eugenia stem cuttings. Hence, further study can also be recommended with longer duration period to possibly obtain better result.

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