

**FLOWERING AND FRUITING CHARACTERISTICS AND BIOCHEMICAL
COMPOSITION OF AN ENDANGERED PALM SPECIES
(*CORYPHA TALIERA* ROXB.)**

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Abstract

Monitoring on the panicle initiation, flowering, fruiting and seedling characteristics of *Corypha taliera* has been carried out. Biochemical composition of fresh and dry flowers together with the pericarp of the fruits have been analysed. Fresh flowers, fruits, seeds, and pericarp and testa weighed 13.75 mg/flower, 19.46 g/fruit, 6.47 g/seed, 12.89 g/pericarp and testa, respectively. The length of fruits and seeds were c 3.34 cm and c 2.33 cm, respectively while the breadth of the same were 3.14 cm and 1.94 cm, respectively. The protein content of fresh flower and pericarp were 12.78 and 14.70%. High energy content 345.97 Kcal was recorded in the pericarp and testa of the fruit. The first sown seeds were germinated in latterite clay soil between January and February and took approximately 30-48 days.

Introduction

Linnaeus (1753) first designated the genus *Corypha* (Arecaceae). *C. taliera* was discovered in 1819 by William Roxburgh and he considered it to be endemic to Bengal (Roxburgh, 1820, 1832; Basu, 1991). There are four species of *Corypha* available in India, viz., *Corypha taliera*, *C. umbraculifera*, *C. elata* and *C. macropoda*. Of these *C. taliera* is rare. The existence of a lone individual of *C. taliera* was preliminarily identified by late Prof. Salar Khan in 1950 in a scrub jungle within the Dhaka University campus, Dhaka, Bangladesh (23°43'46" N and 90°23'33" E). Since the individual was found to grow in a scrub jungle it was considered to be the lone surviving individual of the species throughout the whole world under natural condition (Khan, 2001a,b). The principal characteristic features of the plant are: plant monocarpic, individual tree 12-15 m long, no spiral bands on stem, strong spines on both margins of petiole; petiole c 3 m long, base single, not divided into two parts; panicle terminal, comes out from stem head, robust, compound, pyramid like; fruit green.

Since there is no information on the biochemical composition of flower and fruit biomass of the species throughout the world and the present individual is the last representative so an initiative was undertaken to find the biochemical components of the flower and fruit of this globally endangered species.

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Materials and Methods

Though grew in a scrub jungle, the species was cordoned within the boundary wall of the official residence of the Pro-Vice Chancellor of Dhaka University, Dhaka, Bangladesh because of safety reasons. Regarding fruiting, the plant was under continuous observation since 2000. After panicle initiation (visible on 18 September 2008) monitoring on its growth was done at definite intervals (1 week - 2 months) during which photographs of the plant canopy, stem, panicle, flower, fruits, etc. were taken and digitized (Fig. 1). This activity continued from 18 September 2008 to 23 January 2010.

For chemical analysis, the flower biomass was collected by spreading a synthetic oil-cloth (160 × 117 cm) underneath the tree for 5 days. During this period an amount 500 g of flower biomass was collected (Fig. 3). It was then screened for separating debris manually and then poured in a polythene bag. The biomass was then transported to the BCSIR Laboratories, Dhaka for analysis. Ten selected fresh flowers were weighed individually with the help of an electronic balance (AND FR-200 MK II, Japan). Length and width of juvenile, young and mature fruits and their petiole and seeds were measured from a randomly selected 12 specimens with the help of a slide calliper and a screw gauge. The weight of fresh fruits and seeds were taken with the help of an electronic balance as mentioned above.

The analysis on biochemical components was carried out on fresh flower as well as on dry flower biomass (dried at 100 °C). The biomass was crushed in a mortar with the help of a pestle. The crushed material was then used to determine the amount of protein, ash, fat, moisture, fibre, carbohydrate, calcium, phosphorus, iron and energy content (NIN, 1976). Moisture content was determined with the help of a moisture meter (IB-30, Brand Chyo, Capacity 309, Readability = 0.0019). Mikrokjeldhal method was followed to determine the protein content (NIN, 1976). Ash was determined with the help of a Muffle Furnace (Model No. Carbolite RHF-1600). Pericarp and testa were separated manually from the fresh fruits and analyzed following the same methodology as described above.

Results and Discussion

The present individual of *C. taliera* showed a pipe-like panicle initiation on 18 September 2008 which later on took a shape just like the branched horns of a deer until 16 October 2008 (Fig. 1). The first flower was seen on one of the branched panicle on 24 October 2008 and the whole set of panicle blossomed in January 2009 (Figs. 2 & 3). The flowers are trimerous, white with large dark brown anthers borne on needle like slightly bent filaments (Fig. 3b, d). The weight of each fresh flower ranged from 12.0-17.1 mg with a mean value of 13.75±1.3 mg. Table 1 depicts the biochemical composition of fresh and dry flower and pericarp and testa. The moisture contents were

33.1% and 17.5% in fresh and dry flower, respectively. Except this parameter, all other measured components of flower were higher in dried condition compared to the fresh one.



Fig. 1. Stem characteristics and different stages of panicle growth in *C. taliera*. a. habit; b. first panicle initiation; c. panicle branchlets initiation; d. panicle branchlet growing; e. magnified view at the base of branchlet; f. few small leaves at the base of the panicle; g. pyramidal shape of the whole panicle; h. ring like growth on stem.

The protein content of flower and testa is almost similar to those obtained in safflower flower but calcium, phosphorus and iron are much lower in concentration (<http://nariphaltan.virtualave.net/safflower.htm>). Considering the comparable information available, the protein content of *C. taliera* flower, pericarp and testa are lower than *Sambucus nigra* flowers (Kislechenko and Vel'ma, 2006).

Ripe fruits smelled strongly alcoholic. At night the fruits were chewed by *Pteropus giganteus* Brunnich. (Bangla: *Kala badur*, English common name: Flying fox) and other birds.

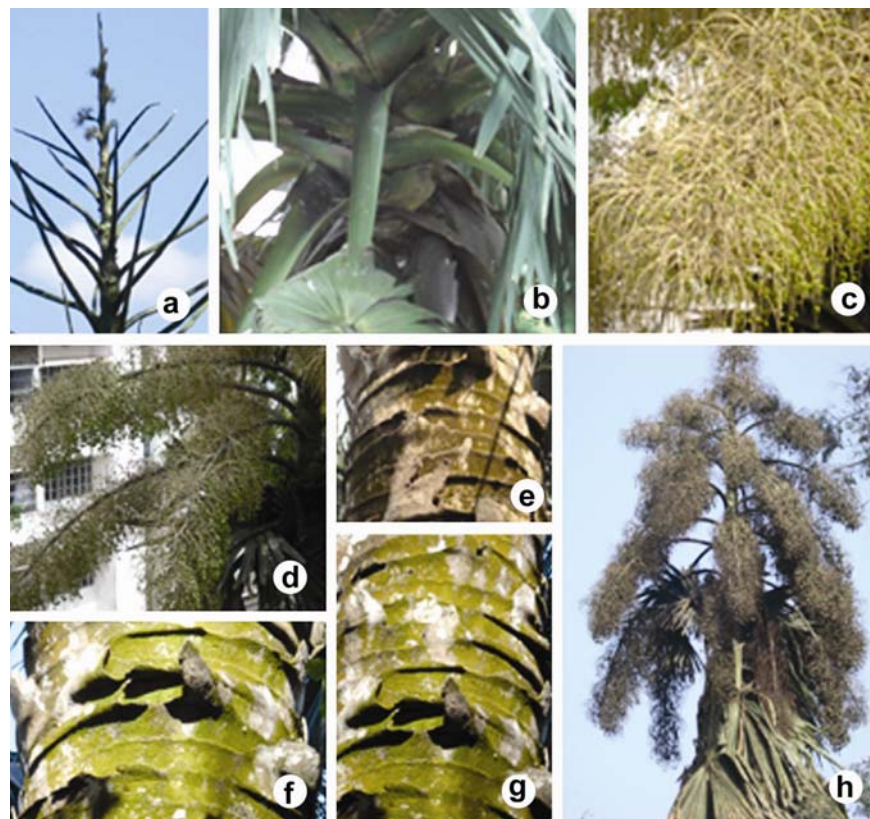


Fig. 2. Flower formation, petiole character, fruit formation and epiphytic growth of algae on stem. a. flower coming out from the top of the panicle; b. base of the leaf petiole not divided; c. juvenile fruit; d. young fruit; e-g. various stages of epiphytic algal growth on the stem of *C. taliera*, three kinds of subaerial corticolous algal association were found, these were, almost unialgal *Scytonema* sp. (e) and *Trentepohlia monilia* (f) and a mixed association of the above mentioned two algae (g); h. dying tree with mature fruits.

Table 1. Weight and biochemical composition of flower, pericarp and testa of *Corypha taliera*.

Parameter	Flower		Pericarp and testa
	Fresh	Dry	Fresh
Mean weight (mg) ^{1,2}	13.75	nd	12.89
Carbohydrate %	41.62	52.62	67.03
Protein %	12.78	14.70	14.70
Fat %	1.25	1.58	1.17
Moisture %	33.10	17.5	12.10
Fibre %	10.58	14.73	41.18
Ash %	11.25	13.60	5.0
Calcium mg/100 g	256.51	432.86	240.0
Phosphorus mg/100 g	290.0	490.00	212.0
Iron mg/100 g	36.80	53.80	17.0
Energy Kcal	228.17	290.70	345.97

¹= (sd ± 0.13 mg/flower, n=10); ² = (sd ± 2.00 g/fruit, n=12), nd = not done.



Fig. 3. Bloomed panicle and individual flower. a. blossom with full length and diameter; b&d. flowers; c. heap of flowers collected for biochemical analyses.



Fig. 4. Fruits and seeds. a. juvenile fruits; b. fruits with stipe; c. mature fruits; d. fruits chewed by bats and birds; e. peeled off pericarp and testa of a mature fruit; f. seeds; g. germinated seed with root; h. seed bed habitat.



Fig. 5. Newly germinated plant of *C. taliera*. a. a primordium; b. grown seedling; c. germination of seed; d. magnified view of germinated seed.

From panicle initiation to first flowering the plant took 36 days and from the very young fruit to mature fruit 415 days (1 year 1 month 20 days). Some picked up fruits chewed by birds/bats were sown in a seed bed (Fig. 4h) containing latterite soil on 10 January 2010. The bed was charged with water at every alternate days in a way as it is normally done in case of flower bed. On 28 February 2010 a seedling was seen to grow in the habitat with a 7 cm long root (Fig. 4g). However, the seedling died after it was transplanted to a normal flower garden. Around 50 other seeds were sown mostly in flower gardens containing latterite soils and were found germinated. After the seeds were sown and waiting for more than a month nothing was visible above the ground level. Then for checking digging was done at the base of few sown fruits and it was seen that all seeds had developed massive roots penetrating soil. After three months of sowing, shoot developed above the ground (Fig. 5a-d). After the primordial development above the ground, the growth rate is about 0.5 cm/day.

Table 2. Size and weight of fruit parts at different stages of development.

Parameter	Unit	Date				
		10.02.09	31.08.09	24.10.09	11.01.10	23.01.10
Peduncle	Length (cm)	0.892 ± 0.112	1.000 ± 0.050	1.000 ± 0.050	-	-
	Breadth (cm)	0.244 ± 0.029	0.240 ± 0.030	0.250 ± 0.040	-	-
	n	12	12	12	-	-
Fruit	Length (cm)	2.060 ± 0.250	3.026 ± 0.230	3.180 ± 0.410	-	3.340 ± 0.180
	Breadth (cm)	1.830 ± 0.210	2.820 ± 0.170	3.040 ± 0.340	-	3.140 ± 0.160
	Weight (g/fruit)	3.740 ± 1.140	12.01 ± 3.74	18.03 ± 4.86	-	19.46 ± 2.79
	n	12	12	12	-	12
Seed	Length (cm)	-	-	-	2.120±0.150	2.33 ± 0.150
	Breadth (cm)	-	-	-	1.770±0.110	1.94 ± 0.140
	Weight (g/fruit)	-	-	-	4.250±0.700	6.470 ± 0.78
	n	-	-	-	27	12
Pericarp and testa	Weight (g/fruit)	-	-	-	-	12.89 ± 2.00
	n	-	-	-	-	12

C. taliera takes a total of 431 days from panicle initiation to fruit ripening and after sowing the seeds germinate approximately within 30-48 days but only root system develops first which continues to penetrate inside the soil. Another 48 days is required to come out the shoot (plumule) above the ground level. The shoot actually develops rupturing a sheath attached with the root system keeping the structure of the seed above (Fig. 5c-d). Since the germination rate of the seeds seems to be high (c 90%) and the present plant has produced nearly 224 kg (sun dried) of fruits (50% of which is properly collected and preserved), there is ample chance of conservation of the plant *ex situ*.

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