



Population studies and Seed Germination of Monocarpic Palm (*Corypha umbraculifera* sp) in Tamil Nadu

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Abstract

The *Corypha umbraculifera* L., belongs to the family Arecaceae is a long-lived monocarp tree with an extended period of vegetative growth of 40-80 years. The species is found naturally growing along the Malabar Coast of south western India and in Sri Lanka (Johnson, 1998). The distribution of the talipot palm is associated with human habitats (Dassanayake, 2000), and it is considered to be rare in the wild (Gadgil and Chandran, 1988; Johnson, 1998). Leaves of the talipot palm have been used for the documentation of Thripitaka (Buddhist scriptures) (Johnson, 1998). It is speculated that this palm was introduced to Sri Lanka for the documentation of ancient Buddhist texts (Dassanayake, 2000). Over exploitation of this species in Thailand and India (Gadgil and Chandran, 1988; Johnson, 1998) has made the talipot palm rare. *C.umbraculifera* has been categorized as a data deficient species in the Red List of Threatened Species, IUCN (1998), while in the list of threatened and rare ornamental plants prepared by Khoshbakht and Hammer (2007) it is listed as a rare ornamental species. The limited distribution of natural population found in Keelakovalavedu village near Vanthavasi of Tiruvannamalai district and in some areas of Kanchipuram and Chengalpet districts. Hardly any population studies on *Corypha umbraculifera* were done throughout Tamil Nadu. Hence the present study aims to survey and document this rare talipot palms in Tamil Nadu.

Secondly, a nursery based experiment was also conducted to study the effect of varied pre-sowing treatments on seed germinations of *Corypha* (talipot palm). Seeds of selected species were subjected to four different pre-sowing treatments. Results revealed that, the highest germination percentage was observed 70% in cold water treatment (72 hours), followed by 50% in soaking in cowdung (48 hours). These findings will be helpful in raising *Corypha* seedlings in nursery.

Key words: Keelakovalaivedu, Talipot palm, Germination and Population studies

Introduction

Palms are the third most economically important plants; they are extensively used as ornamental plants and also for making furniture and thatching material for roof as they are rigid, and exhibit ultimate tensile strength. *Corypha umbraculifera* L. is a fan palm and is one of the largest palms in the world, attaining heights of 20-25 m. The inflorescence of *C. umbraculifera* is the largest one borne on any plant (Tomlinson, 2006) and contains approximately 23.9 million florets (Fisher *et al.*, 1987). Fruits are globose, grayish green and 3–4 cm in diameter. Each fruit contains a single seed. Seeds are narrowly grooved and have a diameter of about 2 cm. In Tamil Nadu it has limited population and locally called as Thalipanai. Natural population of this species occurs in Keelakovalaivedu village of Tiruvannalamalai district in Tamil Nadu and in addition the surviving population is found as a sacred grove in few places of Tamil Nadu. *Corypha umbraculifera* is a multi-purpose ornamental palm tree. Prehistorically, leaves of *C. umbraculifera* were used as thatching material for constructing houses and the leaves were used as manuscripts because of their distinctive characters such as size, shape, rigidity and greater strength and life. The leaves serve for the production of fans, mats, umbrellas, and baskets. The leaf stalks are made into paper. The pith of the stems is the source of a sago-like product. The hard seeds are manufactured into buttons and jewellery (Kruse, 2001).

Basic information on seed biology is essential for the conservation of rare species as many species depend on seeds for propagation (Baskin *et al.*, 1998). To produce the maximum number of healthy seedlings from the minimum number of seeds, we need to determine the dormancy breaking and germination requirements as well as appropriate long-term storage methods to maintain viability of seeds to be used for propagation in the future. Only a few studies have been conducted on the seed biology of *C. umbraculifera*. Viji *et al.* 2013 found that *C. umbraculifera* seeds have a very low germination percentage. According to the latter research conducted by Viji *et al.* 2015, talipot palm seeds require 64-77 days to complete germination. Further, they reported that this palm has the remote type seed germination, i.e. the shoot develops inside the cotyledonary sheath and emerges through a cleft formed in it. However research findings related to the pre-sowing seed treatments of *C. umbraculifera* are very scarce. Also, there is no detailed report on population status of this talipot palm in Tamil Nadu. Under the present condition, the purpose of the research is to explore the natural distribution and best methods to break the seed dormancy of talipot palm in Tamil Nadu.

Materials and Methods

Distance Sampling

Distance sampling is a method for assessment of the absolute density of a tree population, based on accurate distance measurements for all objects detected in the vicinity of a point or line. Distance sampling appears to be useful when reliable estimates of density are needed for the investigation of a single tree population. For objects that are sparsely distributed across large geographic areas, it is highly cost-efficient and often the only method available. In line transect distance sampling; substantially more ground can be covered within a given time than in quadrat sampling. Because plants often have a very patchy distribution, the ability to cover a large area of ground with modest resources is an important advantage of line transects. Objects explored were seedlings, Juvenile trees, mature trees and fallen trees of *C. umbraculifera*.

Mapping

Precise locations of *C. umbraculifera* in Tamil Nadu were mapped using Garmin Global Positioning System (GPS) handheld receiver. The GPS data were plotted using Google Earth software and a distribution map was prepared.

Phenology and Reproductive biology

Phenology is the study of periodic events in biological life cycles and how these are influenced by seasonal and inter-annual variations in climate, as well as habitat factors. Phenological observations were made to determine the timing and duration of the different developmental stages. To determine attributes of floral phenology, a sample of 15 plants at keezhkuvalaivedu site was observed throughout the reproductive period. Phenological events (bud break, flowering, fruiting, shedding of leaves, fresh leaf emergence, fruit dispersal and seed germination) were recorded over a period of two years.

Seed germination test

Ripened fruits of *C. umbraculifera* were collected under the talipots in road side and lake bund during February 2021. They were collected in gunny bags and shade dried for a week before germination test. Pulp of the fruits was removed and seeds were cleaned with water.

A randomized complete block design with four replicates was used for the experiment. Seeds were subjected to 4 pre-sowing treatments including control. Twenty five (25) seeds were used for each replication of each treatment. Therefore, a total of 400 seeds were subjected to four different pre-sowing treatments. The seeds were sown in germination trays filled with fine sand and kept for observation inside the mist chamber. Watering done at regular intervals and observations recorded.

The treatments used in the experiment are as follows:

T1: Control (Intact seeds without applying any treatment),

T2: Soaking in normal water for 72 hours,

T3: Soaking in hot water for 10 minutes,

T4: Soaking in cow dung for 24 hours

Germination Percentage

At the end of the germination period, the germination percentage was calculated using the following equation (Maguire 1962).

Germination percentage = (Number of germinated seeds/ Total number of seed sown) ×100.

Result and Discussion

Table 1. Georeferencing of sample trees, *Corypha umbraculifera* in Tamil Nadu

Tree ID	Height (m)	Girth (m)	GPS	Location	Phase
VATN 01	29	2.6	12°29.418'N 79°39.706'E	Maruthadu	Shed all the fruits
VATN 02	13.27	3.1(with sheath)	12°32.828'N 79°39.642'E	Keezhkuvalaivedu	Vegetative
VATN 03	13.38	3.2 (with sheath)	12°32.834'N 79°33.636'E	Keezhkuvalaivedu	Vegetative
VATN 04	17.7	3.15(with sheath)	12°32.834'N 79°33.636'E	Keezhkuvalaivedu	Vegetative
VATN 05	18.58	2.8(with sheath)	12°32.834'N 79°33.636'E	Keezhkuvalaivedu	Vegetative
VATN 06	18.63	2.9	12°32.834'N 79°33.636'E	Keezhkuvalaivedu	Vegetative
VATN 07	18.40	2.8	12°32.834'N 79°33.636'E	Keezhkuvalaivedu	Vegetative
VATN 08	19.23	2.7	12°32.043'N 79°33.355'E	Keezhkuvalaivedu	Vegetative
VATN 09	20.24	2.9	12°32.043'N 79°33.355'E	Keezhkuvalaivedu	Shed all the fruits
VATN 10	18.22	2.6	12°32.043'N 79°33.355'E	Keezhkuvalaivedu	Vegetative
VATN 11	12.25	3.1(with sheath)	12°32.043'N 79°33.355'E	Keezhkuvalaivedu	Small tree
VATN 12	20.25	2.9	12°32.064'N 79°33.355'E	Keezhkuvalaivedu	Fruting
VATN 13	21.24	3.1(with sheath)	12°32.064'N 79°33.322'E	Keezhkuvalaivedu	Fruiting
METN 14	11.22	3.2(with sheath)	12°32.064'N 79°33.322'E	Melmaruvathur	Juvenile tree
CHTN 15	18.31	2.8	12°59.25'N 80°13.07'E	Velachery, Chennai	Vegetative
MDUTN17	19.45	3.0 (with sheath)	09°59.34'N 78°14.52'E	Madurai -TVS	Fruiting
TNJTN 18	14	2.5	10°38.34'N 79°14.25'E	Tanjore to Kalayarkoil (Thennamanadu)	Vegetative

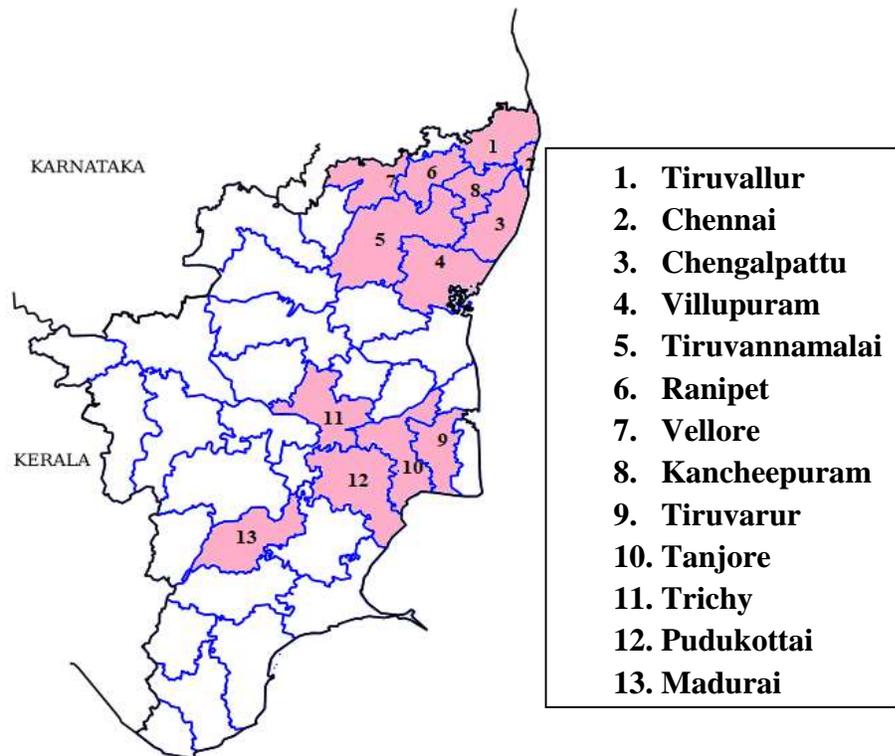


Fig 1. Map Showing the distribution of *Corypha umbraculifera* in Tamil Nadu

Also it was spotted randomly along Tanjore to Tiruvarur route near Salaiyamangalam, Ammapettai, Arunthavapuram, Tanjore to Pattukottai via Orathanad. It was also seen in many regions of Pudukottai district such as Thuralikadu, Sithukadu, Vadakadu, Pulikadu, Alangudi pirivu etc., both fruiting and vegetative stage were observed in these places.

Keezhkuvalaivedu (Hotspot)

The village has more than 200 talipot palms. About 50 trees were seen in fruiting stage. They have started flowering during April-May 2018. Remaining trees were in vegetative state. No flowering stage was observed after that in the population. The palm usually found along the water bodies like edges of lakes, ponds and boundaries of paddy field.

Morphological Characteristics

Tall talipot which reaches a height up to 29 m was recorded, with stems around 2.5-3.5 m diameter; leaves upto 4.8 m in diameter with a petiole upto 4m. It is a flowering plant bears largest inflorescence (6 – 8 m) in the world. Flowers are bisexual. The palm is Monocarpic. Flowering only once when it is 50 to 80 years old. Fruits are yellow green, small, sub – globose, round, 3.5 cm in diameter with solitary seed.

Phenology and Reproductive biology

The palm is monocarpic, that is, it flowers and fruits once its life, on attaining maturity it dies. The flowers are bisexual. Flowering takes place from November to January. Flowering appears at the apex of the tree above the crown of the leaves. Meanwhile the leaves commence to wither and droop. After the fruits ripen and fall, the tree dies and the spadix eventually falls over and decays.

In May 2018, a wide spread occurrence of flowering talipots was found in their hotspots. Gregarious flowering of around 50 talipots in avenue at keezhkuvalaivedu village along Arani-Vandavasi road commenced flowering and remained in blossom until the end of the year. They began to set fruits in April, 2019. Later the fruits ripened towards the end of the year. At the same time, synchronized flowering was also observed in scattered talipots at Madurai, Pudukottai, Tanjore to Tiruvarur area and Tanjore to Pattukottai area. They retained with fruits more than a year.

The seed is disseminated by the agency of birds, squirrels, monkey and by the action of rain, which washes it towards other sites. Natural seedling appears in great profusion, gregarious flowering being sufficient to ensure natural reproduction in abundance owing to large quantity of seed produced.



Fig 2. Talipot palm Hotspot at Keezhkuvalaivedu Village





Effect of pre-treatments on seed germination of *Corypha umbraculifera*

The data was collected by observation and measurement. The effect of pre-sowing treatments was assessed periodically through germination and initial growth performance of the seedlings in the nursery. The germination was recorded everyday from the date of sowing seeds and continued till the last germination (days after seed sown). In this period; the number of species that germinate and the time required for germination for each treatment were recorded. Statistically, data were analyzed by using Microsoft Excel; it provides better accuracy.

Table 2. *Corypha umbraculifera* germination period and germination percentage under different treatments

Treatment	No. of germination	Germination period (days)		Germination percentage
		Start	Complete	
T1	21	35	80	21
T2	65	9	84	65
T3	42	15	76	42
T4	35	18	66	35



Fig 3. Seed germination and transplanted recruits at polybag

Economic Importance

The starchy pith is converted into flour, the leaves are used for thatching, building houses, umbrellas, mats and fans etc., The hard seeds are made into beads and buttons.

Conclusion

Overall, the study showed that the population status of *Corypha umbraquilifera* that has been threatened and faces extinction pressure in their natural habitat. Monocarpic flowering, habitat loss, more space occupancy and slow germination rate are the major reasons for decline of this palm. Nursery routines of these planting stocks for artificial regeneration are very important. Conservation of the species in natural habitat would be the best option to recover the species from near extinction. Restoration of *Corypha umbraquilifera* in to their natural habitat by nursery grown seedlings could be an adaptive strategy to compensate for the lack of natural regeneration.

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