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Technical Note

Cryptocoryne wendtii can successfully be grown in river sand enriched with nutrients

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Abstract

Cryptocoryne wendtii is commonly used for aquaria and water gardens and hence is an economically important aquatic plant with a high demand in local and export markets. There are fifty species of genus *Cryptocoryne* out of which fourteen species including *C. wendtii* are endemic to Sri Lanka. Although Sri Lanka exports around 300 aquatic plants, exportation of endemic and threatened species collected from the wild is prohibited, but the cultivated plants. *C. wendtii* ('Brown') shows poor growth when cultivated in common soil which is used for normal propagation of other ornamental aquatic plants. Hence, this study was undertaken to find an effective substratum for *C. wendtii*, which is important for aquatic plant industry.

C. wendtii was grown in five different media prepared with top soil and river sand in different proportions, both under emerged and submerged conditions. Results were analyzed using one-way analysis of variance. Plants grown in river sand had the highest dry weight gain and percentage survival compared to plants grown in top soil and river sand media prepared according to 1:1, 1:2, 1:3 ratios irrespective of either they were grown emerged or submerged, demonstrating that river sand enriched with commercially available fertilizer is the best medium to grow *C. wendtii*.

Keywords: *Cryptocoryne wendtii* 'brown'; ornamental plants; plant propagation; growth substrate

Introduction

Hundreds of fascinating and attractive plants are grown in aquaria for beautifying and maintaining the quality of water. In addition, aquatic plants provide food, shade,

refuge and breeding sites for many aquarium life forms including fish. There is an escalating demand for aquatic plants, mainly from the developed countries and a sizable global industry, based on propagation and cultivation of aquatic plants for exportation, exists. Although the current Sri Lankan contribution to this global market is marginal, a potential exists for its development (Yapabandara and Ranasinghe 2006).

The genus *Cryptocoryne* is an amphibious member of Family Araceae and various species of this genus show a wide distribution throughout Southeast Asia. Some are commercially cultivated as aquarium plants (Muhlberg 1982). *Cryptocoryne* species are found mostly in slow moving freshwater streams and shallow rivers contributing to the sustainability of the environment by preventing soil erosion with the help of its rhizomes that grow deep into the substratum (Wijesundara and Shantha Siri 2004). Vegetative cover provides surface protection against erosive forces of raindrops.

C. wendtii 'Brown' is a medium sized plant that normally grows up to 12.5-27 cm and more suitable for foreground of aquarium tanks. The leaves are brown in colour and are able to grow either emerged or submersed conditions. The plant is predominantly propagated by runners (Muhlberg 1982). Because of its brown colour, it is very important to get a contrast among green coloured aquatic plants creating a contrast appearance in the aquaria. Besides, they are quite easy to grow in aquaria and thrive well for a longer period.

In Sri Lanka, many aquatic plant suppliers collect specimens from the wild for both export and local market threatening their existence. *C. wendtii* is already declared a critically endangered species in the IUCN Red List (Yakandawala 2012). At present, collection of this species from wild habitats is prohibited. However, permission is granted to export any quantity of *C. wendtii* plants which are proven to have been propagated in nurseries.

Mass propagation through tissue culture has been attempted for *C. wendtii*. Nevertheless, it is not economical due to high production cost. The climatic conditions in Sri Lanka are favorable for its cultivation, despite its slow growth under natural conditions. *C. wendtii* has been reported have cultivated in nutrient enriched water with or without the mechanical support of an inert medium such as sand or gravel with adequate drainage (Jones 2004).

Materials and Methods

The experiments were carried out at Ornamental Fish Breeding and training Centre in Rambadagalla, National Aquaculture Development Authority of Sri Lanka (NAqDA). River sand was collected from 'Deduru oya' river and top soil used for the medium was sieved through 1 mm mesh.

Five different growing substrates were prepared using river sand, and marshy soil alone as well as by mixing top soil and river sand according to 1:1, 1:2, 1:3 ratios. Three replicates were used for each treatment and also emerged and submerged conditions were provided for each substrate. Plants were grown in round shaped clay pots which had 20 cm diameter and 7.5 cm height (Figure 1).

C. wendtii 'Brown' plantlets of similar size were planted in each pot with equal distance between the plantlets. Pots were kept under greenhouse condition and 5 ml from 0.1 g/l solution of commercially available fertilizer of 20% N, 20% P, 20% K and 20% Trace elements, was applied for each pot fortnightly. A constant water level and the wet condition were maintained in the pots throughout the study period. Number of survived plants and their dry weights were taken after three months of growth period by drying in an oven at 105°C for constant weight.

Complete Randomized Design was used as the experimental design with one factor of 'medium' for two conditions as 'emerged' and 'submerged'. SAS (version 9.1) statistical software was employed to analyze the data using ANOVA.

Figure 1. Experimental pots.

Results

C. wendtii showed best growth and survival in river sand substratum when grown emerged (the leaves) (Figs. 2 and 3). The results of ANOVA revealed that substrate and growing pattern affected growth of the plants measured as dry weight gain ($p<0.05$). According to the statistical analysis there was no significant effect on weight gain under conditions, i.e., emergent or submerged, *C. wendtii* 'Brown' cultured in "river sand" under "emerged condition" showed the highest average survival percentage (97%) and mean dry weight gain (53.8 mg) that recorded a statistically different result.

Discussion

Some aquatic plants colonize the riparian zone between water and the land and they are known as marsh plants. They grow on wet soil around the edges of the water or in shallow water (littoral zone), so that shoots and leaves develop above water level.

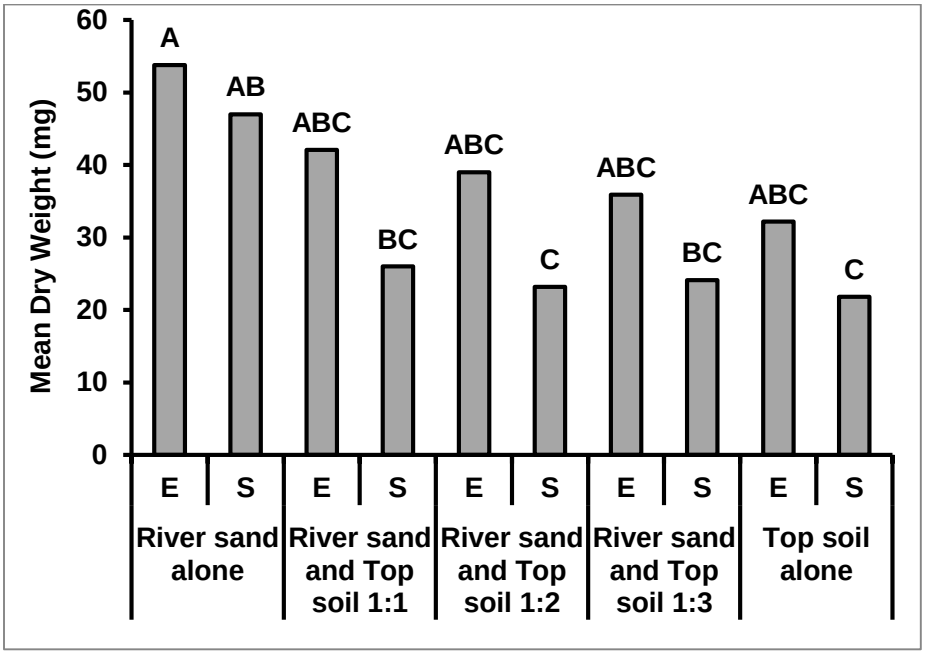

Figure 2. Mean dry weight at the end of the growing period of three-month of *C. wendtii* grown in different growing substrates and conditions (E: Emerged; S: Submerged). Means that share the same letter are not statistically different (p>0.05).

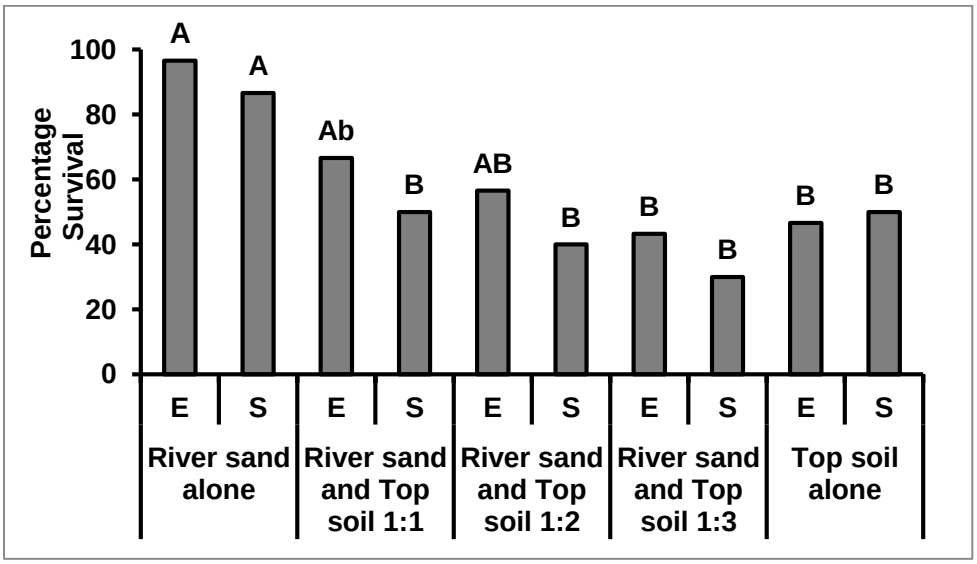

Figure 3. Percentage survival of *C. wendtii* grown in different substrates and conditions (E: Emerged; S: Submerged). Means that share the same letter are not statistically different (p>0.05).

Some marsh plants are able to withstand short periods of drought in their habitats and still others are adapted live submerged. The roots of aquatic plants grow well if they are allowed to develop in an oxygen-rich rhizopheric environment. The substratum for aquatic plants should preferably consist of coarse soil particles i.e., 2-5 mm grain size to retain air and hence growth of aquatic plants (Muhlberg 1982).

Aeration is an important factor that influences root and plant growth whereas oxygen is essential for cell growth and physiological function. If oxygen is not available sufficiently in the rooting substrate severe plant injury or cell death may occur. The energy required for root growth and ion absorption is generated through respiration which requires O_2. Without adequate O_2 to support respiration, water and ion absorption ceases to occur and roots die (Jones 2005).The "river sand" medium encourages the plant growth because the root system develops very well in it due to availability of interstitial spaces which can retain oxygen. A well-developed root system is essential for an aquatic plant to absorb nutrients efficiently and thus it affects plant growth.

Conclusion

Cryprocoryne wendtii 'Brown' cultured in "river sand" under "emerged condition" showed the highest average survival percentage and mean dry weight gain.

Acknowledgement

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