

Effect of Substrate Mixture on the Growth Performance of Ornamental Aquatic Plant *Echinodorus bleherae* "Broad leaved Amazon Swords"

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Abstract

The present study was carried out to evaluate the effect of substrate mixture on the growth of *Echinodorus bleherae*, a popular freshwater aquarium plant. Four different substrate mixtures, T1= top soil: sand 3:1(control), T2=top soil: compost: coir dust: sand 1:1:1:1, T3=compost: coir dust: sand 2:1:1, T4= compost: coir dust: sand 1:2:1 were used with five replicates. Plants (height 8-9cm) were potted in the individual tanks. The height of the substrate mixture was maintained at 5cm and the water level was maintained at 8 cm above the substrate. Plant height, stem height, root height, wet weight of the total plant, number of leaves and surface area of leaves of *E. bleherae* were evaluated for a period of five weeks. Plants cultured in T4 treatment showed the best growth performance parameters; height (21.52 ± 5.66 cm), % height gain (0.03 ± 0.01), stem height (8.96 ± 2.60 cm), root height (12.56 ± 4.49 cm), wet weight (1.35 ± 0.65 g), number of leaves (8.40 ± 1.14) and the surface area of leaves (2278.40 ± 1356.27 mm²) compared to the control (T1). T2 and T3 treatments were not significantly different from the control. This study showed that the compost: coir dust: sand=1:2:1 is the best growing medium that can be recommended for commercial culture of *Echinodorus bleherae*.

Keywords: *Echinodorus bleherae*, Ornamental aquatic plants, Substrate mixture

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Introduction

Aquatic plants have drawn attention worldwide for their importance in the ornamental plant industry which is a blooming industry worldwide. The sustainable exploitation of aquatic ornamental plants will be a good source of income. In Sri Lanka ornamental aquatic plant production is done by small and medium scale farmers. *Echinodorus bleherae* is one of the most popular plants in ornamental aquatic plant trade (Yapabandara and Ranasinghe, 2007).

Proper water conditions, light intensity and substrate mixture are essential for growth of *E. bleherae* (Brough, 1998). Plant growth is mainly affected by the substrate mixture. The substrate significantly increased plant growth in height, stem biomass, leaf biomass, and total biomass because sediment can supply more available nutrients to support the plant growth (Madsen and Cedergreen, 2002).

Generally farmers use traditional cultivation methods in mud ponds to grow ornamental aquatic plants. However, researches on the effects of different culture media on the growth performance of aquatic plants are scarce. Compost, soil, coconut dust and sand are locally available and thus among the low cost substrate types which can be used to prepare substrates for aquatic plant industry (BIMSTEC, 2013). Compost has good dequate physical and chemical

properties such as particle size, porosity, water-holding capacity, air capacity and pH. Nutrition such as P, K⁺, Na⁺, Mg²⁺, Fe²⁺, Zn²⁺, Cu²⁺, Mn²⁺, Cl⁻ and SO₄²⁻ are available in coconut dust (Abad *et al.*, 2001). Therefore the development of low cost effective substrate mixture is important for commercial cultivation.

The objective of this study was to evaluate the effect of different substrate mixtures on the growth performance of a fresh water ornamental aquatic plant *Echinodorus bleherae* in aquarium conditions.

Materials and Methods

Top soil, coir dust, compost and sand were used for preparing the substrate mixtures. Four different substrate mixtures namely, T1= top soil: sand= 3:1, T2=top soil: compost: coconut dust: sand=1:1:1:1, T3=compost: coconut dust: sand=2:1:1, T4= compost: coconut dust: sand = 1:2:1 were used as different substrate mixtures. Twenty glass tanks (32cm x 24cm x10cm) were filled up to 5cm using a particular substrate mixture and each treatment had five replicates. Individual plant (8.50 ± 0.57^a cm- 8.78 ± 0.52 cm height) was planted in the center of the each tank. All tanks were randomly arranged under the shelter made of black nets. Water level was filled up to 8cm above the substrate mixture. 0.3gdm⁻³ of Albert solution was added into each tank once a week.

Initially each plant was blotted and wet weight was measured. Five plants from initial plant population were taken to measure the weight of different parts of plants. Those plants were cut and stem and root were separated and wet weight of stem and roots were measured. In each plant, total plant height, stem height and root height were measured. Number of leaves was counted and stem height was measured in each plant once a week. At the end of the experiment, total plant height, stem height, root height, plant wet weight and surface area of leaves in each plant were measured. Soil, water and air temperature were measured three times a day. pH, Nitrate, nitrite and ammonium in water were measured once a week. All statistical analysis was carried out using the SPSS statistical package (SPSS 16). Results were compared by one way ANOVA followed by Duncan multiple range test.

Results and Discussion

Plants cultured in T4 treatment had significantly higher final plant height and surface area of leaves compared to plant cultured in other three treatments (Table 1). Plants cultured in T4 treatment had significantly higher % of height gain, final stem height, root height and plant weight compared to plants cultured in T1 treatment. Plants cultured in T2, T3 and T4 treatments had significantly higher number of leaves compared to plants cultured in T1 treatment. Results revealed that, Treatment 4 which consists of compost: coir dust: sand in 1:2:1 ratio was the best substrate mixture for *E. bleherae*. Also in Ornamental aquatic plant

market, it is very important to reduce production cost to achieve maximum profit. Therefore, it is important to reduce the cost of substrate to increase the profit. Compost, coconut dust and sand are locally available. Therefore, this substrate mixture can be recommended for cultivation of *E. bleherae*.

Reference

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Table 1: Effect of four different substrate mixtures on the growth performance of *E. bleherae*.

Parameters	Days	Treatments			
		T1	T2	T3	T4
Plant height cm	Initial	8.50	8.74	8.78	8.58
	Final	11.06 ^a	15.78 ^a	14.12 ^a	21.52 ^b
% height gain		0.01 ^a	0.02 ^{ab}	0.01 ^{ab}	0.03 ^b
Stem height cm	Initial	5.62	5.82	5.74	5.40
	Final	5.78 ^a	7.08 ^{ab}	6.70 ^{ab}	8.96 ^b
Root height cm	Initial	2.28	3.24	3.06	3.18 ⁰
	Final	5.28 ^a	8.70 ^{ab}	7.42 ^{ab}	12.56 ^b
Plant weight g(wet)	Initial	0.46	0.41	0.36	0.36
	Final	0.74 ^a	0.81 ^{ab}	0.86 ^{ab}	1.35 ^b
Number of leaves	Initial	2.00	2.00	2.00	2.00
	Final	4.60 ^a	6.60 ^b	7.00 ^b	8.40 ^b
Surface area of leaves mm ²	Initial	246.20	246.20	249.80	244.80
	Final	578.40 ^a	941.80 ^a	1243.80 ^a	2278.40 ^b

Values in a row having different superscripts are significantly different at $p < 0.05$.