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## Matting rush (*Schoenoplectus lacustris* (Linn.) Palla): Status, utility, threat, cultivation and conservation options in Manipur

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Nestled in a small valley among the hills of the eastern Himalayas with nature's pristine glory, Manipur's mythological concept of creation is revealed in her famous handicraft items. Matting/water rush or club rush (*Schoenoplectus lacustris* (Linn.) Palla, syn. *Scirpus lacustris* Linn., an aquatic terete herb belonging to the family Cyperaceae, locally called 'Kouna' in Manipuri, is closely associated with the tradition of the Meitei community of Manipur and is used in making a variety of handicrafts items ranging from ladies' bag to chappal, hat, floor mat, cushion, chair, etc. This aquatic plant is generally cultivated in the wetlands of Manipur valley, c. 800 msl, and is a good source of income. The plant is harvested thrice a year (May–June, September–October and December–January) and can be continued up to 15 years. The productivity of the rush is about  $14.4 \times 10^5$  tillers/ha/yr, which weighs 43,200 kg in fresh weight. A farmer having a cultivable land of 1 ha can earn an annual income of Rs 252,000. Currently, around 1200 ha of land in Manipur is under Kouna cul-

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tivation, which generates a sum of more than Rs 30 crores annually. It has been estimated that more than Rs 250 crores can be generated from matting rush, if cultivated in other potential areas of the state.

**Keywords:** Economy, handicraft items, matting rush, *Schoenoplectus lacustris*, wetland.

OUT of the 200 species of *Schoenoplectus* in the world<sup>1</sup> and 25 species in India<sup>2</sup>, two species, viz. *S. lacustris* (Linn.) Palla and *S. mucronatus* (Linn.) Palla are found in Manipur<sup>3</sup>. Matting/water rush or club-rush (*Schoenoplectus lacustris* (Linn.) Palla, syn. *Scirpus lacustris* Linn.), belonging to the family Cyperaceae and locally called as 'Kouna' in Manipuri, is a perennial, rooted aquatic plant commonly grown in the wetlands of the valley areas of Manipur at an altitude of 800 msl (Figure 1). It is distributed in Europe, Africa, Australia and North America<sup>4</sup>. In India, the plant has been reported in Kashmir and Ladakh, Kumaon and Muneypoor (present Manipur)<sup>4</sup>. The plant attains a height of 2.5 m with numerous dark green, cylindrical, soft spongy, glabrous stems arising from an underground stalk with tough fibrous roots (Figure 2). Mat-making from rush is indigenous to Manipur and is closely associated with the legendary divine snake god 'Pakhangba'. Thus the field where it grows is to be always kept free from filthy waste. Harvesting the plant on Friday is avoided, with the belief that the plant will die or evil consequences will befall the harvester. Hence the plant is also called 'Lady of Friday' ('Irai-Leima').



**Figure 1.** Satellite imagery map of Manipur showing matting/water rush (*Schoenoplectus lacustris*) growing localities<sup>8</sup>.

Floor mat made from matting rush locally called as 'Kouna-phak' is kept spread on the right portion of the verandah of every house of the Meitei community during daytime and rolled up at night. Besides, in every social or other gatherings, the mat is used to sit on.

Nestled in a valley among the hills of eastern Himalayas, far above the sea level with nature's pristine glory, Manipur's mythological concept of creation is revealed in her famous folk dances and crafts<sup>5</sup>. Cane and bamboo furniture and other plant products are an integral part of the people of Manipur because of their multipurpose uses, aesthetic appeal and association with legends<sup>6</sup>. Although in Manipur, matting rush was used only for making floor mats, now-a-days its use is extended to furniture, decorative items, ladies' bag, shoes, hat, electric bulb reflector, etc. (Table 1). The raw materials required for making various items and its use and durability as provided by craftsmen and user groups are presented in Table 1. Weaving is done in different artistic designs. Products of matting rush like ladies' bag (Figure 3 a), chappal (Figure 3 b), hat (Figure 3 c), electric bulb stand (Figure 3 d), dining table mat (Figure 3 e), floor mat (Figure 3 f), round cushion (Figure 3 g), cylindrical cushion (Figure 3 h) and chair (Figure 3 i) are in great demand both locally as well as in other parts of India and fetch high price (Table 1). Products made of rush are highly valued, durable and have great aesthetic appeal. A wood varnish can be applied on the finished products to enhance the shining, beauty, durability and waterproofing. Moreover, being organic products, they are eco-friendly. Many of the rush products are also exported to USA, UK, France, Germany, Australia, Malaysia, Singapore, etc. through Delhi and Kolkata<sup>7</sup>. Children eat the tender shoot which tastes slightly bitter. Matting rush can be described as 'golden water grass' due to its multifarious uses and characteristics like being a bad conductor, sponginess, flexibility, resistance to pests and insects, moisture, etc. There is a belief that sitting on the floor mat or stool (moora) made of matting rush can cure piles. The importance of this plant as a raw material



**Figure 2.** Habitat of rush.





**Figure 3.** Products made using rush. *a*, Ladies' bag; *b*, Chappal; *c*, Hat; *d*, Electric lamp stand; *e*, Dining table mat; *f*, Floor mat; *g*, Round cushion; *h*, Cylindrical cushion and *i*, Chair.

for handicrafts is increasing, as products or articles made from it are in great demand throughout the world. On the other hand, land use/cover change due to increase in human population growth has directed the earlier habitats of this

valuable herb to other purposes like paddy cultivation, human habitation, etc.

The plant thrives well in clay soil. It is generally propagated through slips. About 40,000 slips are required for

cultivation of 1 ha land. Trial to grow the plant from seed showed  $19 \pm 8\%$  success while success rate through slip cultivation showed  $86 \pm 9\%$ . The most suitable period for cultivation is during April–May with the arrival of the first monsoon showers. During the time of transplantation, the level of water should be maintained between 10 and 15 cm. After two weeks of transplantation, the level of the water can be raised gradually. A water body or pond with a depth of 1 ft is most suitable for cultivation. If the water body is deeper, the plant will be thicker and taller, which is not suitable for making good quality articles. The plot for plantation has to be ploughed thrice in a criss-cross pattern, followed by levelling. As soon as the area receives the first monsoon showers, the field has to be ploughed. While tilling the land, fertilizer is to be added depending upon the fertility of the soil. Generally<sup>7</sup>, 200 kg nitrogen, 150 kg phosphorus and 100 kg potash is applied in an area of 1 ha. Transplantation can be done in an interval of 0.5 m space. After two years of transplantation, harvesting can be started and can continue up to 15 years. Regular weeding is necessary for healthy growth of the plant. The rush can be harvested every four months. Thus it can be harvested thrice a year as: (i) Summer rush – harvested during May–June and locally called as ‘Kalen-kouna’, (ii) Autumn rush – harvested during September–October and locally called as ‘Cheirak-kouna’, and (iii) Winter rush – harvested during December–January and locally called as ‘Ningtham-kouna’

(Table 2). Autumn rush is the most productive and durable. After 5–6 years of harvesting, application of certain fertilizers is necessary depending upon the fertility of the soil. If the crop is infected by fungus, Dithane M-45 can be applied<sup>7</sup>. The rush is cut near the base keeping behind 2–4 in of the stump. The harvested tillers are heaped in shady areas for two to three days. Then they are dried in the sun for about 10–15 days till a yellowish colour develops. The dried tillers are tied in bundles and placed in scaffolds for preservation. The best way to preserve the rush is to smoke it, which can be done inside a closed room with wood firing. To protect it from insects, a solution of Bordeaux mixture (2–3%) can be sprayed. The rush is sold in dry form in bundles of about 24" diameter. A bundle has about 350 tillers and costs about sixty rupees in the local market.

According to an estimate based on representative sampling quadrats, at present about 1200 ha of land is under matting rush cultivation and another 10,000 ha of wetlands has the potential for rush cultivation in Manipur (Table 2). Most of the matting rush is produced from Thoubal and Bishnupur districts of Manipur. The Khangabok and Nongpok Sekmai villages account for the largest share of production. ‘Kouna’ grown in Nongpok Sekmai village is regarded as the best in Manipur. It has been estimated based on the productivity and price of raw materials that an income of Rs 252,000 can be earned annually from rush in 1 ha of land. If properly and extensively cultivated in Manipur valley,

**Table 1.** Uses, durability and market price of various matting rush products in Manipur

Item	No. of tillers required per item	Durability (year)	Market price (Rs per item)
Bottle holder	8–10	2–3	40
Box (small circular)	6–8	3–4	25
Bucket cover (rounded)	15–18	3–4	34
Chair (with cane frame)	180–200	5–6	1500
Cushion (rounded)	80–85	6–7	120
Cushion (rectangular)	75–80	6–7	100
Cushion (cylindrical)	120–130	6–7	250
Dining table mat	15–18	2–3	18
Door screen	120–150	3–4	200
File cover (folder)	35–40	3–4	38
Flower vase	8–10	5–6	40
Hand fan	8–10	1–2	25
Hat (cap)	10–12	5–6	50
Ladies' bag	30–35	3–4	140
Floor mat (16" × 28")	100–120	6–7	45
Floor mat (35" × 70")	160–180	6–7	300
Floor mat (25" × 300")	900–1000	10–12	850
Floor mat (cushion type)	450–500	7–8	600
Open shoe (chappal)	6–8	1–2	88
Pen stand	3–5	7–8	30
Refrigerator top cover	40–45	6–7	200
Stool (moora)	90–100	3–5	180
Table lamp	20–25	4–5	300
Tea coaster	8–10	3–4	30
Waist belt	8–10	1–2	100
Wall-hanging box	40–45	5–6	80
Window screen	60–80	4–5	120

**Table 2.** Morphological characteristics, cultivation and productivity of matting rush in Manipur

Matting rush growing areas (ha)	1200
Potential area of rush cultivation (ha)	10,000
Average cultivation density (tillers m <sup>-2</sup> )	55
Plant height (m)	1.3–3.0
Average weight per tiller in fresh weight (g)	30
Average weight per tiller in dry weight (g)	12
Moisture content (%)	60
Stem diameter of tiller (cm)	0.5–2.5
Productivity in fresh weight (kg m <sup>-2</sup> )	10.5–13.5
Harvesting frequency (times per year)	3
Harvesting period	
Summer rush	May–June
Autumn rush	September–October
Winter rush	December–January
Productivity (tillers ha <sup>-1</sup> )	
Summer harvesting	$6.5 \times 10^5$
Autumn harvesting	$5.0 \times 10^5$
Winter harvesting	$3.2 \times 10^5$
Productivity (tillers ha <sup>-1</sup> yr <sup>-1</sup> )	$14.7 \times 10^5$
Income from raw rush (Rs ha <sup>-1</sup> yr <sup>-1</sup> )	252,000
Total income in Manipur (Rs yr <sup>-1</sup> )	$3024 \times 10^5$
Fertilizers recommended for cultivation (kg ha <sup>-1</sup> yr <sup>-1</sup> )	
Nitrogen	200
Phosphorus	150
Potash	100



the production can be increased eightfold (considering 10,000 ha potential land), which is estimated to generate more than Rs 250 crores per year (Table 2). Along with the rush cultivation, other suitable programmes like fish farming, duck farming, cultivation of other wetland edible plants like *Neptunia oleracea*, *Colocasia cuculata*, etc. can be taken up. Cultivation of matting rush is a high income earning agro-practice. Cultivation and promotion of matting rush not only boost the economy and enhance employment opportunity, but also help in the conservation of wetlands.

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## Use of timber in shipbuilding industry: Identification and analysis of timber from shipwrecks off Goa coast, India

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**The use of timber in the boat-building or shipbuilding industry is as old as the construction of boats and ships. Various kinds of timber are used in different regions of India in the construction of vessels. The**

***Yuktikalpataru* (the wishing tree of artifice) composed by the king Bhoja of Dhar (11th century AD) gives a detailed account of boats, ships and the variety of wood used for construction and classification of ships. Further, the text also mentions the quality of timber that is required for construction of seagoing ships, which could resist the action of waves, currents and marine biofouling; above all, it would bring joy and wealth. In order to locate the remains of ships, cargo and their history, maritime archaeological explorations were carried out off Goa, which brought to light timber from the century-old shipwreck off St George's Reef and an iron anchor with a wooden stock 300 years old from Aguada waters. Radiocarbon dating and anatomical analysis of these two timbers were obtained to understand their age and to know the tree species. This communication details the anatomical analysis of timber and associated findings from the sites. Their tentative dates are ascribed to the findings in relation to the maritime history of the Goa region along the central west coast of India. Additionally, the study put forth the view that Indian teak was extensively used by Indian and foreign shipbuilders because of its high quality.**

**Keywords:** Aguada Bay, iron anchor, shipwreck, St George's reef, timber.

INDIAN texts and archival records mention that seaworthy vessels of various types were built in India for overseas trade, commerce and naval warfare. Before the use of steel in the shipbuilding industry, timber was used extensively for construction of boats and ships. Panini (5th century BC) has mentioned that a large quantity of timber was used in construction of different parts of a ship<sup>1</sup>. India has a long maritime history, but there is a very little information available on the number of ships built, their purpose, history and other details. A number of ships are also known to have sunk due to various causes in Indian waters in the course of their voyages<sup>2</sup>. In view of this, maritime archaeological explorations were initiated in Goa waters in 1989 with the objective to explore and study the remains of shipwrecks, causes of shipwrecks, their period and provenance. Historical documents and archival records indicate that there were several wrecks off Goa, causes attributed to natural calamities like cyclone, collision against submerged rocks, reefs, sandbars, human errors and naval warfare<sup>3</sup>. Over the years, explorations have been carried out in Sunchi Reef, St George's Reef, Baga and Aguada waters along the Goa coast<sup>4,5</sup>. The explorations off Sunchi Reef yielded the remains of the Portuguese shipwreck datable to the early 17th century AD. Similarly, a century old shipwreck belonging to the Basel Mission Company has been explored off St George's Reef. An Admiralty Long Shank type of iron anchor with wooden stock of the Portuguese period datable to the 16–17th centuries AD was retrieved from Aguada waters and from the north of Aguada, a pyramidal type of stone anchor was found off Baga waters (Figure 1). The study shows that ships could have wrecked off

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