

STATUS OF PALM TREE AND GROWTH PERFORMANCE OF PALMYRA PALM (*BORASSUS FLABELLIFER* L.) IN COASTAL REGION OF BANGLADESH

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Keywords: Palm, Palmyra palm, *Borassus flabellifer* L., Biodiversity

Abstract

This study assessed the biodiversity status of palm species and evaluated the multiplication performance of palmyra palm (*Borassus flabellifer* L.) in Dumki Upazila, Patuakhali, Bangladesh. To evaluate palm fruit biodiversity, a structured questionnaire survey was conducted across five unions: Sreerampur, Angaria, Labukhali, Pangasia, and Muradia. The results demonstrated that betel nut was the most dominant palm species (52%), followed by coconut (26%), palmyra palm (12.24%), and date palm (10%). The male-to-female ratio of palmyra palm was 1 : 1.4. 89.83% female plants produced fruits seasonally, whereas 10.17% throughout the year. To evaluate multiplication performance of palmyra palm, five different growing media were utilized. The highest seedling height (115.10 cm), number of palmate leaves (6.80), and total leaves (7.80) were observed in growing media T1 (100% red sand), while the maximum base girth (23.50 cm) was recorded in T4 (50% cow dung + 50% soil). Overall, red sand demonstrated the best performance in seedling growth parameters, indicating its suitability as the most effective growing medium for palmyra palm propagation. The findings of this study highlight the potential for improving palm biodiversity conservation and enhancing nursery propagation of palmyra palm in coastal region of Bangladesh.

Introduction

Palm belongs to Arecaceae are widely distributed across tropical and subtropical regions of the world, comprising approximately 2,600 species (Yao *et al.* 2023). In Bangladesh, the most common types of palm trees are the date palm (*Phoenix sylvestris*), betel nut (*Areca catechu*), coconut (*Cocos nucifera*), and palmyra palm (*Borassus flabellifer*) (Rana *et al.* 2009). The date palm is known as "Khejur" in Bangladesh, whose fruit pulp exhibits notable antinociceptive, antioxidant, and antihyperglycemic properties (Shajib *et al.* 2023, Mazumder *et al.* 2024). Betel nut is a widely chewed stimulant that contains diverse bioactive alkaloids, polyphenols, and polysaccharides that exert significant pharmacological effects. (Peng *et al.* 2015, Liu and Chang 2023). Coconut is cultivated in more than 92 tropical countries and provides copra, coconut oil, coconut water, coir, and timber that collectively support the livelihoods of millions of farmers and multiple industries worldwide (Beveridge *et al.* 2022, Henrietta *et al.* 2022).

The palmyra palm commonly known as "Taal" grows sporadically throughout Bangladesh (Rana *et al.* 2009). Among these species, the palmyra palm represents a significant area of economic potential (Gnanavelrajah *et al.* 2025, Mahilrajah *et al.* 2025). The palmyra palm is a well-known multipurpose tree, as every part of it is useful in various ways. It has food, construction, handicrafts, and medicinal value (Shanta *et al.* 2021, Prasad *et al.* 2022). The leaves are widely used for preparing crafts. The woody trunk is in high demand for house construction. The fruit is rich in vitamins, sugars, antioxidants and several bioactive compounds with pharmacological properties (Prasad *et al.* 2022, Mahilrajah *et al.* 2025). The roots are traditionally

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used as diuretics and anti-parasitic agents, and for the treatment of respiratory and gastric disorders, while fibers obtained from the fruit are utilized in textile and paper industries as alternatives to synthetic materials (Rajeshwari *et al.* 2024, Rahman *et al.* 2024).

The palmyra palm is a long-lived species, with a lifespan of up to 100 years (Subramanian *et al.* 2024). As the coastal areas of Bangladesh become increasingly vulnerable to natural calamities, the popularity of the palmyra palm is growing in these regions. However, the abundance of palmyra palms is gradually declining due to climate change and environmental stresses. It is becoming more vulnerable as it frequently attracts lightning strikes. Households in Dumki Upazila were once enriched with a significant number of palmyra palms (Rahman *et al.* 2023), but their dominance in this area is declining rapidly. Although many researchers have studied plant biodiversity in Dumki Upazila, but no specific research has been conducted on assessing the biodiversity of the palmyra palm.

Therefore, the present study was conducted to assess the biodiversity status of major palm species, including palmyra palm, coconut, betel nut, and date palm, in Dumki Upazila. The research further aimed to determine the male-to-female ratio and fruit-bearing behavior of palmyra palm, as well as to evaluate its propagation performance under different growing media. The study is expected to generate valuable information that may contribute to the conservation, sustainable utilization, and nursery-level propagation of palm species in the coastal regions of Bangladesh.

Materials and Methods

The biodiversity assessment was carried out in Dumki Upazila (Agro-Ecological Zone, AEZ-13), Patuakhali, Bangladesh. The geographical location is 22°26' north latitude, 90°22' east longitude and 3 m altitude. The evaluation of the multiplication performance of palmyra palm in different growing media was conducted at the Germplasm Center, Patuakhali Science and Technology University. The study was conducted from August 2024 to September 2025. To assess the biodiversity status of palm tree, a survey was conducted. Twenty homesteads from each union were selected for the survey. A structured questionnaire was prepared for data collection to fulfill the objectives of the experiment. During the survey, parameters such as the relative prevalence of different palm tree, male-female ratio, fruit-bearing habit of palmyra palm, species richness (SR), and dominance rank (DR) of palm tree in homesteads were observed.

200 ripe fruits were collected from the local market to determine the best growing media for the multiplication of palmyra palm. Five seedbeds were prepared with different growing media, i.e., T1 (100% red sand), T2 (100% viti sand), T3 (100% soil), T4 (50% cow dung + 50% soil), and T5 (50% cow dung + 50% sand). A total of 125 seeds were planted in the five beds.

The single-factor experiment was laid out in a Completely Randomized Design (CRD) with five treatments and five replications. Data were collected from the total population of 125 seedlings, using five seedlings from each treatment as working samples. For evaluation, several parameters including germination percentage, number of non-palmate and palmate leaves, total number of leaves, length and width of the longest leaf, base girth, and seedling height were measured. A seedling with at least one non-palmate leaf and a minimum shoot length of 20 cm was considered as successfully germinated (Fig. 1). Analysis of variance (ANOVA) was performed using R software (version 4.6.0). Mean differences among treatments were calculated using Tukey's Honestly Significant Difference (HSD) post hoc test. An inferential statistical approach was used for the analysis of multiplication data.

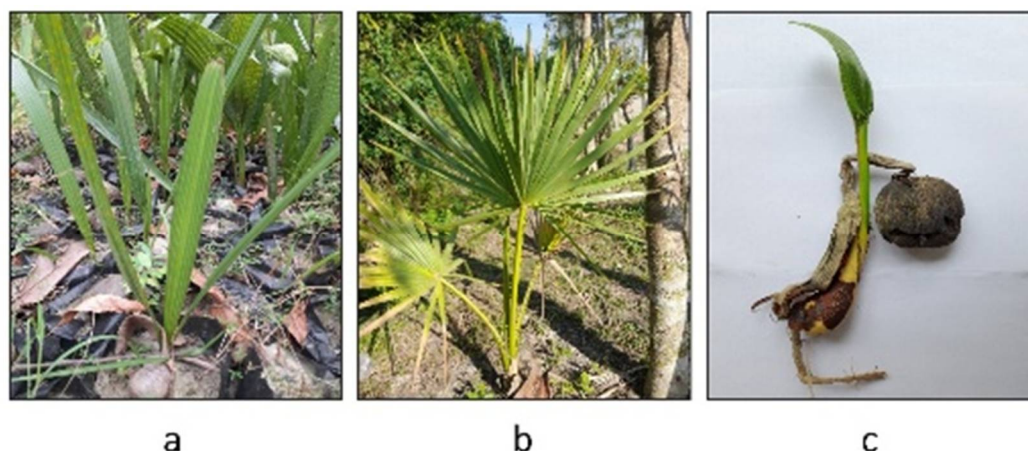


Fig. 1. Characteristics of palmyra palm. a: non-palmate leaves, b: palmate leaves, c: germinated seedling.

Results and Discussion

Households comprised the highest quantity of betel nut (52%), followed by coconut (26%), palmyra palm (12.24%), and date palm (10%) (Table 1). Similar findings were reported by Rana *et al.* (2010) in the Feni district of Bangladesh. The higher prevalence of betel nut may be associated with its small canopy, favorable market value, and low management requirements (Nandi *et al.* 2019). Coconut ranked second due to favorable soil, climatic conditions, and its high local demand (Bakewell-Stone 2025). In contrast, the abundance of palmyra palm appears to be declining compared to previous observations, possibly due to climatic hazards and anthropogenic pressures (Sarker *et al.* 2014, Rummy 2019).

Table 1. Species richness of palm tree at five unions of Dumki upazila.

Name of unions	Palmyra palm				Coconut	Betel nut	Date palm	Total (%)
	Male	Female	Year round	Total				
Sreerampur	56	96	15	167	192	348	114	821 (15.27)
Angaria	51	69	3	123	277	817	93	1310 (24.3)
Labukhali	86	80	13	179	196	373	179	927 (17.24)
Pangasia	29	34	4	67	343	433	74	917 (17)
Muradia	50	69	3	122	391	798	89	1400 (26)
Total	272	348	38	658	1399	2769	549	5375
%	-	-	-	12.24	26.00	52.00	10.00	100

The relative proportion of female palmyra palms was 59%, while male palms accounted for 41%. Among the female plants, 6% exhibited year-round fruit-bearing habits. Out of a total of 658 plants, 272 were male and 386 were female, resulting in a male-to-female ratio of 1 : 1.4 (Table 1). Similar sex ratios have previously been reported in palmyra palm populations (Siju and Sabu 2020). The higher proportion of female plants may be associated with their greater economic value, as female palms produce fruits that are widely consumed and commercially important in the study area.

All homesteads in the study area hosted palm fruits (Table 1). The highest number of palm tree fruits was recorded in Muradia Union (26%), while the lowest was in Sreerampur Union (15.27%). Muradia Union is bordered on three sides by a flowing river. Residents in this area were

more inclined to plant trees, particularly palm species, to protect their homesteads and farmlands from river erosion. Additionally, the remote nature of this union, along with its low population density and limited infrastructure, contributed to its high species richness. Conversely, Sreerampur Union was the most densely populated, with numerous houses, institutions, and other infrastructure developments. This high density reduced space for tree planting, resulting in the lowest species richness among the unions. The dominance ranking of palm species followed the order: betel nut > coconut > palmyra palm > date palm in most unions (Table 2). Similar trends were previously reported by Sarker *et al.* (2014). The moisture-rich, fertile soil and prevalence of gentle breezes supported the strong dominance of coconut. On the other hand, juice production from date palms was low due to mild winters and extended periods of foggy weather (Jackson *et al.* 2024). As a result, local farmers were less inclined to plant more date palms. These factors contributed to the lower dominance rank of date palm in the upazila.

Table 2. Dominance rank of palm fruits at five unions of Dumki upazila.

Palm species	Union					Average position
	Sreerampur	Angaria	Labukhali	Pangasia	Muradia	
Palmyra palm	3	3	3	4	3	3.2
Coconut	2	2	2	2	2	2.0
Betel nut	1	1	1	1	1	1.0
Date palm	4	4	4	3	4	3.8

In the propagation of palmyra palm, all treatments showed comparable effects (92-100%) on seed germination at 60 days after sowing (Table 3), with no significant variation ($p > 0.05$). The seeds germinated well in all types of soil with minimal care. Treatments were statistically non-significant ($p > 0.05$) in terms of non-palmate leaf development (Table 3). Consequently, seedlings in all treatments produced nearly equal numbers of non-palmate leaves. Significant variation ($p \leq 0.01$) was also observed among treatments in total leaf production (Table 3). The highest value was recorded in T1 (7.80), while the lowest in T5 (4.60). A similar finding was reported by Immanuel and Sudhagar (2021). Treatments showed no significant differences ($p > 0.05$) in the length of the longest leaves. However, significant variation ($p \leq 0.05$) was observed in leaf width (Table 4). The maximum width was recorded in T1 (95.08 cm), followed by T5 (78.20 cm), T4 (76.06 cm), and T2 (75.82 cm), whereas the lowest width was observed in T3 (65.26 cm). As palmate leaves were broader, treatments with a higher number of palmate leaves exhibited greater leaf width. Significant variation ($p \leq 0.05$) was recorded among the treatments for base girth (Table 4). Treatments T1, T2, T4, and T5 were statistically non-significant among themselves, with base girth values of 22.30, 21.02, 23.50, and 21.70 cm, whereas the lowest base girth was observed in T3 (15.58 cm). Significant variation ($p \leq 0.01$) was also observed in seedling height across the five treatments (Table 4). The highest plant height was recorded in T1 (115.10 cm), while the lowest in T3 (84.98 cm). Heights of 98.28, 92.54, and 88.08 cm were recorded in T2, T4, and T5 respectively. Red sand likely created a congenial microenvironment in the rhizosphere zone, promoting seedling growth. Although palmyra palm adapts well to various soil types (Subramanian *et al.* 2024), sandy soil provided the most favorable conditions.

Table 3. Germination percentage, number of non-palmate, palmate and total leaves of palmyra palm grown in different growing media at 330 days after sowing.

Treatments	Germination percentage (60 DAS)	Number of non- palmate leaves	Total number of leaves
T ₁	100	1.00	7.80a
T ₂	100	0.60	6.80ab
T ₃	92	0.00	5.20ab
T ₄	100	0.60	6.80ab
T ₅	100	0.20	4.60b
Level of sig.	NS	NS	**
CV (%)	-	-	09.63

Means in a column followed by the same letter (s) do not differ significantly. NS: Non-significant, **: Significant at 1% level, * : Significant at 5% level.

Table 4. Characteristics of palmyra palm in different growing media at 330 days after sowing.

Treatments	Length of longest leaves (cm)	Width of longest leaves (cm)	Base girth (cm)	Seedling height (cm)
T ₁	52.86	95.08a	22.30a	115.10a
T ₂	43.68	75.82ab	21.02a	98.28ab
T ₃	46.24	65.26b	15.58b	84.98b
T ₄	43.90	76.06ab	23.50a	92.54ab
T ₅	44.92	78.20ab	21.70a	88.08b
Level of sig.	NS	*	*	**
CV (%)	-	10.23	14.49	11.88

Abbreviations are similar as Table 3.

The findings of the study revealed that among palm species in Dumki Upazila, betel nut was the most prevalent, followed by coconut, palmyra palm, and date palm. A higher proportion of female palmyra palms was observed, with the majority bearing fruits seasonally. Among the tested growing media, 100% red sand (T₁) demonstrated as the best.

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