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The Effect of Different Growing Media on Rooting of Stem Cuttings in *Dracaena marginata*

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Abstract

Dracaena, or the Madagascar dragon tree (*Dracaena marginata* Ait), is one of the most important ornamental foliage plants in Iran and the world. Suitable growing media are the most critical input for cultivating this plant, supporting reduced losses and optimal growth. This study was conducted in a randomized complete block design with eight treatments and three replications to investigate the effect of different growing media on the rooting of stem cuttings in *D. marginata*. The growing media included azocompost, tea waste, leaf mold, perlite, vermicompost, tea waste mixed with vermicompost (1:1), perlite mixed with tea waste (1:1), and perlite mixed with azocompost (1:1). The measured parameters—stem height, stem height difference, root number, leaf number, root fresh weight, root dry weight, shoot fresh weight, and shoot dry weight—were evaluated after 75 days. The results showed that the highest root number (19.00) and leaf number (30.00) in stem cuttings were achieved in vermicompost and perlite media, respectively. Based on the findings, perlite and vermicompost are recommended as suitable media for rooting and growth of *D. marginata* stem cuttings.

Keywords: *Dracaena marginata* Ait, Growing medium, Madagascar dragon tree, Ornamental plants, Vegetative growth parameters.

INTRODUCTION

Dracaena marginata, or the Madagascar dragon tree, belongs to the Asparagaceae family and is a popular potted houseplant genus comprising about 40 species of evergreen shrubs. One of the major challenges in hard-to-root plants is the inadequate rooting of their cuttings. Propagation via leafy stem cuttings is one of the most widespread and suitable vegetative methods due to its ability to preserve genetic structure. Cuttings of *Dracaena* are generally considered hard to root. Enhancing the rooting capacity of hardwood and semi-hardwood cuttings through various approaches, including the use of different growing media, is being pursued worldwide. The formation of adventitious roots is a critical stage in the vegetative propagation of horticultural crops (Wang *et al*., 2020). Adventitious rooting is a significant physiological response in plants during cutting propagation, with high commercial importance. This process involves many endogenous and exogenous factors (Tsafouros and Roussos, 2020).

The growing medium plays a crucial role in the success of rooting and root growth, especially in hard-to-root plants. Soilless cultures have been successfully used for decades to produce more plant material at lower costs. Growing media such as cocopeat and compost, due to their lightness, affordability, and easier decomposition by microorganisms, have long been used in horticulture. These mixtures provide a suitable structure with good drainage, aeration, and ease of handling. The most important and widely used growing media for rooting these cuttings include peat, perlite, sand, cocopeat, vermiculite, and composts. The use of perlite to enhancing the rooting capacity of hardwood and semi-hardwood cuttings is a global research focus. One widely adopted approach involves the use of different growing media, such as peach × almond hybrids (Davarinejad *et al*., 2015) and rosemary (Bidarnamani *et al*., 2017), has been demonstrated. Shokri *et al.* (2014) identified sand mixed with cocopeat as a suitable medium for rooting *Callistemon* cuttings. The highest rooting percentage in *Cupressus arizonica* cuttings was achieved in a peat-perlite medium (Khandan Mirkohi *et al*., 2014). Cocopeat mixed with peat moss was found suitable for tomato cutting rooting (Saffari and Sajjadi, 2023). A 1:1 ratio of soil and sand was used for optimal rooting of bougainvillea (Eed *et al*., 2015). The suitability of a medium composed of sand and sawdust for grapevine stem cutting rooting was demonstrated (Kheiri and Arshad, 2020). The best growing medium for *Juniperus excelsa* cutting rooting was a perlite-cocopeat mixture (Abshahi *et al.*, 2018). Fornes *et al*. (2013) showed that vermicomposts appeared to be more appropriate than compost as rooting media constituent for shrub cuttings.

While considerable research has been conducted on the rooting of hard-to-root plant cuttings, little study has been done on *Dracaena*, a woody, hard-to-root ornamental plant. Therefore, this study aimed to enhance the rooting of *D. marginata* stem cuttings using different growing media.

MATERIALS AND METHODS

Location and preparation of cuttings

Rooted stem cuttings of *D. marginata* were obtained from a greenhouse in Vishka Suqeh village, Rasht County. The experiment was conducted in autumn in a plastic-covered greenhouse (Fig. 1).

Cutting preparation

Rooted cuttings were used for the experiment. The cuttings were taken from *Dracaena* plants with heights of 70–80 cm and diameters of 1.5–2 cm. To minimize moisture loss, cuttings were collected early in the morning.

Fig. 1. Mature plants of *Dracaena marginata* Ait grown in the experimental greenhouse.

Preparation of growing media

The growing media included azocompost, tea waste, leaf mold, perlite, vermicompost, tea waste mixed with vermicompost (1:1), perlite mixed with tea waste (1:1), and perlite mixed with azocompost (1:1) (Fig. 2). Before filling the pots with these media and planting the cuttings, a layer of rice bran was placed at the bottom of each pot. The cuttings were then planted in the different media and watered thoroughly (Fig. 3).

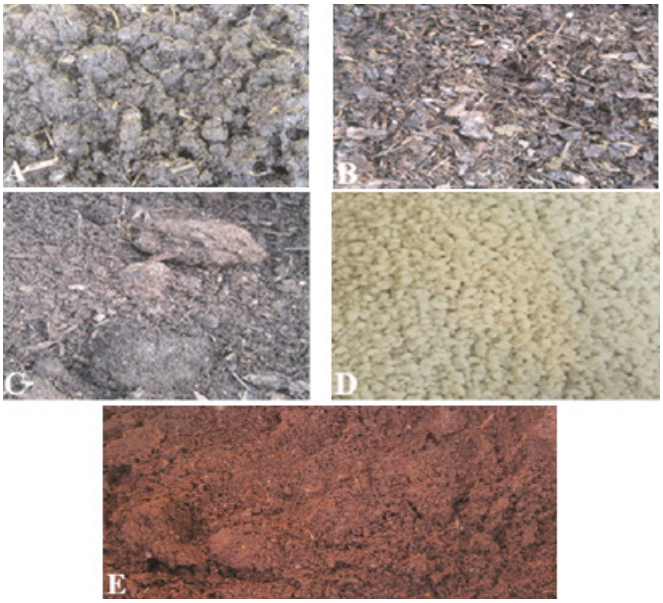

Fig. 2. Growing media used in the study. (A) Azocompost, (B) Tea waste, (C) Leaf mold, (D) Perlite, and (E) Vermicompost.

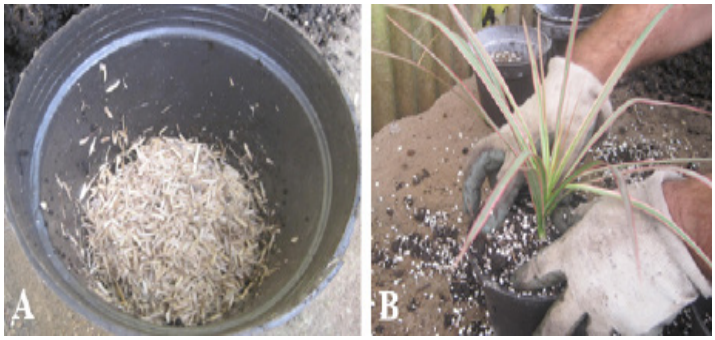

Fig. 3. Preparing the growing medium for *Dracaena marginata* Ait. in pots and planting the cuttings. (A) Adding rice husk to the pot bottom, and (B) Planting the cutting in the medium.

Cutting maintenance conditions

The cuttings were watered for one week according to the medium and environmental conditions. During the growth period, the cuttings were fertilized every 15 days with a 0.2% solution of biofol (a complete mix of macronutrients, micronutrients, and amino acids).

Measured parameters

The parameters— increase in stem height, stem height difference, root number, leaf number, root fresh weight, root dry weight, shoot fresh weight, and shoot dry weight—were measured after 75 days. For fresh and dry weight measurements, the organs were separated from the cuttings mother plant and weighed separately using a sensitive scale (0.01 g precision). The roots and shoots were then dried in an oven at 105 °C for 24 hours. After removal from the oven, they were weighed again (dry weight). The roots and shoots were dried in an oven at 105 °C for 24 h, and then reweighed. The roots and shoots were dried in an oven at 105 °C for 24 h, and then reweighed. To ensure complete drying, samples were kept for an additional 24 h before final weighing.

Experimental design and data analysis

The study was conducted as a randomized complete block design with eight treatments (different growing media) and three replications. The data were analyzed using MSTATC software. Mean comparisons were performed using the LSD test.

RESULTS

The results of variance analysis (Table 1) showed that stem height and leaf number were significantly affected by the growing media at the 1% probability level ($P < 0.01$), while root number was significant at the 5% level ($P < 0.05$). The effect of different growing media on the other measured parameters was not significant.

Table 1. Variance analysis of the effect of cultivation media on measured parameters in *Dracaena marginata.*

S.o.V	df	MS							
		Stem height	Stem height difference	Leaf number	Root number	Shoot fresh weight	Root dry weight	Root fresh weight	Shoot dry weight
Repetition	2	2.40	0.10	41.47	0.13	8.54	0.01	2.52	0.56
Treatment	7	3.10^{**}	0.20^{ns}	39.31^{**}	14.83^{*}	5.99^{ns}	0.08^{ns}	2.54^{ns}	0.22^{ns}
Error	14	0.72	0.24	7.20	4.28	11.38	1.10	2.66	0.30
CV (%)	-	14.60	14.16	9.85	14.16	17.73	29.73	22.00	19.53

*, ** and ns: Significant at $P < 0.05$, $P < 0.01$ and insignificant based on the LSD test, respectively.

Mean comparisons (Table 2) revealed that the perlite medium induced the highest stem height (6.83 cm) and the greatest root number (19) in the cuttings (Table 2, Fig. 4). Stem height in cuttings grown in azocompost, vermicompost, and perlite-azocompost media exceeded 6 cm. The lowest stem height (3.91 cm) was observed in cuttings grown in leaf mold. Despite a relatively high root number (approximately 15) in cuttings grown in tea waste, vermicompost, and perlite-azocompost media, this number was still significantly lower than that in perlite. The lowest root number (11.50) was recorded in azocompost. The highest leaf number (32.17) was observed in vermicompost, though this did not differ significantly from tea waste. Leaf number

in azocompost, leaf mold, and perlite-tea waste media exceeded 27. The lowest leaf numbers (22 and 22.17) were recorded in perlite and tea waste-vermicompost media, respectively. Thus, perlite was identified as the best medium for rooting, as it produced the highest root number and promoted favorable stem elongation. Vermicompost, while showing near-perlite performance in root number, excelled in leaf production.

Table 2. Mean comparison of the effect of cultivation media on measured parameters in *Dracaena marginata*.

Cultivation media	Stem height (cm)	Leaf number	Root number
Azocompost	6.75^{a}	27.50^{ab}	11.50^{b}
Tea waste	5.67^{ab}	30.00^{a}	15.33^{ab}
Leaf mold	3.91^{b}	27.83^{ab}	14.00^{ab}
Perlite	6.83^{a}	22.00^{b}	19.00^{a}
Vermicompost	6.58^{a}	32.17^{a}	15.50^{ab}
Tea waste + Vermicompost (1:1)	5.00^{ab}	22.17^{b}	13.50^{ab}
Perlite + Tea waste (1:1)	5.31^{ab}	29.67^{ab}	13.00^{b}
Perlite + Azocompost (1:1)	6.33^{ab}	26.67^{ab}	15.00^{ab}

*In each column, means with similar letter(s) are not significantly different ($P < 0.05$) using the LSD test.

Fig. 4. Roots produced at the base of stem cuttings of *Dracaena marginata* Ait grown in perlite medium.

DISCUSSION

In the present study, stem cuttings of *Dracaena marginata* exhibited superior rooting performance in perlite. Similar findings have been reported for other hard-to-root plants, such as peach × almond hybrids (Davarinejad *et al*., 2015), schefflera (Bidarnamani and Mohkami, 2015), and rosemary (Bidarnamani *et al*., 2017). In soilless cultivation, selecting an appropriate growing medium is the first and most critical step. Plant growth characteristics are influenced by the physical, chemical, and biological properties of the medium. Perlite is commonly used to improve aeration and water retention in growing media. The enhanced rooting in perlite is mainly due to its favorable oxygen-to-water ratio, which supports root formation (Davarinejad *et al*., 2015). The highest fresh and dry weights in *Melissa officinalis* were achieved in perlite (Farrokhi *et al.*, 2018). Perlite's porous structure balances water and oxygen, facilitating nutrient movement. However, successful rooting also depends on factors such as cutting harvest time, cutting type, endogenous hormones, and exogenous auxin application (Kaviani and Negahdar, 2017; Sahari Moghadam *et al.*, 2024).

In this study, the highest leaf number was observed in vermicompost. Vermicompost increased leaf number in *Physalis* seedlings (Mohammadi *et al*., 2014). Vermicompost is an

organic, peat-like growth stimulant rich in essential nutrients, humic compounds, beneficial microorganisms, and plant hormones (e.g., auxins, cytokinins, and gibberellins). It enhances water retention, nutrient availability, and stress resistance (Rehman *et al*., 2023). Vermicompost stimulates microbial activity (Rajaei *et al*., 2022) and has improved rooting in ornamental plants such as potted calla lily (Rajaei *et al.,* 2022), rosemary (Mendoza-Hernández *et al*., 2014), mint (Loera-Muro *et al.*, 2021), and pomegranate (Bidabadi *et al.*, 2017). Auxin-like substances in vermicompost promote root production (Mendoza-Hernández *et al.*, 2014). Vermicompost also increased fresh and dry weights in *Ficus benjamina* (Mahboob Khomami, 2008).

The choice between perlite and vermicompost depends on the researcher's goal. If cuttings already have sufficient leaves, rooting takes precedence. Conversely, for foliage ornamentals, leaf production is more critical. Since vermicompost produced a respectable root number (second only to perlite) and the highest leaf number, it is recommended as the superior medium in this study.

CONCLUSION

Dracaena species are valuable in the floriculture industry for their ornamental foliage. Given the limitations of sexual propagation, vegetative propagation is more important. Stem cuttings of many ornamental plants, especially woody and semi-woody species, are hard to root. Using suitable growing media is a key strategy to enhance root production. Media with good aeration, water retention, and nutrient content promote rooting and improve vegetative growth, including leaf production in foliage plants. In this study, the highest root and leaf number were achieved in perlite and vermicompost, respectively. Since *D. marginata* is a foliage plant and vermicompost produced both adequate roots and the highest leaf count, it is considered the superior medium. Therefore, using perlite and vermicompost alone or in combination (1:1) can yield favorable results.

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