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GROWTH AND REGENERATION OF *CRYPTOCORYNE CILIATA* (ROXB.) FISCH. *EX* WYDLER (ARACEAE) UNDER *EX-SITU* CONDITIONS

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Abstract

Cultivation of *Cryptocoryne ciliate* (Roxb.) Fisch. *ex* Wydler via seeds resulted 80% survivality.The plant yearly produced 4-8 new leaves whose length varies from 45 to 52 cm and showed highest elongation in summer (1.04 ± 0.21 cm/day), medium (0.82 ± 0.15 cm/day) in monsoon. During winter and autumn foliar parts decompose. The highest growth was associated with 776.83 ± 107.21 µE $m^{-2}s^{-1}$ PAR, 31.58 ± 2.14º C water temperature and 12.74 ± 0.53 hr day length. The plants grew in brown to blackish-brown wet soils having pH, moisture content, OC, OM, CEC of the soil 6.95, 29%, 2.16%, 3.72% and 4.29 me/100 g soil, respectively. Available nitrogen, phosphorus, potassium and sulphur were 620, 3.09, 32 and 370 ppm, respectively.

In Bangladesh three species of *Cryptocoryne* (Family: Araceae) occur in the wetland habitats (Siddiqui *et al*. 2007). These are *Cryptocoryne ciliata* (Roxb.) Fishcer *ex* Wydler, *C. retrospiralis* (Roxb.) Fischer subsp. *albida* (Parker) Rataj and *C. spiralis* (Retz.) Fishcer *ex* Wydler. *C. ciliata* (common name: hobbyists or house plants) grows in the river-banks, ditches, canals and loamy clay soil on coastal plains. It is a perennial aquatic herb of marshes usually submerged with tuberous creeping stoloniferous root-stock clothed with long rather fleshy fibres. It is an ornamental plant, used in glass aquaria; reduce river water current action promoting sedimentation and serves as a good soil binder, shelter and breeding places for fishes and other aquatic animals (Xema 2005). It is found in Bangladesh, India, Malacca and Malay Islands (Biswas and Calder 1954, Khan and Halim 1987).

In Bangladesh some research works on wetland macrophytes were carried out (Islam 1993, Khondker *et al.* 1993, 1994, 2004, Alfasane *et al*. 2008, 2009a,b, 2010a,b) except *C. ciliata*. The present research has therefore been undertaken to carry out an *ex-situ* culture of *C. ciliata.*

Four live plantlets of *C. ciliata* were collected from the banks of river Bhairab, Daulatpur, Khulna and brought to the Botanical Garden, Dhaka University and put them to the culture pit. These were immediately planted in a muddy block and acclimatized. It responded well following a fruiting stage. After fruiting 30 young plants were transferred in a 1.5 × 0.75 m culture pit. Measurement on the foliar growth of these plants were carried out at different stages.

About 500 g of submerged soil sample from the culture pit was collected in a polybag and transferred to the laboratory of BCSIR (Bangladesh Council of Scientific and Industrial Research) for analyses. All the analyses were made following Huq and Alam (2005). Climatic data on relative humidity, total rainfall and day length of Dhaka Metropolis were collected from Bangladesh Meteorological Department, Dhaka. PAR (photosynthetically active radiation) was determined with Li-Cor Quantum Meter, LI-185B, USA.

Cultivation of plants were done by planting 30 young plantlets obtained through viviparous germination of seeds of which 24 survived (80%). The plant is slow growing and producing 4-8 new leaves in a year. The length ranged from 45 to 52 cm. The leaves showed the highest elongation (1.04 ± 0.21 cm/day) in summer but decomposed during winter and autumn (Fig. 1). Xema (2005) mentioned like other plants, crypts need light and nutrients in order to grow and

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develop their full beauty, and plants adapt to a high intensity of light. Ipor *et al*. (2006) also mentioned considerable plasticity of the *Cryptocoryne* species, and the morphological characteristics depend on the environmental conditions of the surroundings.

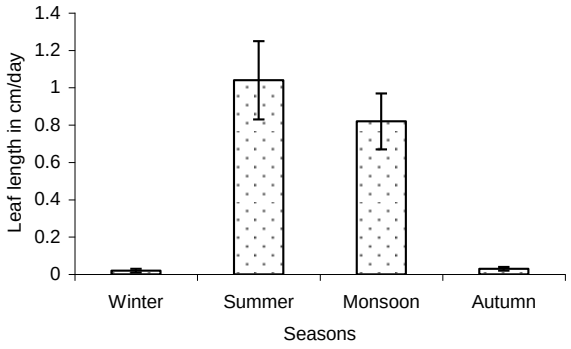

Fig 1. Elongation of leaves of *Cryptocoryne ciliata* in different seasons.

C. ciliata grew in wet and nutritious soil. The soil supporting the plant showed noticeable quantity of sand, silt, clay, organic compounds and rich NPKS (Table 1). According to Xema (2005) macronutrients (nitrogen, potassium and phosphates) are very much important for the growth of *C. ciliata*. The colour of the soil was brown under dry condition and blackish brown when wet. Xema (2005) also mentioned that *C. ciliata* grows well in small streams, in soils of

Table 1. Physicochemical parameters of soil from culture pit of *Cryptocoryne ciliata.*

Parameters	Contents
Color	Brown (dry soil), Blackish Brown (wet soil)
pH	6.95
Moisture Content	29%
Soil particle size:	
Sand size (0.02-2 mm)	45%
Silt Size (0.002-0.02 mm)	37%
Clay size (<0.002 mm)	18%
Soil textural class	Loam
Organic Carbon (O.C.)	2.16 %
Organic Matter (O.M.)	3.72 %
Cation Exchange Capacity (C.E.C.)	4.29 me/100g Sample
Available NH_4^+	0.135%
Available NO_3^-+NO_2^-	620 ppm or 0.062%
Total Nitrogen	0.375%
Total Phosphsorus	700.9 ppm or 0.07%
Available Phosphorus	3.09 ppm or 0.0003%
Total Potassium	629 ppm or 0.062%
Available Potassium	32 ppm or 0.0035%
Total Sulphur (Sulphate form)	9600 ppm or 0.96%
Available Sulphur	370 ppm or 0.037%

sand, clay, rotten leaf deposits, etc. and a good soil, with a noticeable quantity of clay and organic compounds, covered with a thin layer of fine sand is a must to obtain full growth. In the present study full growth of the plant (Fig. 2) was obtained in soil with 45% sand, 37% silt, 18% clay, 2.16% organic carbon and 3.72% organic matter. The cation exchange capacity (CEC) of the soil was 4.29 me/100g sample and available sulphur was 370 ppm (Table 1). Ipor *et al*. (2006) recorded 3.98 me/100g cation exchange capacity in an experimental plot of *Cryptocoryne ferruginea*.

Fig. 2 (A-G): *Cryptocoryne ciliata* grown in culture pits. A. Inoculation in the culture pit. B. Acclimatized plants. C. Mature plant with colourful spathe. D. Seed capsules. E. Propagules dispersed from seed capsule. F. A plantlet. G. Viviparous germination in a seed capsule (sliced).

The climatic data collected in 2006 have been presented in Table 2. It appears that highest PAR of 776.83 ± 107.21 µE/m^2/sec in summer having 31.58 ± 2.14º C water temperature and sunshine hour of 12.84 ± 0.65 are ideal for best growth of the plant (Fig. 2).

Table 2. Seasonal variation of climatic parameters during cultivation of *C. ciliata* in 2006. (n =24)

Parameter	Winter	Summer	Monsoon	Autumn
PAR (µE $m^{-2}s^{-1}$)	620.28 ± 51.30	776.83 ± 107.21	653.78 ± 202.67	677.33 ± 76.20
Sunshine hour (day length)	10.98 ± 0.32	12.74 ± 0.53	12.84 ± 0.65	10.74 ± 0.57
Rainfall (mm)	00	65.00 ± 64.40	167.89 ± 104.40	71.67 ± 99.23
Humidity (%)	54.86 ± 14.53	55.83 ± 12.26	79.44 ± 11.34	74.67 ± 5.79
Air temperature (° C)	25.49 ± 4.02	33.92 ± 2.30	31.59 ± 2.14	33.40 ± 2.15
Water temperature (° C)	24.07 ± 4.05	31.58 ± 2.14	29.12 ± 1.55	31.75 ± 1.43

C. ciliata regenerated well under *ex-situ* condition by transplanting live young plantlets. Under the present experimental conditions, the plant developed its full beauty by a colorful spathe (Fig. 2C). The species produced innumerable number of viviparous propagules (Fig. 2 E-G) each of which develops into a new plant on marshy soil. The whole fruit was divided into segmented seed capsules, 9.08 ± 1.67 cm in diameter and contained numerous seeds. *C. ciliata* produces 1-4 seed capsule/per plant/year. The mean number of seeds per seed capsule was 45.28 ± 7.48.

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References

Alfasane M.A., M Khondker and Z. N. T Begum. 2009a. Effects of some limnological factors on the growth of *Nelumbo nucifera* Gaertn. Bangladesh J. Bot. **38**(2): 133-138.

Alfasane M.A., M. Khondker and Z.N.T. Begum. 2009b. Biochemical composition of the seeds of *Nelumbo nucifera* Gaertn. Dhaka Univ. J. Biol. Sci. **18**(1): 83-85.

Alfasane M.A, M Khondker and Z.N.T Begum. 2010a. Interrelationships between the growth of *Euryale ferox* Salisb. and some limnological factors. Dhaka Univ. J. Biol. Sci. **19**(1): 41-46.

Alfasane MA, M Khondker and Z. N.T Begum. 2010b. Growth of water mimosa (*Neptunia natans* (L.f.) Druce) in relation to habitat limnology. J. Asiat. Soc. Bangladesh, Sci, **36**(1): (in press).

Alfasane M.A., M. Khondker and Z.N.T. Begum, L.A. Banu, M.M. Rahman and U.F. Shahjadee. 2008. Fruit production and biochemical aspects of seeds of *Euryale ferox* Salisb. under *ex-situ* conditions. Bangladesh J. Bot. **37**(2): 179-181.

Biswas K. and C.C. Calder. 1954 (reprint 1984). Hand book of common water and marsh plants of India and Burma. Bishen Singh Mahendra Pal Singh, Dehradun.

Huq S.M.I. and M.D. Alam (Eds). 2005. A handbook on analyses of soil, plant and water. BACER-DU, Univ. Dhaka, Dhaka. 246 pp.

Ipor I.B., C.S. Tawan and M. Basrol. 2006. Growth pattern, biomass allocation and response of *Cryptocoryne ferruginea* Engler (Araceae) to shading and water depth. Jurnal Biosains, Malaysia, **17**(2):55–78.

Islam A.K.M. Nurul. 1993. Limnology and pollution of wetlands. *In:* Freshwater Wetlands in Bangladesh: Issues and approaches for management, *A.* Nishat, Z. Hussain, M.K. Roy and A. Karim (Eds), pp. 123-146. IUCN, Dhaka.

Khan, M.S. and M. Halim, 1987. Aquatic angiosperms of Bangladesh. Bangladesh National Herbarium, BARC, Dhaka, 120 pp.

Khondker M., Z.N.T. Begum and M.A. Alfasane. 2004. Growth and regeneration of *Neptunia natans* (L.f.) Druce and *Euryale ferox* Salisb. Bangladesh J. Bot. **33**(1): 35-39.

Khondker M., A.K.M. Nurul Islam and A.D. Makhnun. 1993. Study of the growth of a floating macrophyte. J. Asiatic Soc. Bangladesh (Sci.) **19**(2): 103-108.

Khondker M., A.K.M. Nurul Islam and A.D. Makhnun.1994. *Lemna perpusilia:* screening on habitat limnology. Bangladesh J. Bot. **23**(1): 99-106.

Siddiqui K.U., M.A. Islam, Z.U. Ahmed, Z.N.T. Begum, M.A. Hassan, M. Khondker, M.M. Rahman, S.M.H. Kabir, M. Ahmad, A.T.A. Ahmed, A.K.A. Rahman and E.U. Haque (Eds). 2007. Encyclopedia of Flora and Fauna of Bangladesh. Vol.**11**. Angiosperms: Monocotyledons (Agavaceae – Najadaceae). Asiatic Society of Bangladesh, Dhaka. 399 pp.

Xema, L. E. 2005. Introduction to the *Cryptocoryne* genus (Fam. Araceae), *Aqua Babble*, Aquarium Club of Edmonton, [Online] (cited 2008 Jun 05). Available From: URL:http://www.aquarticles.com/articles/plants/Xema_Cryptocoryne.html.

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