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ALL INDIA COORDINATED PROJECT ON THE TAXONOMY OF PALMS

C. Renuka
(Forest Ecology & Biodiversity Conservation)

Kerala Forest Research Institute
An Institution of Kerala State Council for Science, Technology and Environment
Peechi - 680 653, Kerala, India

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Project proposal

Project No.	: KFRI 359/00
Title	: All India Coordinated Project on the Taxonomy of Palms
Coordinator Collaborators	Dr. C. Renuka 1. Dr. K Haridasan, SFRI - Arunachal Pradesh (Upto April 2004) 2. Dr. S. N. Ramaswamy, Dept of studies in Botany, University of Mysore (Upto April 2005) 3. Dr. P.K. Padmakumar, NSS College, Vazhoor, Kerala (Upto April 2004)
Objectives	➢ Survey, collection, identification and preservation. ➢ Maintain collections and taxonomic database. ➢ Develop identification manuals. ➢ Train college teachers and students and local communities in parataxonomy.
Duration	April 2000-March 2011
Funding Agency	Ministry of Environment and Forests, Government of India

Contents

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Abstract

Palms, belonging to the family Palmae (Arecaceae) are one of the multiuse monocots, occurring mostly in the tropical regions of the world. About 190 genera and 2364 species are currently recognized in the world. They form a vital component of the forest and agricultural ecosystems providing a wide range of economic products necessary for daily life. In India the family is represented with 22 genera and 106 species and are of restricted distribution in three major geographical regions viz: Peninsular India, North and North Eastern India and Andaman & Nicobar islands. Out of the five subfamilies of Arecaceae, India is represented by four, Calamoideae, Nypoideae, Coryphoideae, and Arecoideae. The largest genus, *Calamus* with 47 species is followed by *Phoenix* with eight species and *Daemonorops* with six species. The rest are with five or less than five species.

Most of Indian palms exhibit highly restricted distribution to ecological niches within biogeographic regions where they exist. Out of 106 species, about 43 species are endemic. Palm populations in the wild are decreasing. Genera like *Borassus, Calamus, Corypha* etc., are threatened because of their constant and increasing utilization. Overexploitation is one of the major threats to the survival of many wild palm species. Some inherent characteristics of palms such a monocarpic flowering, poor germination of seeds and poor establishment of seedlings etc. have also contributed to retard natural regeneration of palm population.

Conservation and sustainable utilization of this resource assumes great importance in the context when forest wealth of the country as a hole has been on the decline. In the absence of concrete efforts towards their replenishment, some of these wild palms are likely to face the threat of extinction.

In this report taxonomic account of all the 106 species along with distributional phonological and utilization aspects are given.

INTRODUCTION

Palms are one of the multi-use monocots confined to tropical regions of the world. They form, in some way or other, a vital component in every day lives of people, especially in Asia and Africa. The aesthetic value of palms is no less important than their traditional and commercial values, and hence there is a rapidly growing horticultural trade in palms world–wide.

Govaerts and Dransfield (2005) published a checklist of palms with 190 genera and 2364 species. The number is changing rapidly as taxonomic studies are progressing in this family (Dransfield *et al.*, 2005). Recently a new genus *Dransfieldia* was published by Baker *et al.* (2006).

In India the family is represented with 22 genera (including the widely cultivated palms *Elaeis guineensis* and 106 species. The largest genus, *Calamus* with 47 species is followed by *Phoenix* with eight species and *Daemonorops* with six species. The rest are with five or less than five species. The genera *Borassus, Salaca, Livistona, Nannorrops, Nypa, Hyphaene,* and *Rhopaloblaste* are represented by a single species each. In addition to the indigenous species of palms, several exotic palms have become naturalized as cultivated ornamentals.

Introduction and cultivation of exotic palms in India began in the early 18th C when Arabian date palm (*Phoenix dectylifera*) was brought for cultivation. Cultivation of indigenous and exotic palms on a scientific basis was started after the establishment of East India Company's Garden in Bengal in the year 1787, when Malayan Sago palm (*Metroxylon sagu*) was introduced to India. Later on several palms like Indonesian sugar palm (*Arenga pinnata*), African oil palm (*Elaeis guineensis*) South

American oil yielding Babasunut palm (*Orbignya cohune*) were also introduced. Several exotic species have since been introduced and many of them are cultivated at present as ornamental plants in the gardens. Three introduced palms cultivated extensively in India as cash crops are coconut (*Cocos nucifera*), arecanut (*Areca catechu*) and African oil palm (*Elaeis guineensis*). *Cocos nucifera* and *Areca catechu* are seen in the natural forest of certain islands in Andaman and Nicobar.

Palm Literature

The earliest record of Indian palms appeared in *Hortus Malabaricus* (Van Rheede, 1678). He described 9 palms with figures. Martius (1832-1853) in his *Historia Naturalis Palmarum* described 15 Indian species. Griffith published *Palms of British East India* in 1850. This was followed by Beccari's (1906-1918, 1931) monographic series. Blatter published *Palms of British India and Ceylon* in 1926. After this not much taxonomic work was carried out in this group till 1982 when Kerala Forest Research Institute initiated studies on rattans (Renuka *et al.*,1987) after which considerable amount of work was carried out on the taxonomy of Indian rattans. The important publications were Basu (1992), Lakshmana (1993), Renuka (1992, 1995, 1999), and Renuka *et al* (2010). Several scientific papers on taxonomy on rattans were published during this period (Anto *et al.*, 2001, Joemon *et al.*, 2008, Renuka, 2001, Renuka *et al.*, 2003, Sreekumar, 2005 and Sreekumar *et al.*, 2006).

Classification

The family Arecaceae (Palmae) is divided into five subfamilies; Calamoideae, Nypoideae, Coryphoideae, Ceroxyloideae and Arecoideae (Dransfield, *et al.*, 2005). In India the family is represented by four subfamilies, Calamoideae, Nypoideae, Coryphoideae, and Arecoideae. Calamoideae and Nypoideae are very distinct subfamilies which can be

recognized very easily. All the species within the Calamoideae are charectrised by overlapping, reflexed scales on the fruit and spines on the plant parts. The subfamily Nypoideae contains a single genus *Nypa* with a single species *Nypa fruticans*. Here the female flowers are borne in a terminal head and the male flowers are crowded on spikes at the tip of inflorescence branches below the female flowers. The palms coming under Coryphoideae have palmate or costapalmate leaves except *Phoenix* which has pinnate leaves. In *Phoenix* lowermost leaflets are modified into spines. The palms coming under Arecoideae have pinnate or bipinnate leaves.

Distribution

Except *Phoenix sylvestris, Caryota urens* and *Borassus flabellfer* which are wide spread in India, palms are of restricted distribution in three major geographical regions viz: Peninsular India, North and North Eastern India and Andaman & Nicobar islands. Palms occupy a diversity of habitats at different altitudes, and show a strong predilection for wet habitats. *Nypa fruticans* and *Phoenix paludosa* are fringe mangrove species occurring in salt marshes of Sundarbans and Andaman and Nicobar islands. *Hyphaene dichotoma* is restricted to the coastal area opposite Nagaon, Shergaon, Daman and Diu.

Majority of the palms are shade loving. A few like *Borassus flabellfer, Phoenix sylvestris, Bentinckia condapanna* etc., grow fully exposed to sunlight. Most of the species are found below 1000 m altitude. Certain species of *Calamus, Trachycarpus takil* and *Bentinckia condapanna* grow above 1300 m. *T. takil* is the only Indian species growing in temperate conditions.

Peninsular India

Peninsular India is represented with 9 indigenous genera and three widely cultivated species (*Areca catechu, Cocos nucifera* and *Elaeis guineensis).* Altogether there are 38 species. Most of the genera are represented with one species with the exception of *Calamus* and *Phoenix. Calamus*, the only rattan genus in Peninsular India is represented with 24 species and *Phoenix* with three species (Table 1).

In Peninsular India palms are distributed along the Western Ghats and the Eastern Ghats. The Western Ghats are a mountain range running parallel to the Arabian Sea coast and range over a distance of approximately 1600 km, from the river Thapti in Gujarat in the north to Kanyakumari in the south. From the narrow coastal plain, historically known as the Malabar coast, the mountains rise steeply to an elevation of about 1000 m. The highest peak is at 2695 m. These mountain ridges are continuous from north to south except the 30 km wide gap at Palakkad region in Kerala. The western slope of the Western Ghats receive both south west and north east monsoons. The mean annual rain fall is 2693 mm. Since the western part is facing the Arabian sea, the south west monsoon is more active and accounts for 60% of the annual rain fall on an average. Because of this rainfall, the western slope have good tropical rain forests running along their windward slopes. The region is considered as one of the world's biodiversity hot spots. Palms are frequent along the western slope of the Western Ghats in the evergreen and semi evergreen patches. They are occasionally seen in the moist deciduous forests also. Most of the palms of the Western Ghats occur in the southern part, from Goa southwards and majority are endemic to the region.

The Eastern Ghats run along the coast of the Bay of Bengal, historically known as the Coromandel coast, extend over a range of approximately

Table 1. Distribution of palms in Peninsular India

Sl. No.	Species Name	Kerala	Karnataka	Tamil Nadu	Andhra pradesh	Maharashtra	Goa	Orissa	Status
1	*Areca catechu***	X	X	X	X	X			LC
2	*Areca triandra***	X	X	X	X				LC
3	*Arenga wightii**	X	X	X					LC
4	*Bentinckia condapanna**	X		X					V
5	*Borassus flabellifer*	X	X	X	X	X	X	X	LC
6	*Calamus brandisii**	X	-	X	-	-	-	-	E
7	*C. delessertianus**	X	X	X	-	-	-	-	V
8	*C. dransfieldii**	X	-	-	-	-	-	-	CR
9	*C. gamblei**	X	X	X	-	-	-	-	NT
10	*C. hookerianus**	X	-	X	-	-	-	-	LC
11	*C. karnatakensis**	X	X	-	-	-	-	-	NT
12	*C. lacciferus**	-	X	-	-	-	-	-	NT
13	*C. lakshmanae**	-	X	-	-	-	-	-	NT
14	*C. metzianus*	X	X	X	-	-	-	-	NT
15	*C. nagbettai**	X	X	-	-	-	-	-	V
16	*C. neelagiricus**	X	-	-	-	-	-	-	CR
17	*C. prasinus**	-	X	-	-	-	-	-	NT
18	*C. pseudofeanus**	-	-	X	-	-	-	-	NE
19	*C. pseudotenuis*	X	X	X	-	-	-	-	LC
20	*C. renukae**								NE
21	*C. rheedii**	X	X	-	-	-	-	-	NE
22	*C. rotang*	X	-	X	X	-	-	-	NT
23	*C. shendurunii**	X	-	-	-	-	-	-	V
24	*C. stoloniferus**	-	X	-	-	-	-	-	NT
25	*C. thwaitesii*	X	X	X	-	X	X	-	LC
26	*C. travancoricus**	X	-	X	-	-	-	-	NT
27	*C. vattayila**	X	X	X	-	-	-	-	E
28	*C. viminalis*	-	-	-	X	-	-	X	LC
29	*C. wightii**	-	X	X	-	-	-	-	CR

30	*Caryota urens*	X	X	X	X	X	X	X	LC
31	*Cocos nucifera* **	X	X	X	X	X	X	X	LC
32	*Corypha umbraculifera*	X	X	X				X	LC
33	*Elaeis guineensis***	X							-
34	*Hyphaene dichotoma**					X	X		NE
35	*Phoenix dactylifera*		X		X				LC
36	*Phoenix loureiroi*	X	X	X	X	X		X	LC
37	*Phoenix pusilla*	X		X					LC
38	*Pinanga dicksonii**	X	X	X		X			LC

**Endemic species* ** *Cultivated*
NE- Near threatened, E- endangered, NT- Near threatened, CR- Critically endangered, LC- Least Concern, V-Vulnerable

1750 km, from the state of Tamil Nadu in the south through Andhra Pradesh to Orissa in the north. Unlike the Western Ghats, the Eastern Ghats are broken into a series of hills and these seldom reach 1500 m elevation. The Eastern Ghats are drier than the Western Ghats and consequently have fewer palms.

Of the 38 species reported, 22 are endemic to the region. Three species are critically endangered (*Calamus dransfieldii*, *C. neelagiricus* and *C. wightii*), two endangered (*C. bradisii* and *C. vattayila*) and one species is possibly extinct (*C. rheedii*).

North and North eastern India

The forests of the Himalayan foothills and the forests of North eastern States of India are rich in palms. Seventeen genera and about 50 species were reported from this region (Table 2). There are more palm species in the eastern part of the Himalayan foothills than in the western part. Palms are conspicuous in the tropical moist deciduous forests in the plains and tropical evergreen to tropical semi evergreen forests in the mountain valleys. The most widespread palm genera are *Calamus, Daemonorops* and *Plectocomia.* The semi wild palms *Borassus flabellifer* and *Phoenix sylvestris* are also frequent in the plains.

Few palms are endemic to this region. *Pinanga griffithii* and *Wallichia nana* are confined to the northern part of the region. Henderson (2009) reports that these mountains provide a high elevation corridor so that several species from the northerly ranges of the Himalayan foothills occur farther to the south along these hills eg., *Caryota maxima* and *Wallichia disticha*..

Table 2. Distribution of palms in North and North eastern India.

Sl. No	Species Name	West Bengal	Sikkim	Meghalaya	Assam	Arunachal Pradesh	Nagaland	Manipur	Tripura	Uttar Pradesh	Bihar	Status
1	*Areca catechu*	X				X				X		-
2	*Areca triandra*											-
3	*Arenga micrantha*	X	X			X						E
4	*Arenga obsutifolia*					X						NE
5	*Arenga westerhoutii*					X		X				NE
6	*Borassus flabellifer*	X		X	X					X	X	LC
7	*Calamus acanthospathus*	X	X	X	X	X	X	-	-	-	-	DD
8	*C. erectus*	X	X	X	X	-	-	X	-	-	-	V
9	*C. flagellum*	X	X	X	X	X	-	-	-	-	-	EN
10	*C. floribundus*	-	-	X	X	X	-	-	-	-	-	DD
11	*C. gracilis*	-	-	X	X	-	-	-	-	-	-	NT
12	*C. guruba*	X	-	X	-	-	-	X	-	-	-	NT
13	*C. khasianus*	-	-	X	X	-	-	-	-	-	-	NT
14	*C. kingianus**	-	-	X	X	X	X	-	-	-	-	V
15	*C. latifolius*	X	X	X	X	X	X	X	-	-	-	DD
16	*C. leptospadix*	X	X	X	-	-	-	-	-	-	-	V
17	*C. meghalayensis*	-	-	-	-	X	-	-	-	-	-	V
18	*C. nambariensis**	-	-	X	X	-	X	X	X	X	-	LC
19	*C. tenuis*	X	-	-	-	-	-	X	X	-	X	LC
20	*C. viminalis*	X	X	X	X	X						V
21	*Caryota maxima*				X	X		X				V
22	*Caryota obtusa*			X			X			X	X	LC
23	*Caryota urens*	X									X	LC
24	*Cocos nucifera.*	X										Ex
25	*Corypha taliera*	X										NT
26	*Daemonorops jenkinsiana*	X	X	X	X	-	-	-	-	-	-	NT
27	*Licuala peltata*											NT
28	*Livistona jenkinsiana*					X	X	X				NT
29	*Nypa fruticans*	X										LC
30	*Phoenix acaulis*	X			X					X		NT
31	*Phoenix loureiroi*	X	X		X		X					LC
32	*Phoenix paludosa*	X										LC
33	*Phoenix rupicola*	X	X		X	X						NT
34	*Phoenix sylvestris*	X	X	X	X	X	X		X		X	LC

35	*Pinanga gracilis**			X	X	X	X	X				E
36	*Pinanga griffithii*			X	X	X						V
37	*Pinanga sylvestris*			X	X							V
38	*Plectocomia assamica*	-	-	-	X	X	-	-	-	-	-	V
39	*P. hilmalayana*	X	X	-	-	X	-	-	-	-	-	E
40	*Salacca secunda*				X	X	X					NE
41	*Trachycarpus fortunei*									X		NT
42	*T. latisectus*	X	X									CR
43	*T. martianus*			X			X	X				NT
44	*Trachycarpus takil*									X		V
45	*T. oreophilus*							X				E
46	*Wallichia caryotoides*					X			X			NT
47	*W. disticha*			X	X	X						E
48	*W.nana**			X	X	X						E
49	*W.oblongifolia*			X								NE
50	*W.triandra*	X	X		X	X		X	X			LC

**Endemic species ** Cultivated*

NE- Near threatened, E- endangered, NT- Near threatened, CR- Critically endangered, LC- Least Concern, V-Vulnerable

Of the species reported, four are endemic to the region. One species is critically endangered (*Trachycarpus latisectus*), seven are endangered (*Arenga micrantha, C. flagellum, Pinanga gracilis, P. himalayana, Trachycarpus oreophilus, Wallichia disticha* and *W. nana* and one species, *Corypha taliera* is possibly extinct.

Andaman and Nicobar islands

The Andaman and Nicobar islands represent, geologically, a continuation of the Arakan Yoma. They are a volcanic island chain stretching from north to south in the Bay of Bengal for approximately 800 km. A chain of about 350 islands, it runs almost parallel to the Malay Peninsula. Due to their proximity with Myanmar, Malay Peninsula and Indonesia, these islands have more of Myanmar and Malaysian elements in their flora and a substantial number of species are endemics (Ellis, 1989).

Covering an area of about 8249 km^2 and with a coastline of 1962 km the island group can be broadly divided into two; the Andaman group in the north, comprising about 325 islands and the Nicobar group of about 25 islands in the south, separated by the Ten Degree Channel. The former is again divided into North, Middle, South and Little Andamans while the latter also can be divided into Northern and Southern parts. Great Nicobar, the largest among Nicobar islands is only 150 km away from Sumatra.

These islands have an extremely rugged terrain. The highest point is the 732 m high Saddle peak in the North Andamans. Only few islands are inhabited, the climate is warm- humid with an average rain fall of about 3800 mm. Except in Great Nicobar, there are no rivers.

The physical isolation from the main land and between the islands through millennia have resulted in the evolution of a rare and unique flora in these island groups. The flora of Andaman group of islands shows striking dissimilarities with that of Nicobar group. While the Andamans have more species common to North eastern India and Myanmar, the Nicobars have more in common with Indonesia and Malaysia.

Wild palms are one of the most important components of the tropical rain forest of the Andaman and Nicobar Islands and have been found distributed from sea level to high altitudes. The islands are represented with 13 genera and about 30 species (Table 3). Many species are endemic and restricted to very small areas (*Calamus dilaceratus, Korthalsia rogersii and Bentinckia nicobarica*). About fifty percent of the palm species of the islands are endemic and over forty percent are endangered (Mathew and Abraham, 1994; Mathew *et al.*, 2007; Renuka, 1995). The major factors that have contributed to this dangerous situation for the native palms are isolation and habitat alterations.

Of the species reported, seventeen are endemic to the region. Three species are critically endangered (*Bentinckia nicobarica, Calamus dilaceratus* and *Korthalsia rogersii*), five endangered (*C. baratangensis, C. basui, C. unifarius, D. manii* and *Phoenix andamanensis,* and one possibly extinct (*C. nicobaricus*).

Habit

Woody trunk is a typical feature of palms except for rattans (*Calamus, Daemonorops* and *Plectocomia.*). *Salaca,* even though a rattan, is having tuberous stem. *Wallichia densiflora* and *Phoenix acaulis* also have tuberous stems. Dichotomous branching is seen in *Hypaene dichotoma, Korthalsia* and certain species of *Calamus.* Rarely branching is induced by injury to the terminal bud.

Table 4. Distribution of palms in Andaman and Nicobar Islands

Sl. No.	Botanical Name	North Andamans	Middle Andamans	South Andamans	Little Andamans	Car Nicobar	Kacchal	Nan coury	Great Nicobar	Status
1	*Arenga pinnata*	X								NE
2	*Bentinckia nicobarica**					X	X	X	X	CR
3	*Calamus andamanicus**	X	X	X	-	-	X	X	X	V
4	*C. baratangensis**	X	X	X	-	-	-	-	-	E
5	*C. basui**	-	-	-	X	-	-	-	-	E
6	*C. dilaceratus**	-	-	-	-	-	-	-	X	CR
7	*C. longisetus*	-	-	X	-	-	-	-	-	LC
8	*C. nicobaricus**	-	-	-	-	-	-	-	X	NE
9	*C. palustris*	-	-	X	X	-	-	-	-	NT
10	*C. pseudorivalis**	-	-	-	-	-	-	-	X	LC
11	*C. semierectus**	-	-	-	-	X	-	-	-	NT
12	*C. unifarius**	-	-	-	-	-	-	-	X	E
13	*C. viminalis*	-	-	X	-	-	-		-	LC
14	*Caryota mitis*	X	X							V
15	*Cocos nucifera*									-
16	*Corypha utan*	X								NE
17	*Daemonorops aurea**	-	-	X	-	-	-	-	-	V
18	*D. kurziana*	-	-	X	-	-	-	-	-	NT
19	*D. manii**	-	-	X	-	-	-	-	-	E
20	*D. rarispinosa**	-	-	-	X	-	-	-	-	V
21	*D. wrightmyoensis**	-	-	X	-	-	-	-	-	V
22	*Korthalsia laciniosa*	-	-	X	X	-	-	-	X	E
23	*K. rogersii**	X	-	X	-	-	-	-	-	CR
24	*Licuala peltata*	X	X	X						NT
25	*Licuala spinosa*	X	X	X						NT
26	*Nypa fruticans*	X							X	LC
27	*Phoenix andamanensis**			X						E
28	*Phoenix paludosa*	X	X	X					X	LC
29	*Pinanga manii**		X	X					X	NT
30	*Rhopaloblaste augusta**					X			X	NT

Endemic species

Palms are growth limited because they have no secondary vascular cambium and so lack any mechanism for secondary increase of vascular tissue; they do have a limited capacity for diffuse secondary growth not dependent on meristematic activity but sometimes so localized at the base of the trunk as to be mechanically useful. Palms normally remain unbranched above ground simply because they either lack completely any lateral vegetative meristems or such meristems are restricted to the base of the stem.

Phenology

Regular annual flowering and fruiting is observed in majority of the species. However, certain palms flower once in its life time after attaining vegetative growth of several years. Such palms are called *monocarpic or hepaxanthic.* In *Corypha* after a prolonged vegetative phase of about 40-50 years, lateral inflorescences are produced in the axils of reduced upper leaves and even the main stem end as a flower bearing rachilla. In *Caryota* and *Arenga* lateral inflorescence buds are initiated in the leaf axils but are suppressed until flowering commences from the uppermost axil. This is followed by the development of buds in the lower axils in the basipetal order.

Economic importance

Palms are among the most frequently harvested plant species in the tropics (McCurrach, 1960). Palms provide a wide range of economic products necessary for daily life. Stems and leaves of many palms are used extensively as construction materials. Leaf sheath fibres, and stem fibres are used as cordage and for making brushes. Leaves are used as writing material as well as for making hats, brooms, baskets etc. Foliage of several palms are used as fodder. The apical bud of several palms, commonly known as 'palm hearts' are edible and is a rich source of starch. Rattan shoots are rich in proteins (Renuka and James, 2006).

They find use in the preparation of several medicines also. Many palms are used in rituals and religious festivals. Toddy is extracted from the inflorescence of *Phoenix, Cocos, Arenga, Caryota* and *Borassus*. A variety of miniature articles are carved from the hard kernels (Vegetable ivory) of *Corypha*.

Rattans play an important role in the rural economy in India. A significant proportion of the rural population and forest dwellers earn their living through extraction and cleaning of rattans. A large number of cottage and small- scale industries in India are involved in the manufacture of rattan furniture, walking sticks, hockey sticks and handicraft items. Mature nuts of *Areca triandra,* and *Pinanga* species are used as substitutes for betel nuts in the North eastern region. *Cocos nucifera, Areca catechu* and *Elaeis guineensis* are extensively cultivated and they play an important role in the economy of the country. Palms also figure prominently in the life cycles of a variety of insects and are important food sources to rodents, bats, ungulates, and primates.

Majority of the species are of tremendous importance to local commerce as sources of food, thatch, fibre, wax, oil, timber, sugar, salt, alcoholic beverages, masticatories, and stimulants. Some are symbolic in several cultures. They have considerable aesthetic value, are used in magic and folk-medicine, and are an essential ecological associate of many primitive tribes. They have become increasingly important in commercial horticulture because of their elegant and predictable shapes.

Present status and conservation

Most of Indian palms exhibit highly restricted distribution to ecological niches within biogeographic regions where they exist. Out of 106 species, about 43 species are endemic. In all these bio-geographic regions

distribution of palms are subjected to extensive habitat loss due to anthropogenic factors as well as environmental catastrophes like tsunami. Palm populations in the wild are decreasing. Genera like *Borassus, Calamus, Corypha* etc., are threatened because of their constant and increasing utilization. Some inherent characteristics of palms such a monocarpic flowering, poor germination of seeds and poor establishment of seedlings etc. have also contributed to retard natural regeneration of palm population.

Overexploitation is one of the major threats to the survival of many wild palm species. Although increased use of palms may provide economic benefits to rural people (Anderson 1988; Peters *et al.*, 1989), some species, particularly those with high market potential, are being depleted by destructive harvesting (Vasquez & Gentry 1989).

Conservation and sustainable utilization of this resource assumes great importance in the context when forest wealth of the country as a hole has been on the decline. In the absence of concrete efforts towards their replenishment, some of these wild palms are likely to face the threat of extinction.

A Palmetum was established at KFRI where live collection of palms is maintained. At present about 50 indigenous and about 45 exotic species area available in the Palmetum. Thirteen species prepared by BSI for Assessment and Conservation are protected at KFRI (Table 4). Nine endemic species from Andaman and Nicobar islands also are protected here (Table 5).

Table 4. Threatened species (Prepared by BSI for assessment and conservation) protected at KFRI

No	Name	Protected at KFRI
1	*Arenga wightii*	+
2	*Calamus dilaceratus*	+
3	*C. inermis*	
4	*C. nagbettai*	+
5	*C. travancoricus*	+
6	*Corypha utan*	+
7	*Korthalsia rogersii*	+
8	*Livistona jenkinsiana*	
9	*Nypa fruticans*	+
10	*Pinanga andamanensis*	
11	*P. manii*	+
12	*Trachycarpus takil*	
13	*Wallichia triandra*	

Table 5. Endemic species of Andaman & Nicobar islands protected at KFRI

No	**Name**	**Conservation status**
1	*Corypha utan*	NE
2	*Korthalsia rogersii*	E
3	*Pinanga manii*	NT
4	*Calamus dilaceratus*	CR
5	*C. unifarius*	E
6	*C. pseudorivalis*	LC
7	*Bentinckia nicobarica*	CR
8	*Rholoblaste augusta*	NT
9	*Phoenix andamanensis*	E

NE- Near threatened, E- endangered, NT- Near threatened, CR- Critically endangered, LC- Least Concern

As a part of the project, the following objectives were fulfilled.

1. Identification manuals

The following identification manuals/CDs were prepared.

a. The book ***'Indian Rattans- their taxonomy, biology and utilization'*** was published.

b. The following books are in the press which will be brought out soon.

- ***A hand book on the 'Field identification of Indian palms'***
- ***Taxonomic manual on Indian palms***

c. A CD (KFRI CD No. 8) on the 'Field identification of Indian palms' was prepared which helps to identify the palm with three to four mouse clicks.

d. An electronic data base on Indian palms was prepared which will be hosted in the Web.

All these documentation will help the foresters, students, teachers and researchers in their studies on Indian Palms.

2. A Palmetum was established at KFRI where live collection of palms is maintained.

3. Training programmes in the identification and conservation of palms were organized for foresters, college teachers and students.

Morphology of palms

Palms are woody monocotyledons with a distinctive appearance.

Roots

The roots of a palm originate form the base of the trunk. The primary root system of a seedling, which help in the early anchorage and initial uptake of nutrients and water, is short lived. The secondary root system is known as adventitious root system. In clump forming palms a new adventitious root system is produced at the base of each new trunk. The roots are thick and tough but some are slender and wiry. The surface of the roots is generally smooth but those of some palms bear numerous spines. A very few palms produce aerial roots.

Stem

Palms have woody stem or trunk. The trunk is terminated by a growing apex which is protected by the leaves and their sheathing bases and is buried well within the trunk. Once this apical bud is destroyed, the palm dies.

A young palm does not start developing a stem until its apical bud has reached a certain critical size. This is the reason for the slow initial development that occurs in young palms before they form their stem.

Palms have no bark as such, although the epidermis is hardened to form a protective layer. Thus they have no secondary thickening and once the stem is formed it can only increase in diameter to a limited extent. The stem attains its maximum girth before the trunk grows upwards. Palm trunks are remarkably strong and withstand tremendous bending stresses exerted by winds. The surface of the palm trunk may be smooth or spiny or covered with the persistent leaf bases. The point on a trunk where the leaf arises is known as the node and the area in between as the inter node. Scars representing the point of attachment of fallen leaves may be prominent on some palms. Their distance apart is a reflection of

the vigour of the palm and their number can be used as a guide to the palm's age. Small inter node indicates slow growth while widely spaced rings indicate rapid growth.

The trunk is a very important feature in the identification of palms. The trunk may be **solitary, branching, clump forming or climbing**. Some palms may be trunkless.

Solitary

Clump forming

Crown shaft

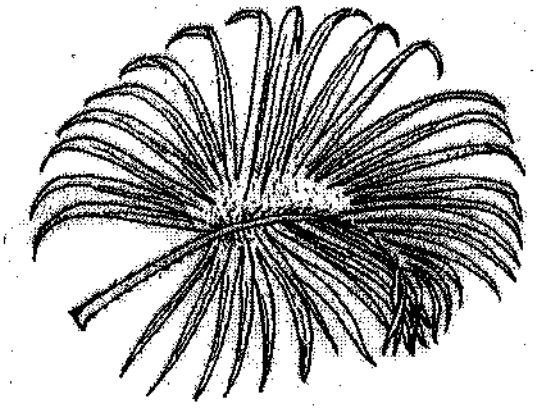
In some palms, the top of the trunk is crowned with a cylinder called crown shaft. This is formed by the tightly packed tubular leaf-bases and is important as a protective measure for the meristem. Its presence provides a useful diagnostic feature.

Leaf

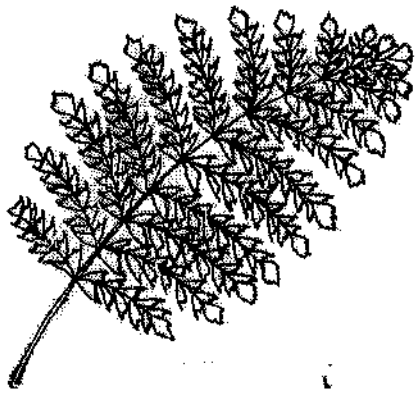
Leaves are of three types, **palmate, pinnate and bipinnate**. Leaf is a major diagnostic feature. A leaf has three parts, the lamina, the petiole and leaf sheath. In palmate or fan leaved palms the lamina is semicircular or circular, entire or divided into segments. The petiole may either stop abruptly where the segments join or continue as an extension

into the lamina. In the former case the leaf is known as palmate and in the latter, **costapalmate**. In some palms, a small projection juts out at right angles to the end of the petiole. This is known as 'hastula'.

Pinnate leaves have the appearance of a feather. The leaflets may be stiff or drooping. The leaf lets may be united in various ways. The size, shape and arrangement of the leaflets vary with species. Bipinnate leaves are twice divided.



Costapalmate leaf

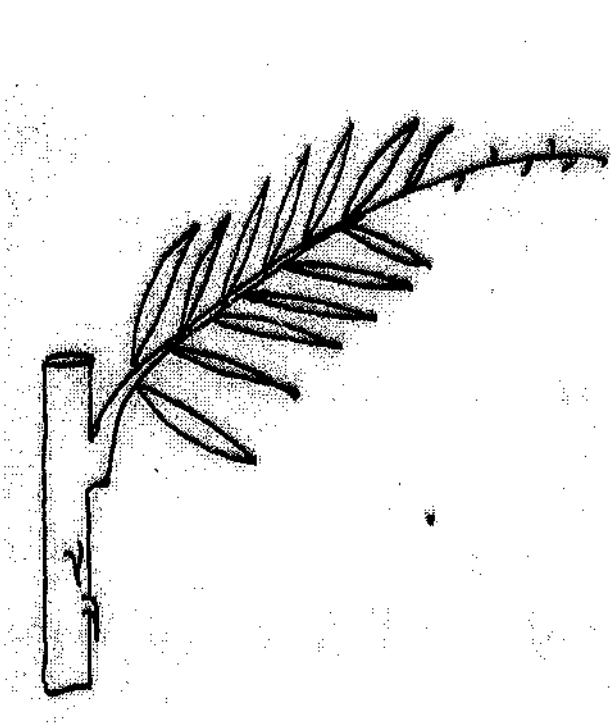


Bipinnate leaf

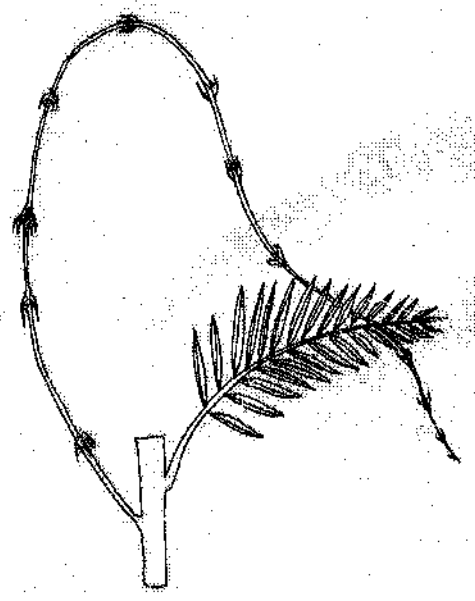
The axial part above the leaf sheath up to the point of origin of leaflets is the **petiole**. The lower portion of the petiole that encircles the stem is the **sheath**. In certain palms, eg., rattans, the sheath cover the stem along its full length leaving only a small apical portion exposed. Sheaths of adjacent leaves overlap and imbricate so that the stem is completely hidden and the actual stem apex lies below the observed tip. The leaf sheath is entire and undivided in most of the species, but in some palms it is split at the base eg., *Thrinax* spp., *Latania* spp. The sheaths persist on the trunk of some species long after the leaves have been shed while in some others, the sheathing base is shed along with the leaf, leaving a clean trunk. The leaf sheath may be provided with various types of spines or fibres in certain palms. In most of the rattan species leaf

sheath bears a large swelling at the base of the petiole termed the **'knee'** and a specialized appendage at the upper part of the leaf sheath which is known as **"ocrea'**. The colour, nature and arrangement of spines on the leaf sheath and presence of knee and ocrea are identifying features in case of rattans (canes).

In certain climbing palms the leaf rachis extends beyond the leaflets to form a spiny, whip-like structure called **'cirrus'**. In certain others a whip-like organ originates from the top of the leaf sheath called **'flagellum'**. Usually cirrus and flagella are mutually exclusive; in species with cirrus there is no flagella and vice-versa. Both the structures are provided with reflexed, grapnel-like spines.



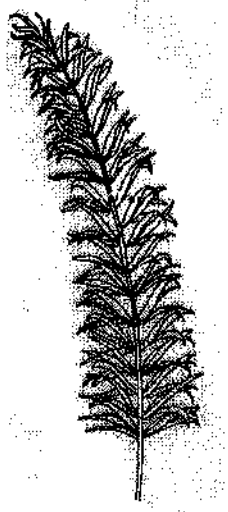
Leaf sheath with cirrus



Leaf sheath with flagellum

Most commonly, leaflets are **regularly arranged** along the rachis and spread in the same plane. In some cases, leaflets are **irregularly** arranged spread in same or different planes. Occasionally, pinnate leaves do not split, and an undivided leaf results. However, the venation is still pinnate. The apices of the leaflets usually pointed or may be jagged or lobed.

Regularly arranged leaflets



Irregularly arranged

Inflorescence

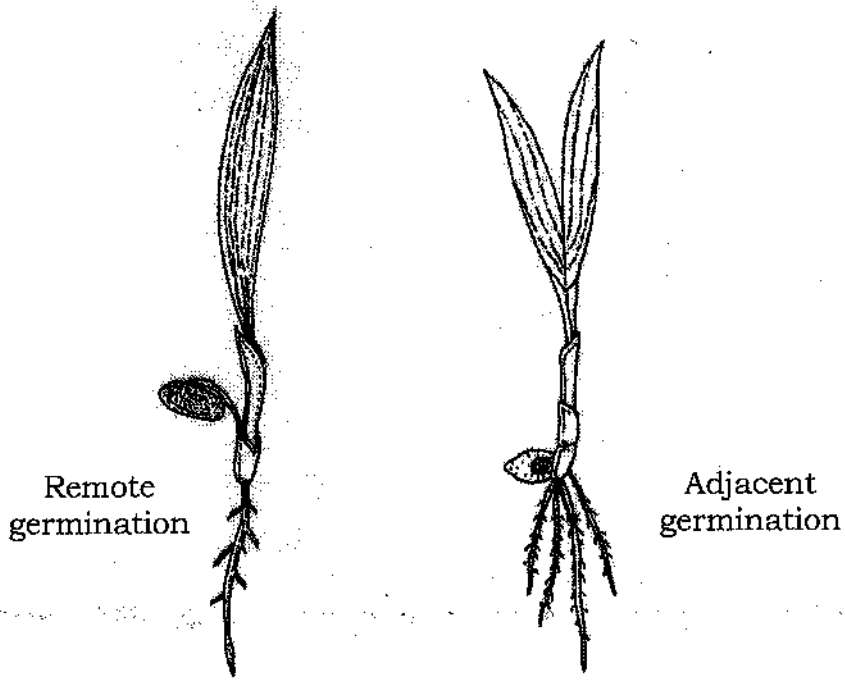
Some species may flower within 3-6 years, while certain other species may take 30-50 years to flower. Certain palms produce a single terminal or several axial inflorescences after which they die. Such palms are called **'hapaxanthic'. (Semelparity)** eg., *Corypha, Caryota.* Most palms continue to live even after the production of inflorescence and such palms are known as **'pleonanthic' (iteroparity).** eg., *Areca, Cocos.* In pleonanthic palms the position of the inflorescence is an identifying feature. The vast majority of palms bear an axillary inflorescence among the existing leaves and this situation is called **interfoliar** eg., *Phoenix.* Some species, especially those with a crown shaft, carry their inflorescence below the crown shaft and this condition is described as being **infrafoliar.** The length of the inflorescence also is an identifying feature. Some palms are **'monoecious'** when both male and female

Flowers

Individual palm flowers are small and fairly inconspicuous. Flowers are typically trimerous having three sepals, three petals, six stamens and a trilocular ovary.

Fruits

Fruits are usually produced in abundance. The size and shape of the fruits vary with the species from a few millimeters to almost 20 cm in diameter (e.g. *Borassus*). The shape also ranges from rounded to ellipsoid to ovoid. The colour of the fruit may vary depending on the species. The fruits of calamoid palms (rattans) are covered with overlapping scales. The endosperm is either **homogenous** or **ruminate**. There are two patterns of germination; **adjacent germination** in which the seedlings develop next to the seed and in the other **remote germination** where the seedlings develop at some distance from the seed and the young plant is connected to the seed by a long tubular cotyledonary petiole.



Types of seed germination in palms

Classification

The family Palmae is divided into six subfamilies Coryphoideae, Calamoideae, Nypoideae, Ceroxyloideae, Arecoideae and Phytelephantoideae. In India the family is represented by four subfamilies, Coryphoideae, Calamoideae, Nypoideae and Arecoideae. Calamoideae and Nypoideae are very distinct subfamilies which can be recognized very easily. In India all the palms coming under Calamoideae are climbing and the ovary and fruit are covered with imbricate scales. The subfamily Nypoideae contains a single genus *Nypa* with a single species *Nypa fruticans*. The female flowers are borne in a terminal head and the male flowers are crowded on spikes at the tips of inflorescence branches below the female flowers.

All the palms coming under Coryphoideae are having palmate or costapalmate leaves except *Phoenix* which has pinnate leaves. The lower most leaflets are modified into spines. The palms coming under Arecoideae have pinnate or bipinnate leaves.

Key to the genera

1a. Leaves palmate or costapalmate : 2
1b. Leaves pinnate (or pinnately veined if undivided) or bipinnate : 7
2a. Stem branching dichotomously above ground : *Hyphaene*
2b. Stem not branching : 4
3a. Inflorescences produced simultaneously above the leaves, their production ending the life of stem (monocarpic palm) : *Corypha*
4b. Inflorescences produced sequentially among the leaves, their production not ending the life of stem (pleonanthic palm): 5
4a. Fruits to 20 cm diameter : *Borassus*
4b. Fruits less than 20 cm diameter : 6
5a. Leafsheath disintegrating into a mass of fine and coarse fibres : *Trachycarpus*
5b. Leafsheath not disintegrating into a mass of fine and coarse fibres : 7
6a. Leafblade divided along abaxial folds to the petiole into single fold or several folds, usually wedge shaped truncate segments, or undivided : *Licuala*
6b. Leafblade divided along adaxial folds to the petiole into single fold or several folds, but not truncate segments : *Livistona*
7a. Leafsheath at the base of the leaf modified into green straight spines.....8
7b. Leafsheath at the base of the leaf not modified into spines..... : *Phoenix*
8a. Stems, leaves, and inflorescences spiny : 9

8b. Stems, leaves, and inflorescences not spiny : 13

9a. Acaulescent palms : *Salacca*
9b. Mostly spiny climbing palms, sometimes with erect stem : 10
10a. Leaflets narrowly to broadly rhomboidal, upper margin erose, usually silvery on the lower surfaces; climbing stems branching above ground : *Korthalsia*
10b. Leaflets not rhomboidal, margin entire, green on the lower surfaces, rarely silvery; climbing stems branching only at ground level, rarely above ground : 11
11a. Leafsheath knee absent; inflorescences in the axils of upper reduced leaves, stem hapaxanthic; female flowers solitary : *Plectocomia*
11b. Leafsheath knee absent; inflorescences in the axils of normal leaves, stem pleonanthic; female flowers paired : 12
12a. Cirri always present; inflorescences not flagellate, shorter than leaves, with loose, boat-shaped non sheathing bracts : *Daemonorops*
12b. Cirri absent or present; inflorescences flagellate non flagellate, longer than leaves, with tight sheathing, tubular persistent bracts : *Calamus*
13a. Leafsheath closed and forming a crownshaft, inflorescence borne below the crownshaft/leaves : 14
13b. Leafsheath open and not forming a crownshaft, inflorescence borne among the leaves : 17
14a. Inflorescence with only large prophyll or first bract : 15
14b. inflorescence with prophyll and distinct peduncular bracts : 16
15a. Leaflets tend to project upwards, rachis arching, basal 2 branches of the inflorescence not recurved, fruit with apical stigmatic remains : *Bentinckia*
15b. Laflets not projecting upwards, often pendulous, basal 2 branches of the inflorescence strongly recurved, fruit with basal stigmatic remains : *Rhopaloblaste*
16a. Female flowers larger than males, situated mostly from the base to middle of the flowering branches : *Areca*
16b. Female flowers smaller than males or equal to males but not restricted to basal portion of the flowering branches only : *Pinanga*
17a. Leaves bipinnate : *Caryota*
17b. Leaves pinnate : 18
18a. Leaflets with jagged or toothed apices : 19
18b. Leaflets with pointed apices : 20
19a. Leaflets strongly assymetrical, scarcely to deeply lobed along the margins, petals in female flowers connate at base to form a solid cylinder : *Wallichia*
19b. Leaflets more or less symetrical, notched but not usually lobed along the margins, petals in female flowers connate to about the middle from the base but not form a solid cylinder : *Arenga*
20a. Stem creeping, never visible; leaves erect : *Nypa*
20b. Stem erect, leaves spreading : *Cocos*

TAXONOMY

Areca L., Sp. Pl. 1189. 1753. Gen. Pl. ed. 5.495. 1754; Becc. & Hook. f. in Hook. f., Fl. Brit. Ind. 6:405. 1894; Blatter in J. Bomb. Nat. Hist. Soc. 24(2): 329. 1916; Furtado in Fed. Rep. Sp. Nov. 33.217-239. 1933; Benthall, Trees Calc. 457. 1946; Bailey, Man. Cult. Pl. (reprint ed.). 173. 1966; Whitmore, Palms Mal. 33. 1973.

Mischophloeus Scheff., Ann. Jard. Bot. Boitenzorg 1: 115, 134 (1876) Type: *M. Paniculatus* (Scheffer) Scheffer (*Area paniculata* Scheffer) (= *A. vestiaria* Giseke).

Gigliolia Becc., Malesia 1: 171 (1877).

Pichisermollia H.C. Monteiro, Rodriguesia 28: 195 (1976). Type: *P. insignis* (Beccari) H. Monteiro-Neto (*Gigliolia insignis* Beccari).

Very small to moderate, solitary or clustered, acaulescent to erect, unarmed, pleonanthic, monoecious palms. Stem slender to moderate, occasionally stilt- rooted, internodes very short to elongate, leaf scars often conspicuous. Leaves undivided and pinnately ribbed, with or without an apical notch, or pinnate; sheaths forming a well defined crownshaft with leaves neatly abscising; petiole present or absent, adaxially channelled or rounded, abaxially rounded, glabrous or variously indumentose; leaftlets regularly or irregularly arranged, 1-several fold, acute, acuminate or lobed, the lobes corresponding to the folds, the apical pair almost always lobed, held in one plane, very rarely with a basal auricle reflexed across the rachis, blade variously scaly or hairy. Inflorescences erect or pendulous, mostly infrafoliar, rarely interfoliar in acaulescentt species with marcescent leaf sheaths, branched to 3 orders basally, fewer orders distally, very rarely spicate, protandrous (or very rarely protogynous); peduncle very short to long; prophyll thin, membranous, enclosing the inflorescence in bud,

quickly splitting and falling, other bracts very inconspicuous; rachis shorter or longer than the peduncle; rachillae glabrous or variously indumentose; rachilla bracts minute; triads confined to the proximal part of the main axis, or to the proximal part of each order of branching, or rarely to a subdistal part of the main axis only; rachillae otherwise bearing solitary or paired staminate flowers arranged spirally, distichously, or in 2 approximate rows on one side of the rachilla, the rachilla tips sometimes devoid of flowers. Staminate flowers frequently minute, sessile, or with a stalk formed from the receptacle; calyx with 3 distinct, slightly imbricate, triangular sepals, or copular with 3 triangular lobes; corolla with triangular, valvate petals, rarely briefly connate at the base, much longer than the sepals; stamens free or briefly epipetalous, 3,6,9 or up to 30 or more , filaments short to elongate, anthers linear or sinuous, sometimes very irregular, latrrorse or rarely opening by apical pores; pollen elliptic or circular, monoporate or triporate, with perforate, finely to coarsely reticulate tectate or intectate exine; pistillode present or minute, or often absent. Pistillate flowers sessile, usually much larger than the staminate, globular; sepals 3, distinct, imbricate; petals similar to the sepals, 3 distinct, sometimes valvate at the very tip, otherwise imbricate; staminodes 3-9 or absent; gynoecium unilocular , uniovulate, globose to ovoid, stigmas 3, fleshy, triangular, reflexed at anthesis, ovule anatropous, basally attached. Fruit globose, ovoid, or spindle- shaped, often brightly colored, rarely dull brown or green, stigmatic remains apical; epicarp smooth, shiny or dull, mesocarp thin to moderately thick, fleshy or fibrous , endocarp composed of robust longitudinal fibers, usually closely appressed to the seed. Seed conforming to the fruit shape or slightly hollowed at the base, with basal hilum, endosperm deeply ruminate; embryo basal.

Distribution:- This genus contains about 50 species, distributed from India to China through Malesia to New Guinea and the Solomon Islands. Mostly small to moderate undergrowth palms. *Areca catechu,* widespread as a cultivated species. From India, 2 species are reported.

Notes: - The genus *Pichisermollia* has recently been included in Areca (Dransfield 1984c). As circumscribed here, Areca is a remarkably variable genus with very distinctive sections. The variation in Borneo is particularly noteworthy.

Key to the species

1a. Stem solitary, straight, tall, stamens 6, fruit 6 cm long, orange coloured.....*catechu*

1b. Stem cluster forming, rarely solitary, stamens 3, fruit 2.5 cm long, red coloured..... *triandra*

Areca catechu L., Sp. Pl.: 1189. 1753; Mart., Hist. Nat. Palm. 3: 169, t. 102. 1823–1853; Griff., Calc. J. Nat. Hist. 5: 153. 1845, and Palms Brit. India 47. 1850; Becc. & Hook. f. in Hook. f., Fl. Brit. India 6: 405. 1893; C. E. Parkinson, Forest Fl. Andaman Isl.: 264 (1923); Fischer in Gamble. Fl. Pres. Madras 1555. 1931; B.K. Sinha., Fl. Great Nicobar Isl.: 460 (1999); Plate 1.

Type: Pinanga Rumphius, Herb. Amboin. 1: t. IV. 1741 (Lectotype – Moore & Dransfield, 1979).

Areca cathechu Burm.f., Fl. Indica: 241. 1768.

Areca faufel Gaertn., Fruct. Sem. Pl. 1: 19. 1788.

Areca hortensis Lour., Fl. Cochinch.: 568. 1790.

Sublimia areca Comm. ex Mart., Hist. Nat. Palm. 3: 169. 1838., nom. inval.

Areca himalayana Griff. ex H.Wendl. in O.C.E.de Kerchove de Denterghem, Palmiers:

231. 1878.

Vernacular names: Areca nut palm, Betel nut palm, Adakka (Mal.), supari (Hind.), puga (Sans.), kamugu (Tam.)

Solitary, pleonanthic, monoecious palm. Stem erect, about 10 – 25 m long, to 10 - 20 cm in diameter; Leaves 8 – 10 in crown, 1.5 – 2 m long, sheath tubular, pinnate with various lengths, erect to arching, petiole almost missing or very short to 15 cm long, channeled adaxially, rounded abaxially; leaflets linear, closely packed, stiff, deflecting above the midrib, distributed evenly along the rachis in one plane, leaflets 65 - 100 cm long, 9-11 cm diameter, briefly pointed and sometimes notched at apices, green, concolorous when dried. Inflorescence infrafoliar, divaricate, 30–80 cm long, branched 2 to 3 orders, rachillae numerous; prophyll caducous, 65–75 cm long, 15 cm wide, leathery; peduncle short, c. 7 - 8 cm wide at the base; rachillae c. 10–40 cm long, rachilla bract not conspicuous, sometimes calyx persistent on rachillae after fruits fallen flowers dimorphic, borne in triads at the base of rachillae and/or on the proximal part of each order of branching, staminate flowers arrange one-sided to distichous; staminate flowers numerous, 4–7.5 mm long, 2–5 mm wide, asymmetrical, lemon yellow in colour, mostly in pairs and closely packed at the distal pair of rachilla, faintly odorous at anthesis, calyx cupular, low; petals 3, 6–7 mm long, 3–4 mm wide, triangular, cream coloured; stamens 12; filaments, 1 mm long; anthers 2 mm long, 0.5–0.6 mm wide; pistillode to 2.5 mm long, trifid; pistillate flowers much larger than males, mostly proximal, tiny male flowers on two sides of female flowers are highly deciduous, 13–15 mm long, 7 –10 mm wide, triangular; sepals 3, to 10 cm long, 10 mm wide, imbricate, strongly keeled with cream to green coloured at anthesis; petals 3, 10–15 mm long, 7–10 mm wide, cream coloured; gynoecium c. 10 mm long, 6 mm wide, stigma trifid; staminodes circular, membranous. Fruits ovoid, 4 cm long, 3 cm wide; mesocarp highly fibrous; seed 1.5-2 cm in diameter, globose to subglobose with more less flattish base to the base flat, hard; endosperm ruminate.

Distribution: The species has been has been distributed throughout tropics and the country of origin is uncertain due to long cultivation

history. However, several locations have been suggested based on the occurrence of the wild close relative species, such as the Philippines, Malaysia, Celebes (Sulawesi) and New Guinea. Cultivated in the mainland in India; naturally occurring in Andaman and Nicobar Islands.

Flowering and Fruiting: Throughout the year.

Conservation status: Least Concern

Specimens examined: Kallar, Nilgiri, Madras, 23.2.1963, fl., Vivekanandan 15693 (MH); Sirunelli Estate, Palghat, 3.11.1976, fr., Vajravelu 48848 (MH); Bavani River side, Mukkali, Palghat, 9.3.1975, fl., Vajravelu 46250 (MH); Aickad, Quilon, 21.2.1979, Mohanan 61173 (MH); Near Neyyar Dam, Thiruvananthapuram, 16.4.1973, fl., Joseph 44179 (MH).

Uses: The hard seed is largely chewed as masticatory along with the betel leaf (Pan), catechu (Khoir) and lime (Chun). The Khasi tribals old and young, consume fermented endosperm of the nut along with betel leaf and lime. It is considered to be weak narcotic and helps warming up of the body during cold season. Dried immature nuts are also chewed by the local people in Darjeeling for warming up of the body during severe cold. *Areca catechu* nuts are also chewed by the tribals of Andaman and Nicobar Islands. Mature stems of unproductive trees are used for making pillars, roof beams of thatched huts. In South India, nicely cut leaf sheaths of *Areca catechu* used as plates. Seeds also contain several alkaloids that have medicinal use.

Areca triandra Roxb. *ex* Buch.-Ham. Mem. Wern. Nat. Hist. Soc. 5: 310. 1826; C. E. Parkinson, Forest Fl. Andaman Isl.: 264 (1923); Plate 1.

Areca laxa Buch.-Ham., Mem. Wern. Nat. Hist. Soc. 5(2): 309. 1826.

Areca nagensis Griff., Calcutta J. Nat. Hist. 5: 453. 1845.

Ptychosperma polystachyum Miq., Fl. Ned. Ind., Eerste Bijv.: 590. 1861.

Areca triandra var. *bancana* Scheff., Natuurk. Tijdschr. Ned.-Indië 32: 165. 1873.

Nenga nagensis (Griff.) Scheff., Ann. Jard. Bot. Buitenzorg 1: 120. 1876.

Areca borneensis Becc., Malesia 1: 22. 1877.

Areca humilis Blanco ex H.Wendl. in O.C.E.de Kerchove de Denterghem, Palmiers: 231. 1878.

Areca polystachya (Miq.) H.Wendl. in O.C.E.de Kerchove de Denterghem, Palmiers: 232. 1878.

Areca aliceae W.Hill ex F.Muell., Gartenflora 28: 199. 1879.

Vernacular Names: Jungli supadi, Abaradah (And. & Nico.), Kaliyadakka (Mal.), Bon Gua (Ass.), Jungli supari (Hind.)

A cluster forming, dwarf to bushy, pleonanthic, monoecious palm. Stem slender, distinctly annulate, 2-3 m long. Leaf pinnate, light green in colour; leaflets subopposite, alternate, linear-ensiform, acuminate, broad at base, prominently nerved on upperside, terminal leaflets joined, broad, deeply divided, lobed, each lobe truncate with bidentate margins. Inflorescence infrafoliar, branched to 3 oders and more than one triad in one rachilla, prophyll light green, leathery, bicarinate; flower branches pale yellow to whitish when opened; rachillae filiform; male flowers minute, in pairs, creamy white, odorous at anthesis; sepals 3, opposite to petals; filaments short, connate at base; pistillode rudimentary; female flowers many times larger than males, proximal; sepals 3, deep green, more or less circular in outline, imbricate; petals 3, imbricate or rarely twisted; staminodes 6, conspicuous; ovary 1-loculed, 1-ovuled; stigma with unequal lobes. Fruits oblong and red in colour when ripe; endosperm ruminate.

Distribution: India, Sri Lanka, Andaman Island, Indochina, Thailand, Malay Peninsula, Sumatra and Borneo. Cultivated in the mainland in India; naturally occuring in Andaman Islands.

Flowering: February-June. **Fruiting:** September-November.

Conservation status: Least Concern

Specimens examined: Assam, S. Coll. M. H. Acc. No. 52640 (MH); Wright myo, South andamans, 13.1.1959, Thothathri 9064 (MH); Habdaypur, S. Andamans, 9.4.1892, Dr. King's Collector, Acc. No. 72642 (MH); Junglebar, Portblair, 3.5.1964, Ellis & Ramamurty 19004 (MH).

Uses: Nuts are favourite to the tribals of Andaman and Nicobar Islands, they use it as masticatory.

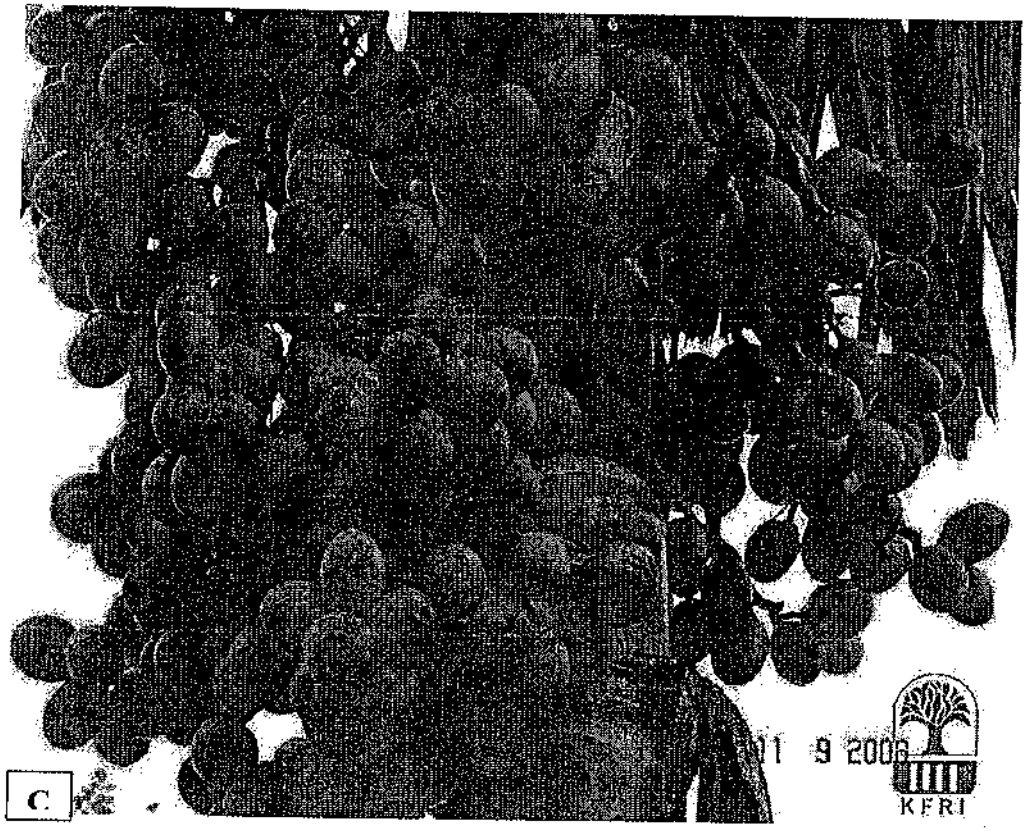


Plate 1. ***Areca catechu.*** **A. Habit B. Stem with unopened inflorescence C. Infructscence**

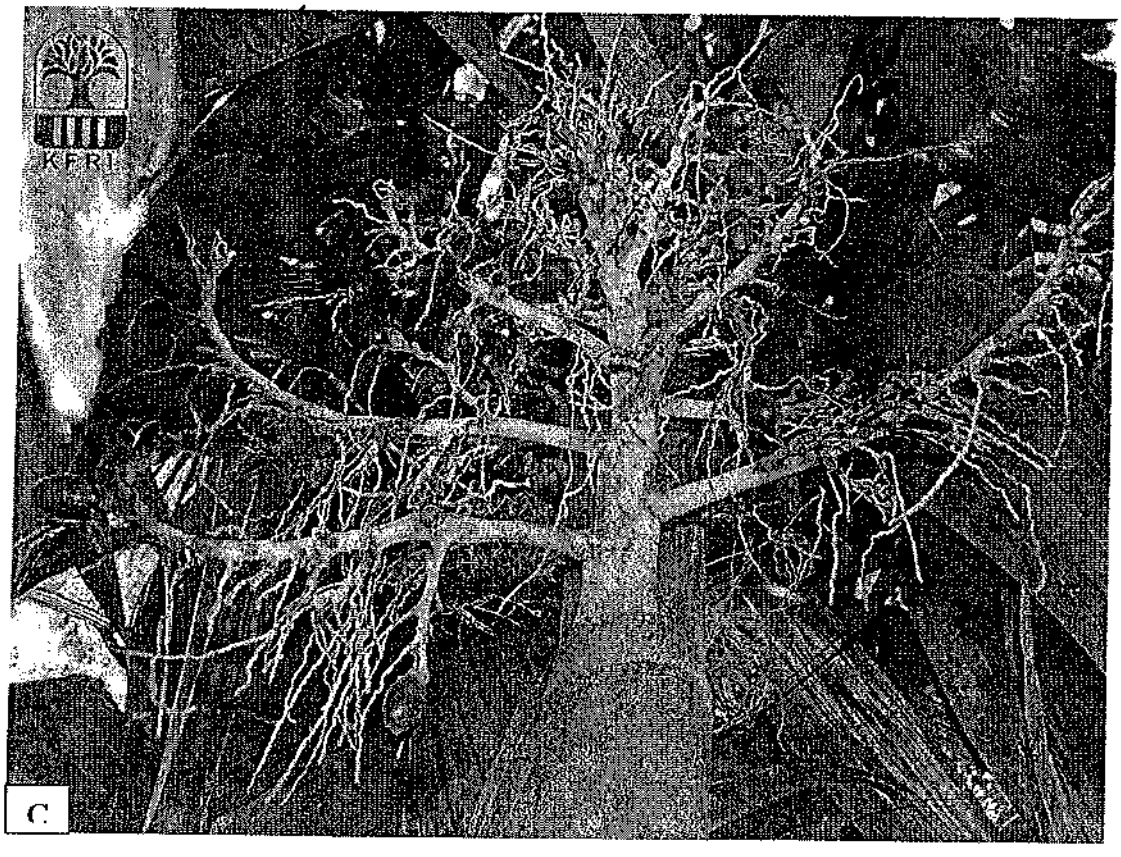


Plate 2. ***Areca triandra.*** **A. Habit B. Stem with male inflorescence C. Infructscence**

Arenga Labilladiere, Bull. Sci. Soc. Philom. Paris 2:162.1800, nom.cons.

Saquerus Steck, Dissertation Inaugualis Medica de Sagu 15. 1757.

Gomutus Correa, Annales du Museum National d' Histoire Naturelle 9: 288. 1807.

Blancoa Blume, Rumphia 2: 128. 1843 ("1848"). (Non J. Lindley 1840).

Didymosperma H.A. Wendland & Drude ex J.D. Hooker, Genera plantarum 3: 917.

Dwarf to large, solitary or clustered, unarmed or lighly armed, pleonanhic or hapaxanhic, monoeciuos or very rarely apparently dioecious, acaulescent, shrubby or tree palms. Stem with congested or elongate internodes, usually obscured by persistent fibrous leaf bases and sheaths, more rarely becoming bare, conspicuously ringed with scars. Leaves flabellate and induplicately ribbed (rarely) or induplicate, imparipinnate, marcescent; sheath covered in great variety of tomentum, scales and hairs, eventually disintegrating into a mass of balck fibers; petiole usually well developed, slender to very robust, channeled or ridged at base adaxially, rounded abaxially; rachis rounded to angled adaxially, rounded to flat abaxially; leaflets single fold, regularly arranged or grouped and held in several planes, or deeply lobed and wavy, often with 1 or 2 basal auricles, the distal margins praemorse, with small sharp teeth, sometimes with a short to long, margins sometimes toothed, abaxial surface usually densely covered in pale indumentum with or without scattered bands of dark brown scales, midribs prominent abaxially, transverse veinlets sarcely visible. Inflorescences interfoliar, sometimes infrafoliar, often bursting through the leaf sheaths, produced in an acropetal sequence in hapaxanthic species, the distalmost inflorescences usually subtended by greatly reduced leaves, bisexual,or unisexual by sterilization of triad components, usually branched to 1-2 orders; peduncle very short to well developed, slender to massive, bearing a generally rather

inconspicuous, basal, 2-keeled prophyll and several conspicuous, spirally arranged, peduncular bracts, soon splitting adaxially; rachillae erect or pendulous, distant or crowded, very slender to extremely massive, frequently tomentose, bearing a loose to dense spiral of triads, subtended by inconspicuous low bracts. Staminate flowers in bisexual inflorescences opening before the pistillate; staminate flowers with sepals 3, rounded; imbricate, coriaceous, distinct, or joined very briefly at the base; corolla tubular at the very base, with 3 ovate to oblong triangular tipped, coriaceous, valvate lobes; stamens rarely as few as 6-9, usually many more than 15, filaments short, anthers elongate, latrorse, connective sometimes prolonged into a_point; pistillode absent. Pistillate flowers usually globose, sometimes massive; sepals 3, distinct, rounded coriaceous, imbricate; petals 3, connate base, valvate, triangular distally; staminodes 3-0; ovary globose, trilocular, stigmas 2-3, low, fertile locules 2-3, septal glands present basally and opening at the ovary surface, ovules inserted adaxially at the base, hemianatropous. Fruit globose to ellipsoidal, often somewhat angled, 1-3 seeded with apical stigmatic remains, epicarp smooth, dull to brightly colored, mesocarp fleshy, filled with abundant, irritant needle crystals, endocarp not differentiated. Seeds basally attached endosperm homogeneous; embryo lateral.

Distribution:- With about 20 species, distributed from India to South east Asia, reaching New Guinea and Australia. India is represented with 4 species.

Notes: - *Arenga* may be confused with *Wallichia*, the latter is with strongly assymetrical leaflets with deeply lobed margins. *Arenga* leaflets are usually linear and only briefly lobed, but there are exceptions to this – *Arenga caudata*, *A. hastata*, and *A. longicarpa*. In reproductive features *Arenga* occupies a position intermediate between unspecialized *Caryota* and specialized *Wallichia*.

Key to the species

1a. Stem solitary; Northeast India or Andaman Islands.....2

1b. Stem clustered; South India .....*wightii*

2a. Stem to 20 m tall, with stolons.....*obsutifolia*

2b. Stem less than 20 m tall, without stolons.....3

3a. Leaflets irregularly arranged and spreading in the different plane, cultivated.....*pinnata*

3b. Leaflets regularly arranged and spreading in the same plane, naturally occurring.....4

4a. Leaflets to 30-35 per side of rachis.....*micrantha*

4b. Leaflets more than 35 per side of rachis..... *westerhoutii*

Arenga micrantha C.F. Wei, in Acta Phytotax. Sinica 26 : 404 1988; S. Pie et al., Fl. China 23 : 152 2010 ; H. J. Noltie, in Palms 44: 16 2000.

Type: China, Xizang (Tibet), Medog, Gelinpendi, 1600 m, 12 Aug 1980, *W. L. Chen* 14214 (holo. PE, *n.v.*).

Hapaxanthic, dioecious, dwarf, solitary palm. Stems to 2 m, to 15 cm in diameter. Leaf sheath fibers blackish-brown. Leaves to 3 m, pinnate, blade 80-180 x up to 65 cm, curved to one side, with basal ear rings, green above, whitish beneath; rachis triangular in section, brown-scurfy; petiole 35-50(-100) cm, brown-scurfy, upper surface slightly concave, lower side strongly convex; lateral leaflets arranged singly, held in one plane, to (30-) 48 x 2.5-3.5(-4) cm, narrowly oblong, narrowed to irregularly erose apex, margins very weakly praemorse; base asymmetric with minute auricle sometimes developed on lower side; terminal leaflet 21-24 x 4-18 cm, narrowly to widely flabellate. Flowering basipetally. Female inflorescences pseudoterminal and lateral, branched to 1 order; primary axis of terminal inflorescence to c. 90 cm, stout, those of lateral ones shorter; branches to 32 cm, stout, flattened at base; bracteoles minute (under 1.5 mm). Flowers c.

10 mm diameter; sepals swollen, coriaceous, free, broadly oblong, margins dark brown, c. 3.2 mm long, 5.5 mm wide; petals pale yellowish, coriaceous, broadly rhombic, subacute, fused in lower half, strongly concave; immature ovaries orange, weakly hexagonal in outline, depressed, with three, weak radial ridges; stigmas 3, very low, dark brown; staminodes 0; locules 3, ovules 1-2, basal. Male inflorescence a narrow panicle, 80-100 cm, branches in 2-4 rows, the lower c. 17 cm, the upper decreasing to c. 5 cm. Flowers 4 -5.5 mm, oblong sepals c. 2 mm long, 2.5-3 mm wide, broadly rounded, free; petals yellow, oblanceolate or obovate, coriaceous, slightly unequal; stamens 9-23, filaments short, slightly connate at base; anthers 2.7-3.2 mm, narrowly oblong, acute.

Distribution: India (Sikkim, Arunachal Pradesh, West Bengal), China and Bhutan; on steep, highly inaccessible, evergreen montane rain forests at 1500–2200 m elevation.

Flowering: June-August. **Fruiting:** Not known
Conservation status: Endangered
Uses: Leaves used for thatching.

Arenga pinnata (Wurmb) Merr. Interpr. Herb. Amboin.: 119. 1917 ; S. Pie et al., Fl. China 23 : 151 2010 ; Plate 3.

Saguerus pinnatus Wurmb, Verh. Batav. Genootsch. Kunsten 1: 351. 1779.

Saguerus gamuto Houtt., Handl. Pl.-Kruidk. 1: 410. 1773., nom. inval.

Borassus gomutus Lour., Fl. Cochinch. 2: 618. 1790.

Arenga saccharifera Labill. ex DC., Bull. Sci. Soc. Philom. Paris 2: 162. 1800.

Gomutus rumphii Corrêa, Ann. Mus. Hist. Nat. 9: 288. 1807.

Sagus gomutus (Lour.) Perr., Mém. Soc. Linn. Paris 3: 142. 1824.

Gomutus saccharifer (Labill. ex DC.) Spreng., Syst. Veg. 2: 624. 1825.

Saguerus rumphii (Corrêa) Roxb. ex Ainslie, Mat. ind. 2: 225. 1826.

Caryota onusta Blanco, Fl. Filip.: 741. 1837.

Gomutus vulgaris Oken, Allg. Naturgesch. 3(1): 675. 1841.

Saguerus saccharifer (Labill. ex DC.) Blume, Rumphia 2: 128. 1843.

Arenga griffithii Seem. ex H.Wendl. in O.C.E.de Kerchove de Denterghem, Palmiers: 232. 1878.

Arenga gamuto Merr., Philipp. J. Sci., C 9: 63. 1914.

Vernacular Names: Jungly Nariel.

Single stemmed monocarpic palm about 10 m long. Stem massive, completely covered with black coarse leafsheath fibres and bristles and portion of persistent leafbases. Leaves pinnate, massive, to 10 m long; upper leaves ascending, petiole heavy, deep green in colour, rounded, to 1.5 m long; leaflets narrowly oblong, deep green above, whitish below; margins distinctly toothed, arranged in fascicles in 6 ranks, middle and upper leaflets auriculate at base, truncate at apices. Inflorescence terminal and axillary, basipetal in emergence; each 2-3 m long; peduncle stout, roundish, deep green, covered with many boat shaped fibrous bracts; pistillate inflorescence terminal; flower branches simple, pendulous, to 110 cm long; flowers basically in triads; male flowers oblong, sepals 3, orbicular, about 9 mm long; anthers apiculate; female flowers subglobose, sepals transversely ovate; petals ovate-cordate, 2.5 cm x 1 cm, fleshy, 1/4th connate; ovary subtrigonous, 3 ridged above; stigma trifid. Fruits acutely trigonous, obovoid, apically truncate, 4 cm x 3.5 cm, bright yellow when ripe, 3 seeded; seed narrowly ovoid, longitudinally flattened.

Distribution: India (Semi wild in Andaman Islands), Malaysia, Indonesia and Philippines.

Flowering: April-June. **Fruiting:** September-December.

Conservation status: Endangered

Specimens examined: Austine I, Maya Bunder, Andaman Islands, 19.10.2008, Linto 25017 (KFRI); BSI Garden, Howrah, 18.2.2008, Linto & Anand 24291 (KFRI).

Uses: The core of the stem yields huge quantity of edible starch, the terminal bud (cabbage) is eaten as vegetable, the sap collected from the peduncle of inflorescences after boiling is made into jaggary or fermented into toddy. The endosperm of the seed after soaking in lime water and boiling becomes edible. Leafsheath fibres are used for making brush, rope, mats etc.

Arenga westerhoutii Griff. Calcutta J. Nat. Hist. 5: 474. 1845; S. Pie et al., Fl. China 23:151: 2010.

Saguerus westerhoutii (Griff.) H.Wendl. & Drude in O.C.E.de Kerchove de Denterghem, Palmiers 256: 1878.

Solitary, monocarpic with stem about 9-12 m tall, 50-60 cm diameter, dark gray in colour; upper part of the stem with persistent leafsheaths. Leaves pinnate, 8-10 m long, slightly ascending; petiole 1-1.8 m long; rachis 3- 4 m; leaflets linerar, regular with ear at base, bifarious, deflected in one plane, often with drooping apices, narrowly oblong, upper surface green, grey to light brown below, 60- 80 cm long, 2.5 cm broad at middle. Inflorescence to 3 m, terminal and axilary, basipetal in emergence; male rachillae 60–70, to 60 cm; simple, mostly pendulous, flower clusters basically triads. Male flowers oblong, about 1 cm long, sepals 4–6 mm; petals 20–25 mm, stamens numerous, 200 - 300; filaments shorter than corolla; anthers aristate; female rachillae ca. 40, 80–120 cm; female flowers to 10 mm;

sepals ca. 5 mm; petals ca. 10 mm. Fruit semiglobose, 3 seeded, faintly 3 angular, 3.5 cm x 2 cm; seed convex, bifaced, endosperm horny.

Distribution: India, Malaya Peninsula, Burma.

Flowering: March-May. **Fruiting:** Auguest-October.

Conservation status: Endangered

Specimens examined: Amboli, Dibang Valley, Arunachal Pradesh, 9.4.1999, Baumik 2352 (BSI Shillong); Angolin, Dibang Valley, Arunachal Pradesh, 27.8.2000, Baumik 3292 (BSI Shillong); Glow village, Lohit Dist., Arunachal Pradesh, 10.12.1969, Joseph 48567 (BSI Shillong); Kameng, 26.11.1970, Rao 50688 (BSI Shillong); Chinnhang, Tirap, 27.6.1961, Deb 26197 (BSI Shillong); Lohit, Arunachal Pradesh, 13.11.1957, Rolla Rao 10563 (BSI Shillong); Heyuliang, Lohit, Arunachal Pradesh, 22.11.1957, Rolla Rao 10765 (BSI Shillong); Kothang, Tirap, Arunachal Pradesh, 25.6.1961, Deb 26099 (BSI Shillong); Hoonly, Lower Dibang valley district, Arunachal Pradesh, 09.05.09, Linto 25035 (KFRI).

Arenga wightii Griff. Calcutta J. Nat. Hist. 5: 475. 1845 and Palms Brit. E. Ind.: 167, t. 235 E (1850); Becc. & Hook. f., Fl. Brit. India 6:422.1892; T. Cooke, Fl. Bombay 2: 314. 1907; C.E.C Fischer in Gamble, Fl. Pres. Madras 1558. 1928; Sharma et al., Fl. Karnataka 293. 1984; Mohanan, Fl. Quilon Dist. 426. 1984; Ramach. & V.J. Nair, Fl. Cannanore Dist. 489. 1988; Vajr., Fl. Palghat Dist. 526. 1990; Antony, Syst. Stud. Fl. Kottayam Dist. 412. 1989; M. Mohanan & Henry, Fl. Thiruvanthapuram 490. 1994; Subram., Fl. Thenmala Div. 406. 1995; Sasidh. & Sivar., Fl. Pl. Thrissur For. 478. 1996; Sasidh., Fl. Shenduruny WLS 351. 1997; Sivar. & Mathew, Fl. Nilambur 742. 1997; Sasidh., Fl. Periyar Tiger Reserve 467. 1998; Renuka, Palms Kerala 15. 1999; Ramaswamy et al., Fl. Shimoga Dist. 632. 2001; Sasidh., Fl. Parambikulam WLS 361. 2002; Mohanan & Sivad., Fl. Agasthyamala 742. 2002; Anil Kumar et al., Fl. Pathanamthitta 518. 2005. Plate 4.

Saguerus wightii (Griff.) H.Wendl. & Drude in O.C.E.de Kerchove de Denterghem, Palmiers: 256 (1878).

Vernacular names: Kattuthengu, Malanthengu, Alathil thenga (Mal.), Alam panei, Ala panai, Kattu thengai (Tam.), Dhadashi (Kan.).

Monoecious, solitary hapaxanthic palm. Stem to 10 m high and to 30 cm diameter, densely clothed above with fibrous remains of leaf sheaths. Sheaths covered with black hairs often extended beyond the petiole to form a ligule eventually disintegrating into a mass of black fibres. Leaves 4-7 m long; petiole 1-1.15 m long; leaflets dark green above, white beneath, 100 x 5 cm, linear ensiform, apical ones often unequally 2 lobed, toothed in the upper half, confluent and obconic, bases 2 auricled, the lower lobe up to 5 cm long, obliquely overlying the midrib, the upper shorter. Inflorescences pleonanthic, interfoliar, bursting through the leaf sheaths, basipetal in emergence, pendulous, about 1.2 m long, peduncle to 60 cm long, quite concealed by the sheathing lacerate spathes rachillae pendulous, massive; flowers unisexual, triad of two male and a middle female flowers; male flowers petals and sepals rounded, imbricate, coriaceous; stamens numerous; filaments short; anther linear, connective prolonged into a point; pistillode absent; female flowers solitary in a shallow bilobed cup, sepals distinct, rounded, coriaceous, imbricate; petals connate basally, valvate, triangular distally; staminodes 0; ovary globose, trilocule; ovule one in each cell, inserted adaxially at the base, hemianatropous; stigmas 3. Fruits depressed globose, 2.5 cm long, 3.8 cm wide, seed with apical stigmatic regions, epicarp smooth, dull coloured, mesocarp fleshy, filled with irritant needle crystals, endocarp not differentiated; endosperm homogenous; embryo lateral.

Distribution: Peninsular India (W. Ghats). Ever green forest at 800-1000m elevation.

Flowering: April -June. **Fruiting:** October-December.

Conservation status: Least Concern

Specimens examined: Kannikatti, Thinnavelly, 19.3.1917, S. Coll. M.H. Acc. No. 52662, (MH); Nilgiri, 1886, leaf, Gamble, 18273 (MH); Lower Kodayar, Vallachithodu, Kanyakumari, 23.3.1979, fr., Henry 61532 (MH); Nilgiris, 1886, Acc. No. 52664, leaf, Gamble (MH); Chandanathodu, Way to Kannoth, Cannonore, 4.11.1965, Ellis 28431 (MH); Vatttapara to Palakayam, Palakkad, 29.5.1979, Vajravelu 62870 (MH); Manjeri, Malappuram , 28.2.1997, fr., Ellis 33621 (MH); Forest Near Bonacaud Estate, Thiruvananthapuram, 2.10.1973, fr., Joseph 44526 (MH).

Uses: Leaves are used as thatch. Sap from the peduncle is fermented to make toddy.

Arenga obsutifolia Mart. Hist.Nat. Palm III, 191, t. 147, 148 -161; Miq. Fl. Ind. Bat. III, 36; Hook. Fl. Brit. Ind. VI, 421. Plate 3.

Saguerus langbak Blume, Rumphia 2: 131 (1843)

Gomutus obtusifolius Blume, Rumphia 2: 131 (1843), nom. inval.

A large clustered clustered stems, slender and tall, 15 m. long; leaf sheaths only persist for a short distance underneath the crown; leaflets in several planes, regularly arranged, evenly distributed; pinnae ensiform with more or less revolute to undulate margins, dark lustrous green above and mealy below, distal margins are jaggedly toothed, bases unequally auriculate. Inflorescence monoecious with flowers grouped in sympodial clusters of three, the clusters are composed of one female flower flanked by two male flowers; staminate inflorescences 0.8–1.0 m; stamens numerous, connective yellow, narrow; filament short; corolla is smooth and fleshy purplish; pistillate inflorescence not seen; fruits oblong turbinate to ellipsoid fruits about 4.5 cm long and 3 cm wide; apex rounded, adorned with three lines that radiate along the middle of the carpels; longer than wide; at maturity yellowish green; perianth black; carpel keels absent; locules separated by mesocarp; stigma remnant narrow, with 3 slits;

seed elongate, with rounded keel, funicular scar conspicuous, light colored.

Distribution: India (Arunachal Pradesh) Thailand, Java, Peninsular Malaysia; lowland evergreen forests or secondary forest, to 500m elevation.

Flowering: April – June **Fruiting:** not known

Uses: Leaves are used as thatching material.

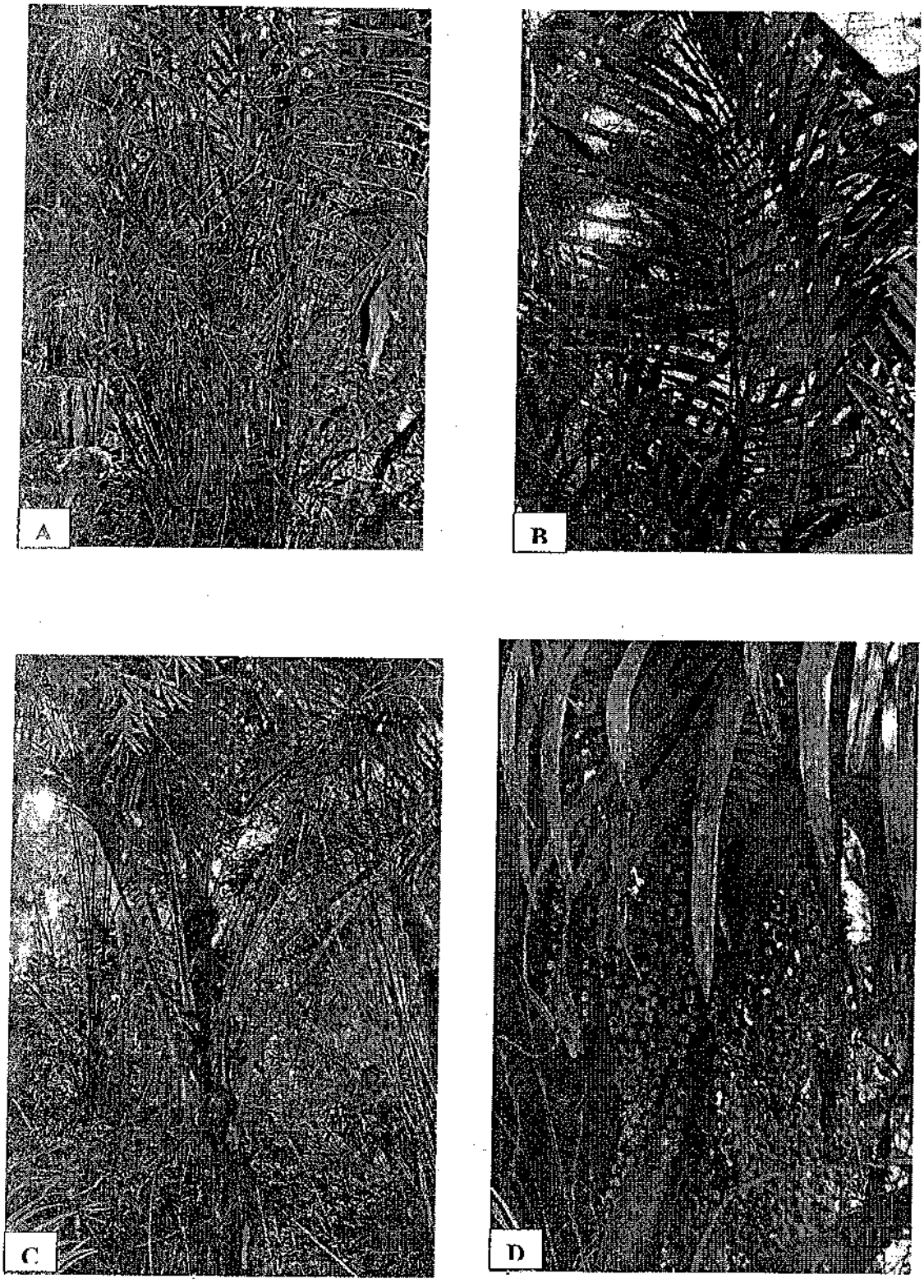


Plate 3. *Arenga pinnata.* A. Habit B. Leaf
Arenga obsutifolia C. Habit B. Famale Inflorescence

Bentinckia A. Berry in Roxburgh, Fl. Indica (edition 2) 3: 621. 1832 .
Keppleria Martius ex Endlicher, Genera Plantarum 251. 1837.

Moderate, solitary, unarmed, pleonanthic, monoecious palms. Stem moderate, closely ringed with leaf scars, brown. Leaves pinnate, somewhat arching to spreading, becoming pendulous, neatly abscising; sheaths thick, striate, tubular, forming a conspicuous crownshaft; petiole very short, stout, adaxially channelled, abaxially rounded; rachis elongate; leaflets single-fold, basal adaxially, rounded abaxially; leaflets single–fold, basal leaflets sometimes united, alternate, lanceolate, acute or acuminate, tips bifid, with small, brown scales on both surfaces, and long, pale ramenta near the base adaxially, transverse veinlets not evident. Inflorescences infrafoliar, branched to 3 orders basally, fewer distally, somewhat pendulous at anthesis; peduncle very short, dorsiventrally flattened; prophyll and peduncular bract inserted close together at base of peduncle, both caduceus, tomentose; prophyll tubular, rather wide, 2-keeled laterally, tapering slightly to a blunt tip; splitting abaxially; peduncular bract like the prophyll but beaked and lacking keels; rachis longer than the peduncle; bearing rather distant, spirally arranged, short sometimes pointed bracts subtending braches and rachillae, glabrous except for a dense tuft of short hairs in bract axils; rachillae rather stiff, moderate, tapering, bearing spirally arranged, low, rounded bracts subtending triads of flowers nearly throughout, a few paired or solitary staminate flowers distally; flowers borne in vertical, laterally compressed pits, inner surfaces of pits densely hairy; floral bracteoles about equal, shallow, rounded. Staminate flowers slightly asymmetrical, sepals, distinct, scarcely imbricate, membranous; petals 3, asymmetrical and angled; stamens 6 those opposite the sepals usually shorter than those opposite the petals, anthers elliptic to oblong, basifixed, the connective very short, latrorse; pollen elliptic, monosulcate, with finely reticulate, tectate exine; pistillode ovoid with expanded capitates tip when fresh, as long as the stamens in bud. Pistillate flowers more or

less symmetrical; sepals 3, distinct, imbricate, petals 3, broadly imbricate with very briefly valvate apices; staminodes 3-6, awl-shaped or narrowly deltoid; gynoecium ellipsoidal, asymmetrical, unilocular but vestigial locules evident, uniovulate, stigmas 3, recurved, papillose, ovule pendulous, probably hemianatropous. Fruit globose-obovoid, black or purplish at maturity, with stigmatic remains near the base; epicarp smooth but drying dimpled, mesocarp fleshy with sclerosomes, endocarp operculate, thickish. Seed shining brown, conspicuously grooved abaxially and laterally with raphe branches ascending adaxially; endosperm homogeneous; embryo basal.

Distribution: Two species, one in Tranvancore, India and one in the Nicobar Islands.

Notes: - The genus is so far reported from the Western Ghats and Nicobar Islands; *B. condapanna* must be regarded as an ancient relict.

Key to the species

1a. Stem slender, 10 m long, flowering branches light pink around pits, ripe fruits deep scarlet; Southern India.....*condapanna.*

1b. Stem robust, 20 m long, flowering branches yellowish white, ripe fruits deep brown; Nicobar Islands..... .....*nicobarica.*

Plate 4. ***Arenga wightii.*** **A. Habit B. Infructescence**

Bentinckia condapanna **C. Habit**

Bentinckia condapanna Berry & Roxb., Fl. Ind. 3:621.1832; Hook. f., Fl. Brit. India 6:418.1892; Gamble, Fl. Pres. Madras 1555 (1085). 1931; Mohanan, Fl. Quilon Dist. 426. 1984; M. Mohanan & Henry, Fl. Thiruvanthapuram 491. 1994; Sasidh., Fl. Shenduruny WLS 351. 1997; Sasidh., Fl. Periyar Tiger Reserve 467. 1998; Renuka, Palms Kerala 157. 1999; Mohanan & Sivad., Fl. Agasthyamala 743. 2002; Anil Kumar et al., Fl. Pathanamthitta 518. 2005 ; Plate 4.

Vernacular Names: Kattukamuku; Parapakku (Mal.)

Solitary, unarmed, pleonanthic, monoecious palm. Stem annulate, 6-10 m high, 15 cm diameter, leaf scars brown, annular. Leaves 1-1.5 m long, pinnate, somewhat arching to spreading, becoming pendulous, neatly abscising, sheaths thick, striate, tubular forming a conspicuous crown shaft. Petiole stout, short, adaxially channelled; rachis elongate, angled adaxially; leaflets 30-40 pairs, basal leaflets sometimes united, alternate, lanceolate acute, tips bifid with small brown scales on both surfaces, long pale ramenta near the base adaxially, along ribs adaxially. Inflorescence infrafoliar, completely covered with two bracts, branched to 3 order basally, somewhat pendulous at anthesis; peduncle very short, dorsi-ventrally flattened; rachillae rather stiff, tapering, being spirally arranged, triads of flowers; flowers borne in vertical, laterally compressed pits, inner surface of pits densely hairy; staminate flowers slightly asymmetrical, sepals distinct, scarcely imbricate; petals asymmetrical; stamens 6, those opposite the sepals usually shorter than those opposite the petals; the filaments awl-shaped, gynoecium ellipsoidal, asymmetrical, unilocular but vestigial locules evident, uniovulate; stigmas 3, recurved, papillose. Fruit globose-ovoid, bright chocolate coloured when ripe, 1.3-1.5 cm in diameter, seed shining brown, conspicuously grooved adaxially and laterally, endosperm homogenous, embryo basal.

Distribution: Endemic to India (Southern parts of W. Ghats).

Flowering and fruiting: Throughout the year.

Conservation status: Vulnerable

Specimens examined: Chenmungi, Thiruvananthapuram, 19.5.1979, fr., Mohanan 61877 (MH); Western slope of Agasthyamalai, Thiruvananthapuram, 6.10.1973, fr., Joseph 44639 (MH); Ponnambalamedu, Quilon, 15.12.1981, fr., Mohanan 72826 (MH); Manjanamparai, 30.5.1963, fr., Henry 16383 (MH); Way to Pothigay, Agasthyamalai, 21.4.1992, fr., Gopalan 99354 (MH); Way to valve house, upper Kondayar, 7.8.1977, fr., Henry 49651 (MH); Perumalmalai, 28.8.1967, fr., Thanikaimuni, 1039 (MH).

Uses: This species can be grown as ornamental palm in large and small gardens in the coastal areas of India. It is susceptible to drought.

Bentinckia nicobarica (Kurz) Becc. (Kurz) Becc., Ann. Jard. Bot. Buitenzorg. 2: 165. 1885; Becc. & Hook. f. in Hook f., Fl. Brit. India 6: 418. 1892. Brandis Ind. Trees 647. 1906; Plate 5.

Orania nicobarica Kurz in Journ. Bot. 13: 331, t.171, f. 19 – 25. 1875.

Vernacular Names: Hilua (Nico.)

Solitary, pleonanthic, monoecious palm. Stem columner, distinctly annulate, to 20 m long, to 40 cm in diameter near base; crownshaft cylindrical, green, about 1 m long. Leaves ascending to arching, about 2.5 m long; leaflets closely packed, linear-lanceolate, acuminate, alternate to subopposite in adult trees; laterally jointed in younger plants, 50-60 cm long with conspicuous midnerve on upper side; terminal leaflets jointed. Inflorescence infrafoliar, decompound; prophyll and peduncular bract large, green, bicarinate, spatuliform; flower branches greenish yellow; ultimate rachillae slightly inserted at the point of attachment; flowers bracteolate; female flower sepals orbicular, imbricate; petals 3, orbicular, obtuse, leathery, light brown in colour, each about 3 mm long. Ripe fruits subglobose, deep brown

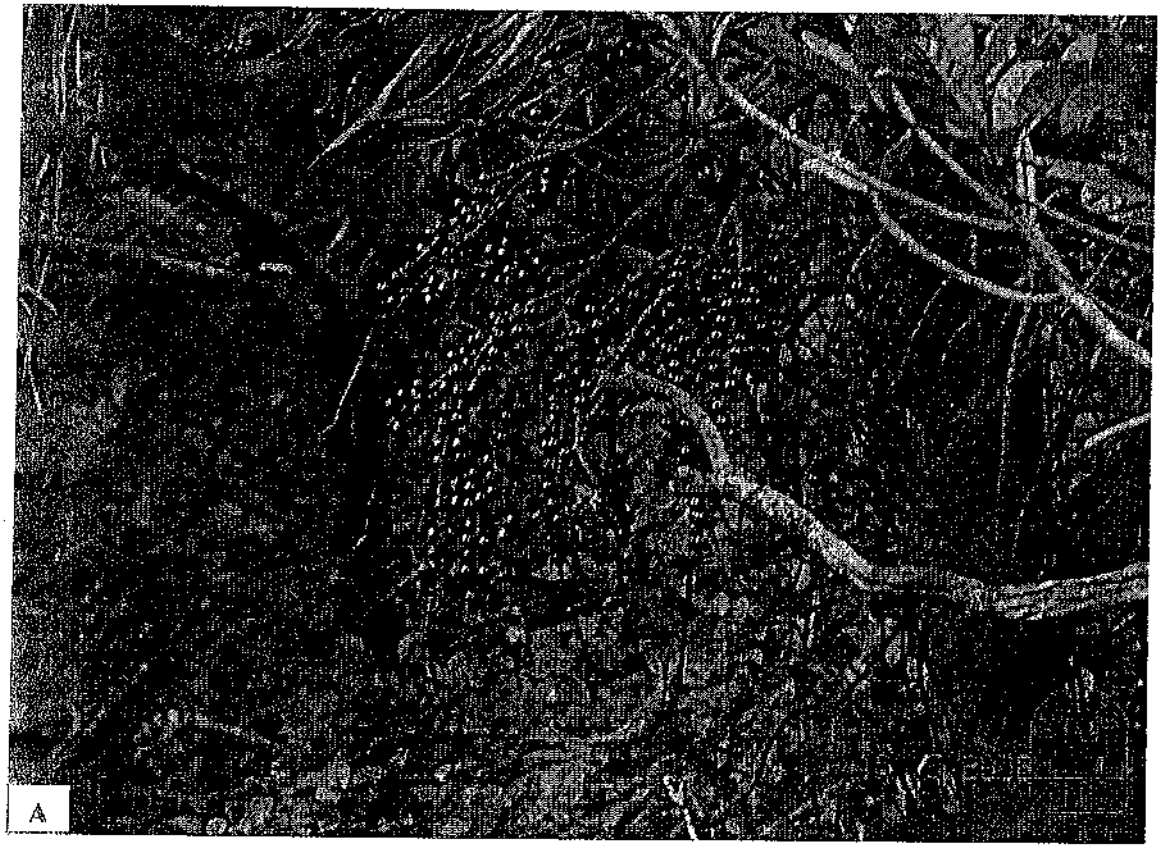
in colour; measocarp fibrous; endocarp brittle; seed ovoid 8-9 mm long; endosperm white, homogeneous.

Distribution: Endemic to India (Nicobar Islands).

Flowering: April - September. **Fruiting:** November - March.

Conservation Status: Critically Endangered.

Uses: This species can be grown as avenue trees along the path ways, drive ways etc. It is also susceptible to draught.



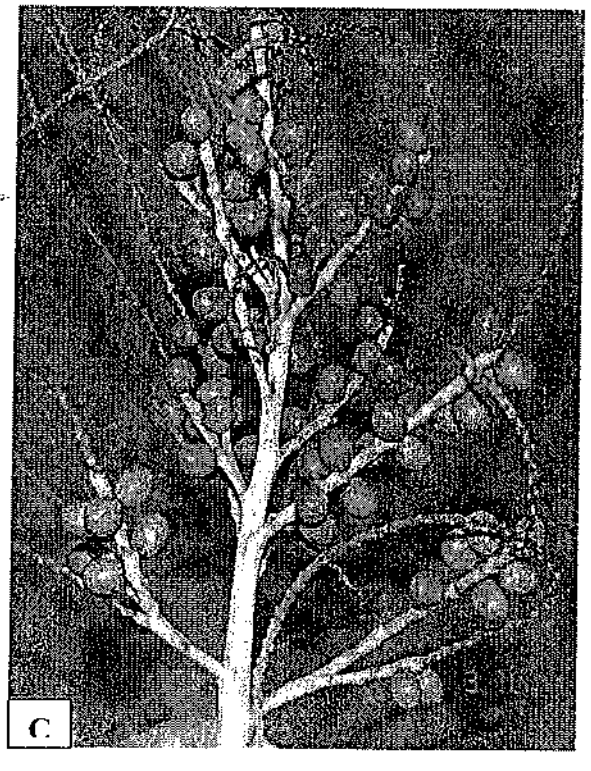


Plate 5. ***Bentinckia condapanna*** **A. Immature infructescence**

Bentinckia nicobarica. **A. Habit B. Infructescence**

Borassus L., Sp. Pl.: 1183 1753; Roxburgh., Pl.Coromandel 98: 50 1795; Kunth., Enum Pl. 221 1841; Brandis, Forest Fl. N.W. India: 544 1874; Blatter Palms Brit. East Ceylon 930 1912; Uhl & Dransfield Genera Palmarum: 222 1987 Zoysa Fl. Ceylon 48 2000.

Massive, robust, solitary, armed, pleonanthic, dioecious, tree palms. Stem grey with well defined leaf scars, base often enlarged, usually have a large mound of roots at the base. Leaves strongly costapalmate; between 16 and 28 in the crown, leafsheath open and split at the base to give a central triangular cleft; petiole robust, armed or unarmed, deeply channelled adaxially, rounded abaxially, surfaces smooth to minutely rough, colour varying from green to yellow or black; blade suborbicular to flabellate, the lamina is split to one third or half of its radius, with up to 130 induplicate leaflets, leaflet apices may be acute or cuspidate, bifid or entire. Inflorescences interfoliar, shorter than the leaves, staminate and pistillate forms superficially similar, staminate inflorescence branched to 2 orders; peduncle very short; prophyll 2-keeled, with long tubular base, limp short, pointed, variously split apically; rachis also short; first order branches long, flattened, each bearing a prophyll and branched digitately into several rachillae; rachillae large, catkin like, elongate, bearing spirally arranged, imbricate bracts, connate laterally and distally to form large pits, each containing a reflexed cincinnus of ca. 30 staminate flowers. Staminate flowers less than a centimeter long, each subtended by a long membranous bracteoile; sepals 3, asymmetrical, connate only basally, distinct lobes keeled, elongate, membranous, stiff; corolla with a long stalk like base and 3 short, rounded lobes, ridged adaxially; stamens 6, filaments short, triangular, anthers medifixed, elongate, latrorse; pistillode small, conical, varying size. Pistillate inflorescences typically spicate, unbranched or with a single first order branch; peduncle short; prophyll tubular, pointed, 2-keeled, split ventrally about half of its length. Peduncular bracts few; rachilla massive, bearing large copular bracts, the first few empty, the

subsequent each subtending a single pistillate flowers large, each bearing 2 lateral cuplike, rounded, leathery, bracteoles; sepals 3 distinct, imbricate, thick, rounded; petals 3, similar to sepals; staminodes triangular, connate basally in a low cupule, sterile anthers present or not; gynoecium rounded, tricarpellate, with a central, basal septal nectary, stylar region hemispherical, stigma a low knob, carpels each with a basal, orthotropous ovule, and 2 lateral bodies, perhaps vestigial ovules. Fruit large, rounded, with a coriaceous epicarp, colour varies from green to orange or black, mesocarp pulpy and fragrant, with many longitudinal fibres, endocarp comprising 3 hard bony pyrenes; seed shallowly to deeply bilobed, pointed, basally attached; endosperm homogeneous and bony with a small central hollow; embryo apical.

Distribution: The genus is one of the world's most widely distributed palm genera like *Calamus* L. or *Phoenix* L.; the exact natural distribution if the genus is not identified due to its long history of cultivation. Five species have been recognized occur in Africa, Madagascar, north eastern Arabia, through India and Southwest Asia to New Guinea and Australia. In India, only one species Borassus flabellifer is represented.

Notes:- The name of the genus originated from the greek word *'borassos'* refers to ' inappropriately', to the date palms. The genus can be recognized by the large stiff costapalmate leaves with both adaxial and abaxial hastulae, and by the large irregular teeth on the petiole.

Borassus flabellifer L. : Sp. Pl.: 1187. 1753. Mart., Hist. Nat. Palm. 3: 221. Pl. 108, 121, 162. 1823–1853. Hook. f., Fl. Brit. India 6: 482. 1892 ; Dalzell & Gibson, Bombay Fl. 278 :1861; C. E. Parkinson, Forest Fl. Andaman Isl.: 268 1923; Plate 6.

Borassus flabelliformis L.in J.A.Murray, Syst.Veg.ed.13:827.1774.
Lontarus domestica Gaertn., Fruct.Sem.P1. 1:21. 1788
Borassus tunicatus Lour., Fl. Cochinch. 2: 618.1790
Pholidocarpus tunicatus (Lour.) H.Wendl. in O.C.E.de Kerchove de Denterghem, Palmiers: 235.1878.
Borassus sundaicus Becc., Webbia 4: 321.1914.

Vernacular names: Nungu (Tamil), Pana Nangu, Karimpana (Malayalam) Tateningu (Kannda), Tari (Hindi), Taadfali (Gujarathi)

Solitary, dioecious, pleonanthic palm. Stem 10-20 m tall and to 60 cm in diameter, with deep grey or black in colour with distinct annulate leaf scars. Leaves costapalmate, rigid; crown more or less roundish with evenly projecting leaves, leaf base splits at base; petiole about 1-1.3 m long, 4-5 cm wide at mid point, robust, bright yellow, semi-terete, the edges armed with hard, horny spines; costa 65 - 110 cm long; adaxial hastula conspicuous, abaxial hastula rudimentary; lamina radius to 150 cm maximum, dense adaxial and abaxial-indumentum on the ribs of some juvenile leaves, leaflets - 62, 4.2 - 9.5 cm wide, apices acute and entire or splitting longitudinally with age, shortest leaflet 13 - 39 cm long, leaf divided to 30 - 100 cm; Staminate inflorescences branched to two orders, peduncle sheathed with open bracts, upper subtending branches terminating in 1 – 3 rachillae; rachillae green to brown and catkin-like, 23 - 50 cm long and 1.8 - 2.5 cm diameter, rachilla bracts forming pits containing a cincinnus of 4 - 7 flowers. Pistillate inflorescences usually spicate, sparingly branched, flower-bearing portion 12 - 85 cm long with 4 – 20 solitary flowers arranged spirally; male flowers exserted from pits

individually, 0.3 - 0.6 cm long, bracteoles 0.4 - 0.7 cm long, 0.1 - 0.3 cm wide, calyx 0.3 cm long, 0.15 cm wide and shallowly divided into three sepals, narrow cuneate, tip inflexed, imbricate; petals shorter than the sepals, imbricate, petal lobes 0.1 long, 0.1 cm wide; stamens 6 with very short filaments, 0.2 cm long, 0.03 cm wide, anthers, 0.05 cm long, 0.03 cm wide, linear; pistillode minute; female flowers, globose, 3 cm long, 3 cm wide, bracteoles large, 2 cm in diameter; sepals reniform, imbricate; petals smaller; staminodes 6; ovary globose, subtrigonous, entire, 3-4 celled, ovules basilar, erect, stigmas 3, sessile, recurved. Fruits massive, 8 x 13 – 7.5 x 16 cm, subglobose, rounded or flattened at the apex, produced inside the persistent perianth segments; green when immature, dark purple when ripe, turning black; epicarp coriaceous, mesocarp fibrous, with thick yellow pulp; pyrenes 1 - 3, 6 - 10 cm x 4.4 – 8 cm x 3.1 - 4.6 cm, somewhat bilobed; young endosperm juicy and edible.

Distribution: the species is distributed in South and South east Asia. Widely distributed in India; common in home gardens in Kerala, Tamil Nadu and Andhra Pradesh; in low lands, paddy fields, flat disturbed areas, occasionally in small hills to 600 m elevation. Also found in other countries like Bangladesh, China, Laos, Myanmar, Sri Lanka, Thailand, Indonesia, Malaysia and Vietnam.

Flowering: March - April. **Fruiting**: July - September.

Conservation Status: Least Concern.

Specimens examined: Maharashtra, 12.05.1960, John Cherian 68256 (CAL); Indravati Tiger Reserve, Batar, Madhya Pradesh, 27.05.1987, Anand Kumar 16369; (CAL); Agarthala, 12.4.1921, Debbarman 1237 (CAL); Ramanathapuram, Coimbatore, Tamil Nadu, 3.4.1973, male fl., Chandrabose 39258 (MH); Sayalgudi, Ramanathapuram, Coimbatore, Tamil Nadu, 21.6.1978, Nair 57392 (MH); Gangineni, Andhrapradesh, 12.3.1985, male fl., Venkanna 5572

(MH); Varangal, Andhrapradesh, 6.4.1988, Ramarao & Ravishankar 86111 (MH).

Uses: One of the most economic palms of India. It yields sweet sap from the peduncle which is converted into jaggery (Gur) or fermented into toddy. Numerous village level artisans are thriving on this jaggery industry. The other parts of the tree are also useful. Mature stem is hard and termite resistant, therefore used in the village for making roof beams of thatched and semi-permanent masonary houses, stem pieces are also used as fuel in brick kiln. Unopened Palmyra leaves are soft, therefore used for making baskets and various other fancy handicrafts. In South India in religious ceremonies and marriages ripe fruits are used as sacred objects just as green coconuts are used in the Eastern India.

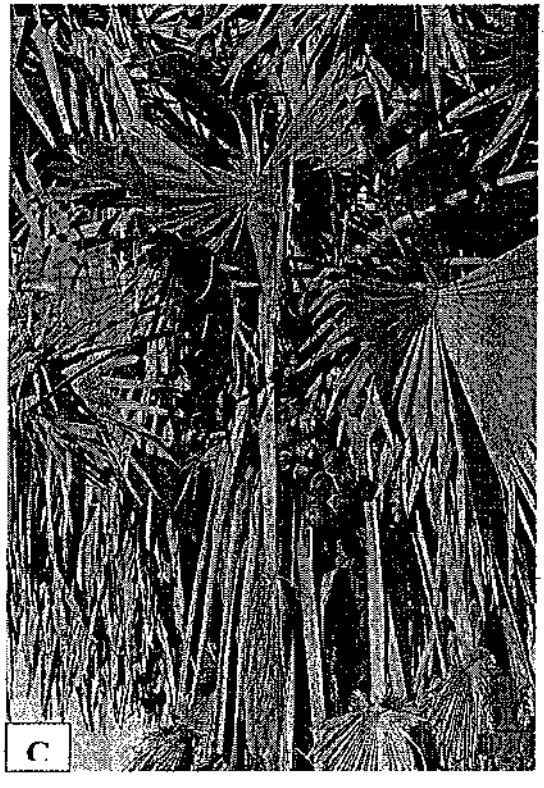


Plate 6. ***Borassus flabellifer*** **A. Habit B. Leafbases showing horny black spines C. Infructscence**

Calamus L., Sp. Pl. 325. 1753. Gen. Pl. ed 5. 152.1754; Becc. & Hook. f. in Hook. f., Fl. Brit. Ind. 6: 436. 1894; Becc. in Ann. Roy. Bot. Gard. Calc. 11: 73. 1908; Talbot, For. Fl. Bomb. Sind 2:555. 1911; Furtado in Gard. Bull. Sing. 15:32-265. 1956; Hutch., Fl. W. Trop. Afr. 3:166.1968; Dransfield, Man. Rattans of Mal. Peninsula, 1979.

Solitary or clustered, spiny, acaulescent, erect or high climbing, pleonanthic, dioecious, rattan. Leaves pinnate, rarely bifid, sometimes with a terminal cirrus; sheath splitting in acaulescent species; ocrea often present, papery and disintegrating, or coriaceous; knee present in most climbing species; flagellum often present in species lacking cirri, very rarely a small vestigial flagellum present in cirrate species; petiole absent or well developed, flattened adaxially, rounded abaxially, variously armed; rachis often armed with distant groups of reflexed grapnel spines; cirrus when present armed with scattered or grouped reflexed spines; leaftlets few to very numerous, single-fold, entire or very rarely praemorse, linear to lanceolate or rhomboid, regularly arranged or irregular, grouped, sometimes fanned within the groups, concolorous or discolorous, variously bearing hairs, bristles, spine, and scales. Inflorescences - male and female superficially similar, often ending in a long flagellum, bracts always tubular at the base, variously armed; partial inflorescence usually much longer than the subtending bract, very rarely shorter. axillary but adnate to the internode and leaf sheath of the flowing leaf, male flowers with small cup- shaped calyx, usually with three well defined lobes, corolla split in to 3 petals, stamens 6, very shortly epipetalous, pistillode minute. Female flower usually larger than male; calyx shallowly three lobed; corolla with 3 petals; staminodes 6, joined basally to form a cup like ring; ovary tipped with 3 stigmas, covered with reflexed scales, locules 3 with one ovule in each. Fruit spherical, ellipsoid to conical - ovoid, usually 1 seeded, rarely consistently 2 or 3-seeded, stigmatic remains apical; covered vertical rows of reflexed scales. Seed with thick sweet, sour, or astringent sarcotesta, inner part of the seed rounded, grooved,

angled, or sharply winged, lateral. Seedling with fanshaped or bifid juvenile leaves.

Distribution: With about 370 species, *Calamus* is the largest plam genus. It has a very wide distribution, occurring in the humid tropics of Africa India, Burma, and South China through the Malay Archipelago to Queensland and Fiji, Sunda shelf area & New Guinea.

Key to the species

1a. Leaves ecirrate or with vestigial cirrus.....10
1b. Leaves cirrate.....2

2a. Leaflets more or less regular on rachis, linear-lanceolate, ensiform.....3
2b. Leaflets irregularly alternate on the rachis or in groups.....7

3a. Stem solitary.....4
3b. Stem cluster forming.....5

4a. Spines arranged in comb like series, basal part of the stem not erect.....*andamanicus*
4b. Spines not arranged in comb like series, basal part of the stem erect and distal portion limbing.....*semierectus*

5a. Sheath completely covered by dense reddish brown pines....*dilaceratus*
5b. Spines black, sheath not completely covered by spines.....6

6a. Leaflets remotely sub equidistant on rachis.....*nambariensis*
6b. Leaflets alternate, sub opposite.....*nagbettai*

7a. Leaflets irregularly alternate, not in groups; leaf sheath covered with Closely packed, bulbous-based, 5-10 mm long, non seriate spines.....*unifarius*
7b. Leaflets irregularly alternate and in groups; leaf sheath more or less smooth or armed with flattened subulate spines.....8

8a. Leafsheath more or less smooth on upper part, lower part infrequently armed with flattened subulate spines .....*khasianus*
8b. Leafsheath spines subulate, seriate to sub seriate, closely Packed.....9

9a. Entire plant dull green, fruiting perianth non pedicelliform .....*palustris*
9b. Entire plant shiny green, fruiting perianth pedicelliform.....*latifolius*

10a. Stem solitary or two stemmed.....11
10b. Stem cluster forming.....17

11a. Leaves about 1-1.2 m long, leaflets oblong or elliptic, six veined.....12
11b. Leaves more than 1.5 to 2.5 m long, leaflets linear lanceolate, 3 veined.....14

12a. Stem solitary or two stemmed, sheath dark green, covered with small tuberculate or broad based, solitary or jointed indumentum with blotches of pale indumentum .....*acanthospathus*
12b. Stem solitary, sheath glossy green.....13

13a. Fruit oblong, with distinct columnar beak.....*vattayila*
13b. Fruit globose, abruptly beaked.....*pseudofeanus*

14a. Stems when cut exudes milky latex.....*prasinus*
14b. Stems when cut does not exudes milky latex.....15

15a. Leaf sheath sparingly spiny, pale green, cilia on veins 2 cm Long.....*dransfieldii*
15b. Leaf sheath spiny, green, cilia on veins 1 cm long.....16

16a. Rachilla not twisted, fruit globose, 1.5 cm diameter, scales in 27 rows.....*delessertianus*
16b.Rachilla twisted, fruit oblate, 1x 0.5 cm, scales in 21 rows.....*neelagiricus*

17a. Leaflets grouped.....18
17b. Leaflets not grouped.....26

18a. Leaflet elongate, ensiform, solitary or in clusters.....19
18b. Leaflet lanceolate, in clusters.....20

19a. Leafsheath green with 3-4 cm long, broad based, black spines, longer spines in series.....*longisetus*
19b. Leafsheath yellowish, densely covered with flat, black, subulate spines arranged in oblique whorls.....*thwaitesii*

20a. Uppermost leaflets digitately grouped.....21
20b. Uppermost leaflets not digitately grouped.....22

21a. Uppermost leaflets digitate, about 6 in number at the summit, terminal leaflets not connate at base.....*brandisii*
21b. Uppermost leaflets digitate, about 4 in number, terminal leaflets connate at base.....*gracilis*

22a. Leaflets 6-12 in number, terminal leaflets connate at base.....23
22b. Leaflets more than 12 in number, terminal leaflets free at base.....24

23a. Terminal leaflets conspicuously connate at base.....*floribundus*
23b. Terminal leaflets slightly connate at base.....*kingianus*

24a. Leaflets lanceolate, distinctly grouped, irregular with 2-3 leaflets in each group.....*viminalis*
24b. Leaflets oblanceolate, in regular opposite groups of

2-5 leaflets in each group.....25

25a. Leaflets deflected from rachis in one plane, each 15-18 cm long, 10-15 mm broad.....*travancoricus*
25b. Leaflets narrowly lanceolate in opposite groups of 4 leaflets, each 10-13 cm long, 1.5-2 cm broad, deflected in different planes.....*rheedii*

26a. Leaves without petiole.....27
26b. Leaves with petiole.....30

27a. Leaves ending in a vestigial cirrus, fruit scales in 15 vertical rows, endosperm ruminate.....*basui*
27b. Leaves not ending in a vestigial cirrus, fruit scales in 21 vertical rows, endosperm not ruminate.....28
28a. Stem about 30 m long, with sheath about 2.5 cm in diameter, sheath densely covered with spines, spines green, interspersed with bristly spines, female flowering branches 13 cm long, fruit violet on ripening.....*pseudorivalis*
28b. Stem about 15 m long, with sheath 1-1.5 cm in diameter, not much covered with spines, spines yellowish, not interspersed with bristly spines, female flowering branches 8 cm, fruit straw yellow on ripening.....29

29a. Fruit globose, slightly broader, straw yellow coloured, scales with deep central channel.....*rotang*
29b. Fruit very broadly ovoid, fruit scales with brown margines, not channeled, violet on ripening..... *metzianus*

30a. Stem erect, leaf sheath without flagellum.....*erectus*
30b. Stem climbing, leafsheath with flagellum.....31

31a. Basal flagella transformed into shoots, rachis when cut exudes milky latex.....*lacciferus*
31b. Basal flagella not getting transformed into shoots, rachis when cut does not produce milky latex.....32

32a. Stolon present, 5-6 apical leaflet crowded together.....*stoloniferus*
32b. Stolon absent, apical leaflets not crowded.....33

33a. Leafsheath with strong heavily armed 6-7 m long flagellum, leaflets prominently single nerved on upperside, flowering branches 20-25 cm long.....*flagellum*
33b. Leafsheath with comparatively slender flagellum, leaflets prominently 3 or more nerved.....34

34a. Stem with sheath more than 2 cm diameter, leaf more than 1.2 m Long.....35
34b. Stem with sheath to 2 cm diameter, leaf to 1.2 m long.....40

35a. Leafsheath with brown tomentum, spines at the mouth longer.....36

35b. Leafsheath without brown tomentum, spines at the mouth not longer.....39

36a. Petiole and rachis with yellow needle like spines, spines to 3 cm long, mouth of the sheath with one or two longer spines .....*pseudotenuis*
36b. Petiole and rachis devoid of yellow needle like spines, mouth with many long spines.....37

37a. Spines on the sheath to 2.5 cm long, sometimes forming half whorls, longer spines at the mouth of the sheath to 4 cm long.....38
37b. Spines on the sheath not arranged in half spirals, longer spines at the mouth of the sheath to 10 cm long.....*hookerianus*

38a. Terminal leaflets free at base, partial inflorescence rigid, pyramidate, spikelets gradually diminishing, fruit black, 1- 1.8 cm in diameter, endosperm ruminate.....*wightii*

38b. Terminal leaflets jointed at base, partial inflorescence not rigid, not pyramidate, not gradually diminishing, fruit violet, to 1cm in diameter, endosperm not ruminate .....*karnatakensis*

39a. Involucrophorum stalked.....*gamblei*
39b. Involucrophorum not stalked.....*lakshmanae*

40a. Leaf sheath with very few spines.....41
40b. Leaf sheath with numerous spines.....42

41a. Young leaf sheath green; endosperm ruminate .....*shendurunii*
41b. Young leaf sheath brownish violet, turns green on maturing; endosperm not ruminate.....*baratangensis*

42a. Leaf lets closely placed, rachis covered with greyish Indumentum.....*leptospadix*
42b. Leaflets not closely packed, rachis not covered with greyish indumentum.....43

43a. Primary bracts of the inflorescence forms long laminar appendage.....*guruba*
43b. primary bracts of the inflorescence does not form long laminar Appendage.....*tenuis*

Calamus acanthospathus Griff., Calcutta J. Nat. Hist. 5: 39. 1845; Becc., Ann. Roy. Bot. Gard. (Calcutta) 11: 283. 1908, & Appendix, P1. 105. 1913; Basu, Rattans in India Monogr. Rev. 126. 1992.

Palmijuncus acanthospathus (Griff.) Kuntze, Revis. Gen. Pl. 2: 733. 1891.

Calamus montanus T.Anderson, J. Linn. Soc., Bot. 11: 9. 1869.

Palmijuncus montanus (T.Anderson) Kuntze, Revis. Gen. Pl. 2: 733. 1891.

Calamus feanus Becc. in J.D.Hooker, Fl. Brit. India 6: 448. 1892.

Calamus feanus var. *medogensis* S.J.Pei & S.Y.Chen, Acta Phytotax. Sin. 27: 137. 1989.

Calamus yunnanensis var. *densiflorus* S.J.Pei & S.Y.Chen, Acta Phytotax. Sin. 27: 135. 1989., nom. inval.

Calamus yunnanensis var. *intermedius* S.J.Pei & S.Y.Chen, Acta Phytotax. Sin. 27: 137. 1989., nom. inval.

Calamus yunnanensis Govaerts, World Checklist Seed Pl. 3(1): 11. 1999.

Solitary, medium diameter rattan. Stem 10 m. long or more, with sheaths 2.5 cm in diameter, without sheaths 2 cm in diameter. Leaf ecirrate; sheath green, flagelliferous, heavily armed with spines; spines dimorphic, larger ones 2.5 cm long, base upraised, straight, triangular, interspersed with smaller ones, spines above the knee uniform, mouth of the sheath with longer spines, the sheath with lesser spines in mature portions; knee prominent with an oblique upraised portion just below; ocrea slightly developed, petiole absent in young leaves; rachis prickly on the upper surface, spines to 1 cm long, margins with long spines, upper portion of the rachis biconvex, with less spines; leaflets regular, sub opposite, 7 cm apart, with 7 veins, veins and margins bristly, terminal leaflets free. Male inflorescence flagellate; primary sheath not tightly sheathing, armed heavily with spines, spines to 1.5 cm long; partial inflorescence to 10 cm long;

secondary sheath funnel shaped; rachilla to 4 cm long, 2 cm apart. Female spadix decompound, elongate-flagellioform, erect, rather rigid; primary sheath tubular, closely sheathing, glabrous, the lowest about 20 cm long; partial inflorescence short, to 10-14 cm long; secondary sheaths tubular infundibuliform; rachis 3- 5 cm long, involucrophorum exert from its own spathe; involucre cup shaped, fruiting perianth pedicelliform. Fruit broadly ovoid, 1.8 x 1.2 cm; scales in 15 vertical rows, reddish brown or cinnamon, not channelled in the middle; endosperm sub-ruminate.

Distribution: India (West Bengal, Sikkim, Meghalaya, Assam, Arunachal Pradesh, Nagaland), Bhutan.

Flowering: April – May. **Fruiting:** Not known.

Conservation Status: Data deficient

Specimens examined: Ahey gang, Jan 1912, Toppin 6191 (CAL); Dzeleuke, Nagaland, 8.5.1994, male fl., Renuka & Vijayakumaran, 7079 (KFRI); Ahey gang, Jan 1912, Toppin 6191 (CAL).

Uses: Used in furniture industry. The cane is used for making cane bridges over the mountain streams. Distribution Arunachal Pradesh, or Assam, or Meghalaya, or Nagaland, or Sikkim, or West Bengal.

Calamus andamanicus Kurz, : J. Asiat. Soc. Bengal, Pt. 2, Nat. Hist. 43(2): 211. 1874; Becc. & Hook. f. in Hook.f., Fl. Brit. Ind. 6: 453. 1893; Becc., Ann. Roy. Bot .Gard. (Calcutta) 11: 385, Pl. 163, 164. 1908; C. E. Parkinson, Forest Fl. Andaman Isl.: 265 (1923); Basu, Rattans in India Monogr. Rev. 53. 1992; Renuka, Manual of the rattans of Andaman and Nicobar Isl. 30. 1995; B.K. Sinha., Fl. Great Nicobar Isl.: 460 (1999); Plate 7.

Palmijuncus andamanicus (Kurz) Kuntze, Revis. Gen. Pl. 2: 733. 1891.

Vernacular Names: Mottabeth.

Solitary, large diameter rattan. Stem 24 m long or more, with sheaths to 8 cm in diameter, without sheaths to 4.5 cm, straw-yellow when exposed. Leaf 4 m long, cirrate; sheath slightly pale yellow, turning

reddish brown, thick woody, with minute bristle like spines, spines upto 0.3 cm long, arranged in comb-like narrow crests, mouth of the sheath with spines to 1.2 cm long; knee present; ocrea indistinct; petiole very robust, upto 5 cm broad at the base, with small spines on the margins, often interspersed with a few smaller ones; rachis spiny along the margins and along the adaxial side at the distal end; leaflets 32 – 51 x 2.5 - 4cm, regular, midvein prominent, lateral veins bristly on the upper surface, midvein and two lateral veins bristly on the lower surface, cirrus with whorls of 4-7 black tipped claws. Inflorescence erect; male inflorescence 1.25 m long, panicled; primary sheath tubular, 8-10 cm long, slightly enlarged above, the upper ones longitudinally split, sparingly armed with prickles; partial inflorescence to 80 cm long, twice branched; rachilla 2-2.5 cm long, arched with 15-20 bifarious flowers on each side; female inflorescence flaglliferous or not, primary sheath not tightly sheathing, armed with spines to 0.6 cm long; partial inflorescence 30 cm long; rachillae 4-6 cm long, involucre cup-shaped. Fruit elliptic ovoid. 1.4 x 0.9 cm; scales in 17 vertical rows, brown with dark brown border, slightly channelled, having an appendage of 0.3 cm long at the apex; endosperm not ruminate.

Distribution: India (Andaman & Nicobar Islands). Endemic. In evergreen forests upto 260 m.

Flowering: November – December. **Fruiting:** April –May.

Conservation Status: Vulnerable

Specimens examined: Kalatang, South Andamans, 5.4.1988, fr., Renuka 4056 (KFRI); Tharmugali, Wondoor, 8.4.1988, fr., Renuka 4064 (KFRI); Wumberleygung, South Andamans, 2.4.1992, fr., Vijayakumaran 6639 (KFRI); Mannarghat, South Andamans, 1.4.1993, fr., Renuka & Vijayakumaran 7032 (KFRI); Baratang island, 1.5.1964. Thothatri 10846 (CAL); Sipighat, 25.11.1978, Basu 7067 (CAL & ANC); Kamorta, Nicobar Islands, 1875 Kurz (CAL); Nongmaigin, Manipur, 4.4.54, lf., Sinha 2206 (CAL); Ali musjid Hill

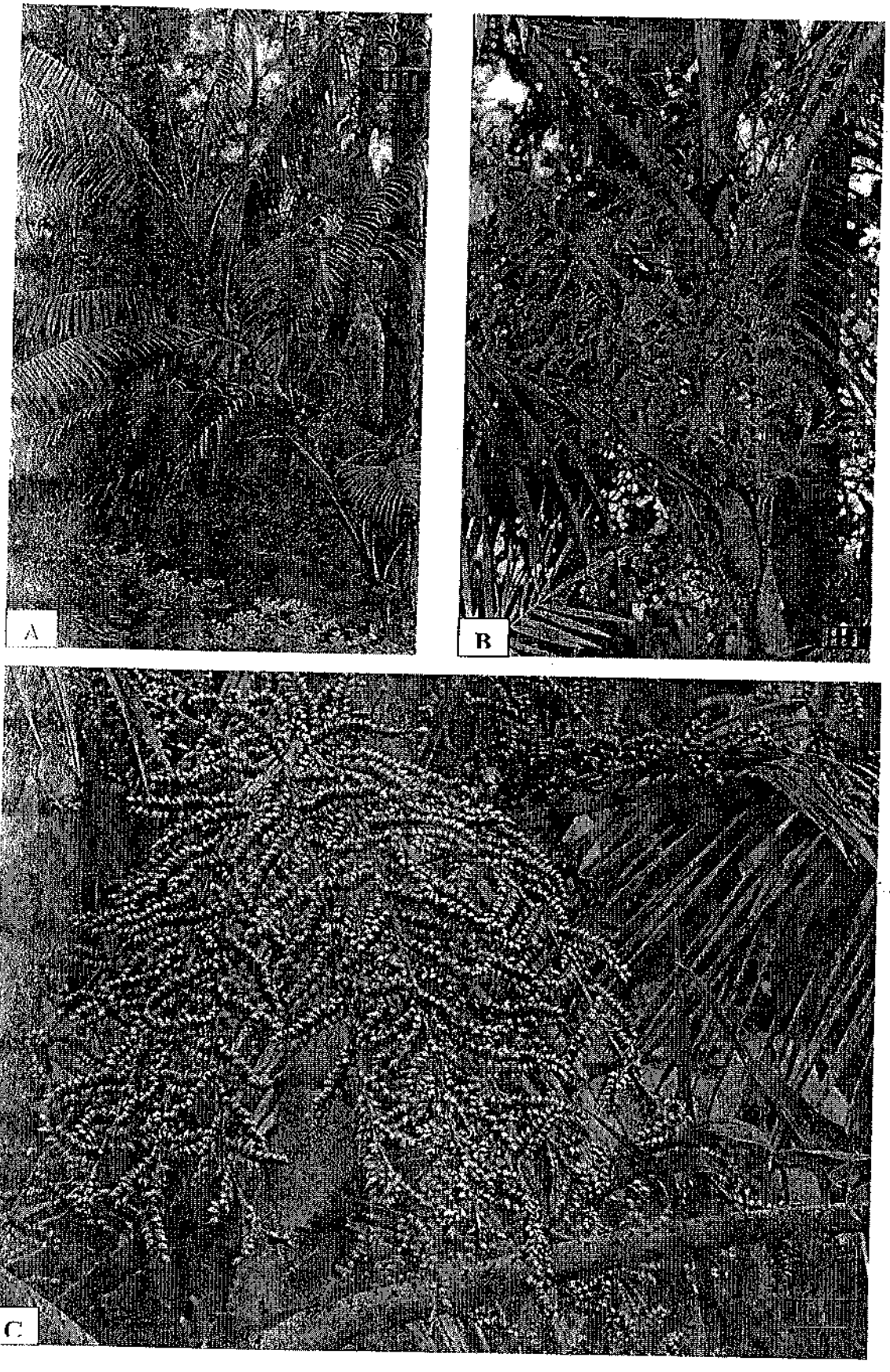


Plate 7. *Calamus andamanicus* A. Habit B. Male inflorescence C. Infructscence

Jungle, South Andamans, 14.10.1895, fl., Dr. King's collection Acc. 72656 (MH).

Uses: The radical leaves are employed for thatching. Extensively used in furniture industry; this is one of the most exploited rattan species from Andamans. Distribution Nicobar Islands, or Andaman Islands.

Calamus baratangensis *Renuka & Vijayak.* Rheedea 4: 141. 1994. *C. pseudorivalis* auct. non. Becc., 1908; Sensu Parkinson, Forest Flora of the Andaman. Isl. 265, 1921; Basu, Rattans in India Monogr. Rev. 90. 1992; Renuka, Manual of the rattans of Andaman and Nicobar Isl. 36. 1995; Plate 8.

Vernacular Names: Malay beth, Razi beth.

Clustering, medium diameter rattan. Stem 25 m long or more, with sheaths 2 cm in diameter, without sheaths 1.2 cm. Leaf 1 m long, ecirrate; sheath green, spiny or glabrous, spines when present brown or black, flat, short on the younger sheaths, to 2 cm long on mature sheath; knee prominent; ocrea slightly developed; petiole 14 cm long, margins armed with small spines to 0.3 cm long; rachis with a row of small spines underneath, spines to 0.5 cm long; leaflets 30-56 x 2.5 - 4 cm, gradually becoming smaller towards the tip, basal part of the terminal pair united, dark green, linear lanceolate, regular, midvein prominent. Male inflorescence long flagellate, primary sheath tightly sheating; partial inflorescence to 55 cm long; secondary sheath funnel -shaped, rachilla 7 cm long. Female inflorescence long flagellate, primary sheath tightly sheathing, spiny along the sides; partial inflorescence 55 cm long; secondary sheath tightly sheathing; rachilla to 7 cm long, decrease in length distally; involucre cup shaped; fruiting perianth 0.4 cm long. Fruits ovoid, 1.25 x 0.9 cm; scales in 21 vertical rows, green when young, turns grey white on maturation, light violet on ripening, channelled at the middle; endosperm not ruminate.

Distribution: India (Andamans). Endemic and common in Baratang island.

Flowering: November - December. Fruiting: April - May.

Conservation Status: Endangered

Specimens examined: Baratang island, Andamans, 12.4.1988, fr., Renuka 4066 (KFRI); Adajig Range, Baratang island, Andamans, 4.4.1992, fr., Vijayakumaran 6628 (KFRI); Ppudumadurai, North Andamans, 30.4.1992, fr., Vijayakumaran 6640 (KFRI); Mannarghat, South Andamans, 1.4.1993, male fl., Renuka & Vijayakumaran 7029 (KFRI); Rogers 48, 49 (K; cibachrome).

Uses: Used in furniture industry and for tying rafts.

Calamus basui Renuka & Vijayak. Rheedea 4: 120. 1994; Renuka, Manual of the rattans of Andaman and Nicobar Isl. 36. 1995; Plate 8.

Vernacular Names: Safed beth.

Clustering, medium diameter rattan. Stem 20 m long, with sheaths 3 cm in diameter, without sheaths 1.5 cm. Leaf 1 m long with vestigial cirrus; sheath dark green, flagellate, spiny, spines to 1 cm long, interspersed with smaller ones; knee prominent; ocrea slightly developed; petiole absent; rachis triangular towards the distal end, spiny towards the base, spines straight, recurved on the adaxial side, leaflets regular, 56 x 4 cm, apical leaflet 19.5 x 2.2 cm, linear lanceolate, tip, margins and midrib ciliate. Inflorescence long flagellate; primary sheaths tightly sheathing, armed with downwardly directed spines to 0.5 cm long; partial inflorescence 27 cm long; secondary sheaths to 2 cm long, funnel shaped; rachillae upto 5 cm long, decreasing in length distally; involucre cup-shaped. Fruit ovoid, 1.5 x 1 cm; scales in 15 vertical rows, brown with a dark brown border, deeply channelled in the middle; endosperm ruminate.

Distribution: India (Endemic to Little Andamans).

Flowering: Not known. *Fruiting:* April - May.

Conservation Status: Endangered

Specimens examined: 4th Km Little Andaman, 13.4.1992, fr., Vijayakumaran 6634 (KFRI)

Uses: Extensively used in furniture industry. Distribution Andaman Islands. Conservation Status: endangered.

Calamus ***brandisii*** Becc. J.D.Hooker, Fl. Brit. India 6: 448. 1892; Becc., Ann. Roy. Bot. Gard. (Calcutta). 11: 278, Pl. 102. 1908; Fischer in Gamble, Fl. Pres. Madras. 3: 1567. 1931; Basu, Rattans in India Monogr. Rev. 109. 1992; Renuka, Rattans of the Weatern Ghats- a taxonomic manual 23. 1992; Plate 9.

Vernacular Names: Cheru chooral.

Clustering, small diameter rattan. Stem 10 m long or more, with sheaths 1.5 cm in diameter, without sheaths 0.8 cm. Leaf 1 m long, ecirrate; sheath green, with minute bristle like spines, mouth of the sheath with longer spines to 4 cm long; knee present; ocrea absent; petiole 22 cm long, in young plants 60 cm long, spiny, spines to 3 cm long, often interspersed with a few smaller spines; rachis with spines to 2 cm long; leaflets 25 x 2 cm, grouped, linear-lanceolate, midvein prominent. Male and female inflorescences long, slender; primary sheath tightly sheathing basally, splits open distally, with small spines; partial inflorescence 55 cm long, attached at the mouth of the sheath; secondary sheaths narrow at base, with small prickles, rachillae to 15 cm long, attached at the mouth of the sheath; involucrophorum not stalked; involucre cup shaped; fruiting perianth explanate. Fruit 1.8 cm, ovoid; scales in 17 vertical rows, brown with dark brown border, slightly channelled along the middle; endosperm not ruminate.

Distribution: Endemic to India (Tamil Nadu, Kerala).

Flowering: October - December. **Fruiting:** March -May.

Conservation Status: Endangered

Specimens examined: Kerala: Courtallum, 1550 m. Feb. 1882, Brandis s.n. (CAL); Netrikal, 3.3.1917, Beddome 1877 (CAL); Naterikal 23.12.1980, fl., Vajravelu 7644 (MH); Naterikal, 13.2.1913, male fl., D. Hooper and M. S. Ramaswami 38574 (CAL); Sengaltheri, 13.2.1983, Vajravelu 80650 (MH); Bonacaud, 11.2.1987, fl., fr., Nair 6144 (KFRI); Kalakkadu, 25.4.1990. fr., Renuka 6616 (KFRI); Muthukuzhivayal,

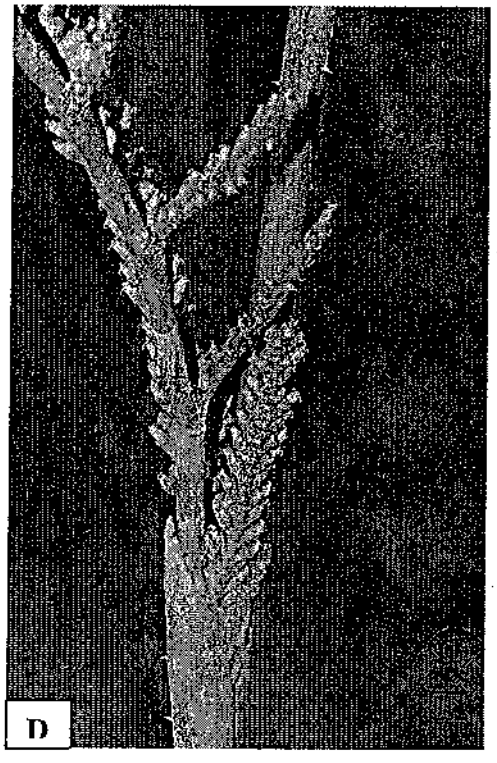


Plate 8. ***Calamus baratangensis*** **A. Leafsheath B. Infructscence**
Calamus basuii **C. Leafsheath D. Female rachilla**

26.4.1990, fr., Renuka 6618 (KFRI); Kakachiway forest Sengutheri, Thirunelveli, 13.2.1983, fr., Vajravelu 80650 (MH); Yumai Elumbu, Odai Neverical Forests, Thirunelveli, 23.12.1980, fl., Vajravelu 76441 (MH).

Uses: excellent small diameter cane, extensively used in furniture industry. Distribution Kerala, or Tamil Nadu.

Calamus delessertianus Becc. Ann. Roy. Bot. Gard. (Calcutta) 11(1): 276. 1908; Karthik. & Sharma, JBNHS 80: 76. 1983; Basu, Rattans in India, Monogr. Rev. 92. 1992. Renuka, Rheedea 9: 81–84. 1999; Plate 9.

Vernacular Names: Pacchachural, Ottamoodan.

Single stemmed, large diameter rattan. Stem to 15 m long or more, with sheaths 4 cm in diameter, without sheaths 2.5 to 3 cm. Leaf 2 m long, ecirrate; sheath green with bulbous based spines; knee present; ocrea not seen; petiole to 50 cm long; rachis armed with numerous spines; spines strong, solitary, bulbous based, black tipped; leaflets 58 x 2.5 cm, linear-lanceolate, pale green when dry, rusty furfuraceous in the small cavity formed underneath by the folding of the base of the leaflets; veins ciliated on both surfaces, cilia 1.5 cm long, leaf margin closely spinulose, sometimes a small spinule occurs at the base of the midvein on the upper surface. Female inflorescence rather large; primary sheath pale green, coriaceous, tubular, closely sheathing densely armed with small, broad based, straight spines; spines to 1.3 cm long; partial inflorescence to 40 cm long, attached inside the sheath, arising erect at first and then spreading; secondary sheath tubular infundibuliform, closely sheathing, unarmed; rachillae 10 cm long, inserted at the mouth of the sheath, with a distinct axillary callus, rigid, arched, basal ones branched; involucrophorum almost exserted from the own sheath, to 0.8 cm long, involucre disc shaped; female flowers 3 mm long, very regularly bifarious, inserted at an angle of 45°. Fruit globose to obovate, 1.4 cm across; scales in 28

vertical rows, light green when fresh, straw yellow when dry, deeply channeled; endosperm ruminate.

Distribution: Endemic to Western Ghats, India

Flowering: August –September. **Fruiting:** April-May.

Conservation Status: Vulnerable

Specimens examined: Balur State Forest, Karnataka, 19.5.1988, fr., Renuka 4079 (KFRI); Nariakkad estate, Nagarcoil, 5.3.1992, fr., Renuka 6622 (KFRI); Moodegiri, 26.4.1992, Renuka 7004 (KFRI).

Uses: Used for making baskets, furniture etc. Distribution Western Ghats.

Calamus dilaceratus Becc., Rec. Bot. Surv. India 2: 198. 1902; Ann. Roy. Bot. Gard. (Calcutta) 11: 144, Pl.15. 1908; Basu, Rattans in India Mongr. Rev. 7. 1992. (emend. descr.); Renuka, Manual of the rattans of Andaman and Nicobar Isl. 39. 1995; B.K. Sinha., Fl. Great Nicobar Isl.: 461 (1999); Plate 10.

Clustering, large diameter rattan. Stem 20 m long or more, with sheaths to 4 cm in diameter, without sheaths 2 cm. Leaf to 6 m long, cirrate; sheath green, densely armed with spines, spines 2-4 cm long, yellow with a reddish brown tinge, grouped together, arranged horizontally in slightly raised rims; knee present, not seen clearly from a distance because of dense spines; petiole armed with spines, spines brownish yellow, grouped together, arranged horizontally in slightly raised rims; rachis stout, armed with 3 rows of spines; spines to 0.3 cm long, black, grouped together in slightly raised rims; leaflets 50 x 2.5 cm, basal and distal ones smaller, veins and margins sparsely ciliate. Inflorescence not flagellate; male inflorescence, primary sheath lacerate, spiny, spines black, 1 cm long; partial inflorescences to 18 cm long; secondary sheath splits open, not spiny; rachilla to 4 cm long, flowers in distichous rows; female inflorescence, primary sheath to 2.5 cm long, spiny, splitting open, slightly prolonged at the distal end into a lanceolate point; partial inflorescence to 25 cm long;

secondary sheaths splits open, not spiny, 1 cm long, prolonged at the distal end into a lanceolate point; rachilla to 6 cm long, arched; female flower outer side of outer perianth with black spots, both whorls split longitudinally in fruit; involucrophorum sessile. Fruit ovoid, 1 x 0.8 cm; scales in 21 vertical rows, yellowish white with thin brown margin, channelled in the middle; endosperm not ruminate.

Distribution: Endemic to Great Nicobar Islands; India.

Flowering: November - December. **Fruiting:** April - May.

Conservation Status: Critically Endangered

Specimens examined: 16 Km, East West Road, Nicobar, 12.4.1993, male fl., Renuka & Vijayakumaran 7043 (KFRI); 16th km, East West Road, Nicobar, 15.4.1993, fr., Renuka & Vijayakumaran 7047 (KFRI).

Uses: Used in furniture industry and house construction. Leaves are used for thatching.

Calamus dransfieldii Renuka, Citation: Kew Bull. 42: 433. 1987; Basu, Rattans in India Monogr. Rev. 98. 1992; Renuka, Rattans of the Western Ghats - a taxonomic manual 26. 1992; Plate 10.

Solitary, large diameter rattan. Stem 10 m long or more with sheaths to 3.5 cm in diameter, without sheaths 2.5 cm. Leaves 2 m long, ecirrate; sheath pale green, sparingly spiny; spines 1 cm long, bulbous based; knee conspicuous; ocrea absent; flagellum 6 m long; petiole 55 cm, spiny, spines 6 mm long; rachis armed with distant row of very small spines; leaflets 45 x 2 cm, narrowly lanceolate, regularly arranged, long-acuminate, pale green; veins ciliate on both surfaces, cilia 2 cm long. Inflorescences 3.5 m long, flagellate, axis 1.5 cm in diameter; partial inflorescences 4-5, primary sheath cylindrical; basal sheath smaller in younger plants, spines to 1.3 cm long, black, bulbous-based; partial inflorescence of male 9 cm long, very slender; rachillae to 2 cm long, smaller upwards, staminate flowers 8 mm long; stamens 6; filaments shortly epipetalous; anther medi-fixed; partial inflorescence of female 25 cm long, attached at the mouth of the

sheath; secondary sheaths cylindrical at base, funnel shaped distally; rachillae attached above the mouth of its own sheath; involucrophorum stalked, to 7 mm long; involucre disc shaped; fruiting perianth callous at the base. Fruit unknown.

Distribution: India (Kerala) Endemic.

Flowering: November – December. **Fruiting:** Not observed.

Conservation Status: Critically Endangered

Specimens examined: Dhoni forests, 16.12.1983, fl., Renuka 2982, 2983 (KFRI); 20.10.1987, fl., Renuka 4030, 4031 (KFRI).

Uses: A good large diameter cane. Can be used in furniture industry. But only very limited number of plants are available in the natural forests. Distribution Karnataka, or Kerala

Calamus erectus Roxb., Fl. Ind. ed. 1832, 3: 774 1832; Becc. & Hook. f. in Hook. f., Fl. Brit. India 6: 438. 1892. Becc., Ann. Roy. Bot. Gard. (Calcutta) 11: 126. Pl. 2. 1908; Plate 11.

Palmijuncus erectus (Roxb.) Kuntze, Revis. Gen. Pl. 2: 733. 1891.

Calamus collinus Griff., Calcutta J. Nat. Hist. 5: 31. 1845.

Calamus schizospathus Griff., Calcutta J. Nat. Hist. 5: 32. 1845.

Calamus macrocarpus Griff. ex Mart., Hist. Nat. Palm. 3: 333. 1853.

Palmijuncus collinus (Griff.) Kuntze, Revis. Gen. Pl. 2: 733. 1891.

Palmijuncus macrocarpus (Griff. ex Mart.) Kuntze, Revis. Gen. Pl. 2: 733. 1891.

Palmijuncus schizospathus (Griff.) Kuntze, Revis. Gen. Pl. 2: 733. 1891.

Calamus erectus var. *collinus* (Griff.) Becc. in J.D.Hooker, Fl. Brit. India 6: 439. 1892.

Calamus erectus var. *macrocarpus* (Griff. ex Mart.) Becc. in J.D.Hooker, Fl. Brit. India 6: 439. 1892.

Calamus erectus var. *birmanicus* Becc., Rec. Bot. Surv. India 2: 197. 1902.

Calamus erectus var. *schizospathus* (Griff.) Becc., Ann. Roy. Bot. Gard. (Calcutta) 11: 125. 1908.

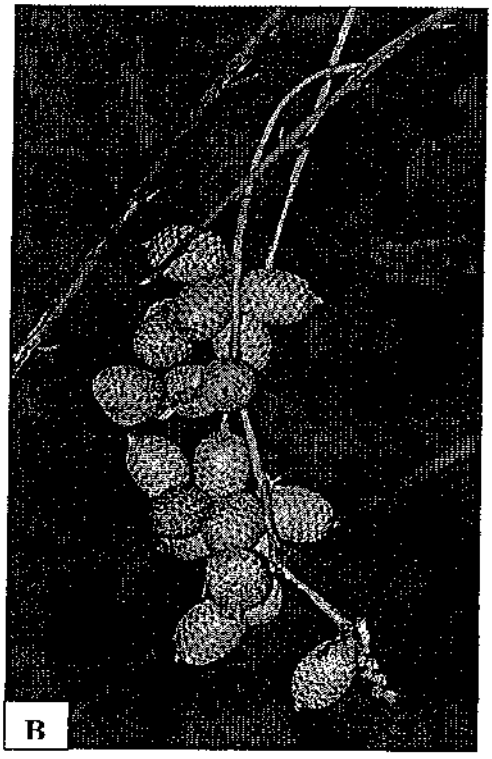
Clustering, non-scandent, large diameter rattan. Stem with sheaths 6 cm in diameter, without sheaths, 3.5 cm in diameter, exposed part of the stem, green. Leaves 2 m long; ecirrate, sheath green, not flagelliferous, armed with spines; spines dimorphic, longer ones 4 cm long, downwardly directed, triangular, arranged in regular half whorls, interspersed with whorls of small black spines in upraised crusts, base enlarged; knee absent; ocrea well developed and prolonged in young leafsheath, with small black bristles; petiole very prominent, 1.5 m long, spiny; spines triangular, solitary or in groups of 2 or 3, longest 9 cm; rachis with a white powder, spiny below; spines in whorls at regular intervals, flat, triangular, 2.5 cm long; leaflets regular, somewhat alternate at the base and middle, sub-opposite towards the tip, 67x4 cm, terminal leaflets connate at their base, midrib with bristles, margin spinulose. Inflorescence 1 m long, non-flagelliform; primary sheath not tightly sheathing, lacerate distally, armed towards the upper portion, secondary sheath not tightly sheathing, distal and lacerate; rachilla 23 cm long, male rachillae slender, sterile basal part of rachillae enclosed within the basal bracts; male flowers bifarious, narrowly oblong, obscurely 3- angled at base; in female inflorescence rachillae without sterile basal part; involucrophorum non-pedicelliform; involucre cup shaped. Fruit ovoid, 3.5 x 2 cm; scales in 12 vertical rows, brown with dark brown border; endosperm ruminate.

Distribution: India (West Bengal, Sikkim, Assam, Meghalaya, Manipur), Bangladesh, Myanmar.

Flowering: Not known. **Fruiting:** November -December.

Conservation Status: Vulnerable

Specimens examined: Berreck block, North Bengal, 2.12.1993, female fl., fr., Vijayakumaran 7053 (KFRI); Siorke Hills, Himalaya, North Bengal, 28.10.1975, 197 A, Acc. 52705 (MH); Hamaupuri, 22.1.1962, fl., D. B. Deb 27023 (CAL).



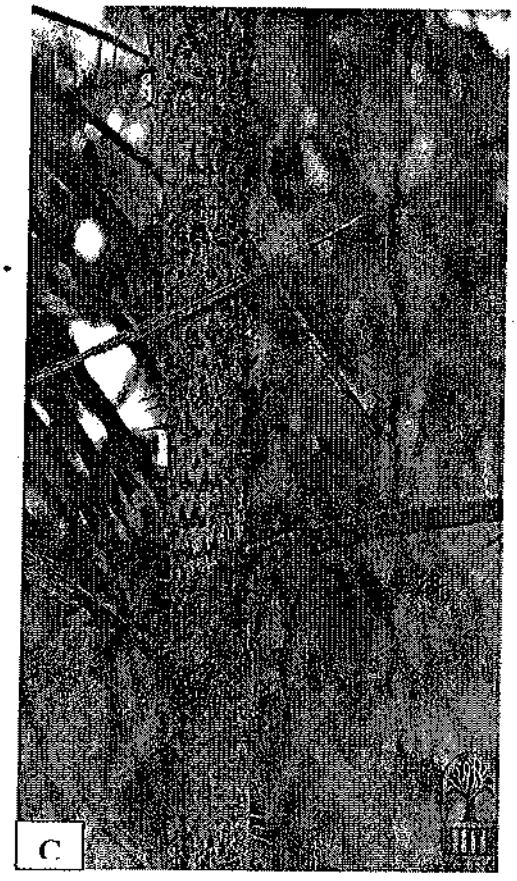


Plate 9. ***Calamus brandisii*** **A. Leafsheath B. Infructscence**
Calamus delessertianus **C. Leafsheath D. Infructscence**

Uses: Thick sticks are mostly used as posts, alpenstocks etc. Distribution Assam, or Manipur, or Meghalaya, or Sikkim, or West Bengal.

Calamus flagellum Griff. ex Mart. Hist. Nat. Palm. 3: 333. 1853; Becc. & Hook. f. in Hook. f., Fl. Brit. India 6: 439. 1892; Becc., Ann. Roy. Bot. Gard. (Calcutta) 11: 127, Pl. 1908 & Appendix Pl. 4, 5. 1913; Basu, Rattans in India Monogr. Rev. 115, 1992 ; Plate 11.

Palmijuncus flagellum (Griff. ex Mart.) Kuntze, Revis. Gen. Pl. 2: 733. 1891.

Clustering, large diameter rattan. Stem with sheaths 5 cm in diameter, without sheaths 3.5 cm in diameter. Leaf ecirrate; sheath green, flagelliferous, fearfully armed with spines; spines black, dimorphic, the larger ones triangular with a long needle like tip, base bulbous, concave beneath, to 5 cm long, flat, solitary or in groups of horizontal or oblique series, smaller ones intermingled with the larger ones, sometimes bristly, spines above the knee small with few larger ones; knee very prominent; ocrea not seen; petiole to 2 m long, margins and lower side spiny; spines solitary or in series, to 3.5 cm long, upper concave surface unarmed; rachis spiny on the margins and on the lower side; leaflets regular towards middle and distal end, grouped at the base, 35 x 3 to 64 x 5 cm, midvein very prominent and stout, terminal leaflets connate at their base, margins, midvein and distal part of lateral veins bristly. Male inflorescence not known. Female inflorescence long flagellate; primary sheath not tightly sheathing; partial inflorescence 45 cm long; secondary sheath not tightly sheathing, distal end free, lacerate, armed with few spines; spines to 0.7 cm long; recurved; rachilla 25 cm long; involucre cup shaped; fruiting perianth not pedicelliform. Fruit broadly ovoid, rounded at the base, 3 x 2.2 cm; scales in 12 vertical series,

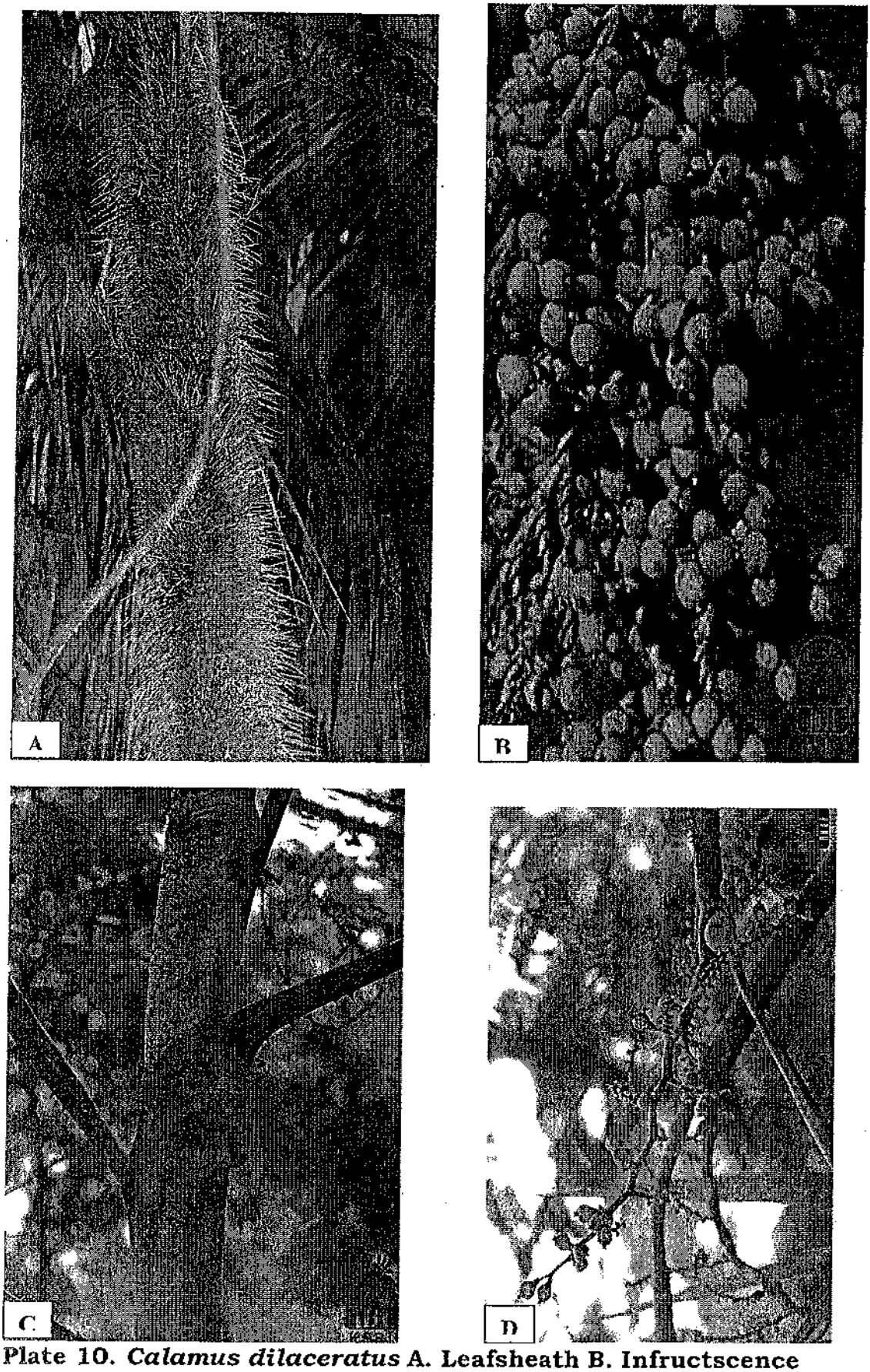


Plate 10. ***Calamus dilaceratus*** **A. Leafsheath B. Infructscence**
Calamus dransfieldii **C. Leafsheath D. Infructscence**

channelled along the middle, dirty straw colour with a dark intramarginal line; endosperm ruminate.

Distribution: India (Arunachal Pradesh, Meghalaya, W. Bengal, Assam, Sikkim), Bangladesh, Bhutan.

Flowering: June. **Fruiting:** Not known.

Conservation Status: Endangered

Specimens examined: Kamlao, Manmao Division, Arunachal Pradesh, 9.6.1989, female fl. Renuka, 6606 (KFRI); fl., Gamble, 455 B & 455 B (MH); Sikkim, 3.12.1908, Craib 506 (CAL).

Uses: The fruit is edible.Used in furniture industry. Distribution Arunachal Pradesh, or Assam, or Meghalaya, or Sikkim, or West Bengal. –

Calamus floribundus Griff., : Calcutta J. Nat. Hist. 5: 56. 1845; Becc. & Hook. f. in Hook. f., Fl. Brit. India 6: 444. 1892; Becc., Ann. Roy. Bot. Gard. (Calcutta) 11: 191. Pl. 47. 1908. Basu, Rattans in India Monogr. Rev. 115–116, 1992.

Palmijuncus floribundus (Griff.) Kuntze, Revis. Gen. Pl. 2: 733. 1891.

Calamus mishmeensis Griff., Calcutta J. Nat. Hist. 5: 55. 1845.

Palmijuncus mishmeensis (Griff.) Kuntze, Revis. Gen. Pl. 2: 733. 1891.

Calamus floribundus var. *depauperatus* Becc., Ann. Roy. Bot. Gard. (Calcutta) 11: 79. 1908.

Clustering, medium diameter rattan. Stem with sheaths 2 cm in diameter, without sheaths 1.2 cm in diameter. Leaves ecirrate, sheaths green, armed with spines; spines dimorphic, larger ones to 3 cm long, interspered with few, solitary or grouped small ones; knee prominent, absent in young ones; ocrea slightly developed; petiole spiny; spines dimorphic, larger ones few, solitary, 2.5 cm long, intermingled with smaller ones; rachis spiny at sides and below, spines to 4 cm long, intermingled with smaller ones; leaflets grouped with long vacant space in between, 33 x 3.8 cm; margins and veins with bristles, terminal leaflets free. Male inflorescence 1.5 - 2 m long; primary sheath tubular, closely sheathing, armed or unarmed, split

distally; partial inflorescences not numerous, pyramidally paniculate, 20-40 cm; secondaly sheath unarmed, tubular; rachilla 3 cm long; male flower 3 mm long; female inflorescence flagellate; primary sheath not tightly sheathing, distal end free, lacerate, margins armed; partial inflorescence 18 cm long; secondary sheath tightly sheathing; rachilla 7 cm long; involucrophorum rudimentary; involucre cup shaped. Fruit sub obovate, 0.9 x 0.6 cm; scales in 15 vertical rows, yellow with dark brown border, slightly channelled at the middle; endosperm not ruminate.

Distribution: India (Assam, Meghalaya & Arunachal Pradesh), Bangladesh, Myanmar. Distributed in the evergreen forests.

Flowering: April - May. **Fruiting:** June.

Conservation Status: Data deficient

Specimens examined: Dibru forest, Assam, 7.6.1989, fr., Renuka 6602 (KFRI); Makum, 21.11.1919, Burkhil 35743 (CAL); Povomukh, 15.12.1911, Burkhil 37041(CAL); Kobo towords Povomuch, Assam, 5.12.1911, male fl., Burkill 37036 (CAL); Kumpang, Arunachal Pradesh, 25.11.1958, Rao 18027 (CAL); Thakhama, February 1906, fl., Meebold 5556 (CAL).

Uses: A moderately srong cane used in furniture industry.

Calamus gamblei Becc. : J.D.Hooker, Fl. Brit. India 6: 453. 1893; var. gamblei; Becc., Ann. Roy. Bot. Gard. (Calcutta) 11: 316. Pl. 123. 1908; Fischer in Gamble, Fl. Pres. Madras 3: 1568. 1931; Basu, Rattans in India Monogr. Rev. 98. 1992; Renuka, Rattans of Western Ghats - a taxonomic manual, 28. 1992; Plate 12.

Calamus gamblei var. *sphaerocarpus* Becc. in J.D.Hooker, Fl. Brit. India 6: 453. 1893.

Vernacular Names: Pacchachooral.

Clustering, medium diameter rattan. Stem to 30 m or more long, with sheaths 2.5 cm in diameter, without sheaths 1.5 cm, internodes to 35 cm long. Sheath green, armed with spines, spines 0.5 to 1.5 cm long, horizontally held, bulbous based, tip slightly pointing upwards; knee present; ocrea not well developed; flagellum to 4 m long. Leaves ecirrate, to 1.2 m long; petioles to 25 cm long, armed with spines, spines upto 2 cm long; rachis armed with hooked spines; leaflets regular, 40 x 2.5 cm, long - acuminate, tips armed with short bristles, veins ciliate on both surfaces. Inflorescence flagellate, to 3 m long; partial inflorescences 5-6, upto 90 cm long, arising well above the mouth of the sheath; male inflorescence with branches of 3 orders, primary sheath tightly sheathing, distally produced into a lanceolate point, armed with small spines, spines to 0.5 cm long; secondary sheaths tight, narrow at base, expanded distally; rachillae to 2 cm long; female inflorescence with branches of 2 orders; primary sheath tight, provided with prickles; partial inflorescence to 90 cm long; secondary sheaths 2 cm long, cylindrical at the base and slightly expanded distally; rachillae 6-8 cm long, the upper ones shorter, arched and recurved, base distinctly callous at their insertion; involucrophorum distinctly pedicelliform, involucre disc-shaped. Fruit 2 cm across, slightly tapering at the base, short stalked; scales in 23 rows, pale yellow, shiny, deeply channelled.

Distribution: Endemic to South Western Ghats of India (Tamil Nadu, Kerala, Karnataka).

Flowering: December - January. **Fruiting:** May - June.

Conservation Status: Near threatened

Specimens examined: Chandanathodu, Wayanad, 22.2.1984, young fr., Renuka and Nambiar 3028 (KFRI); Pampa (Kakki), Goodrical range, Ranni, 24.5.1984, fr., Renuka 3173 (KFRI); Pannithavarnachola, Munnar, 28.12.1984, fr., Renuka 3401 (KFRI); Eravikulam, 12.2.1985, fr., Renuka 3444 (KFRI); Arippa, 17.1.1985, Renuka 3433 (KFRI); Attappady, Palghat, 27.2.1985, Renuka 3473 (KFRI); Silent Valley, 28.2.1985, Renuka 3474 (KFRI); Achenkovil, 3.1.1986, fl., Renuka

4007 (KFRI); Meghamala, 27.2.1988, fl., Renuka 4039 (KFRI); Courtallam, 29.2.1988, Renuka 4042 (KFRI); Deviyar estate, 3.3.1988, fr., Renuka 4049 (KFRI); Thalakaveri, 15.3.1989; fl., Renuka 4087 (KFRI), Kudremukh, 25.8.1984, Vajravelu 77850 (MH); Madura, 10.9.25, fr., Jacob 17684 (MH); Kilaviarumalai, Kanyakumari, 29.8.76, Henry 48117 (MH); Kudremukh Township Forest, Chikmanglore, Karnataka 25.2.1984 (MH); Bonacaud, Thiruvananthapuram, 22.5.1979, fr., Mohanan 63205 (MH); Upper Vagavurrai, Idukki, 25.4.1966, male fl., Shetty 27375 (MH); Old Devikolam, Kottayam, 25.1.1964, fr., Sebastine 18474 (MH); Bellaji Shola, Kollegal, Coimbatore, 9.7.1930, Narayanaswamy 3810 (MH).

Uses: Used in furniture industry and for basket making.

Calamus gracilis Roxb. Fl. Ind. ed. 1832, 3: 781. 1832; Becc. & Hook. f. in Hook. f., Fl. Brit. India 6 : 453. 1892. Becc., Ann. Roy. Bot. Gard. (Calcutta) 11: 318. Pl. 124. 1908; Basu, Rattans in India Monogr. Rev. 111. 1992; Plate 12.

Palmijuncus gracilis (Roxb.) Kuntze, Revis. Gen. Pl. 2: 733. 1891.

Calamus hainanensis C.C.Chang & L.G.Xu ex R.H.Miau, Acta Sci. Nat. Univ. Sunyatseni 1981(3): 116. 1981.

Cluster forming, small diameter rattans. Stem 30 mm long or more, with sheaths 1 cm in diameter without sheaths 0.3 cm in diameter. Leaves ecirrate, below 50 cm long; sheath green, flagelliferous, sparingly armed with spines; spines to 0.5 cm long, solitary; knee prominent; ocrea present; petiole very small (1-3 cm long); rachis armed below with a row of recurved spines; leaflets fascicled, at first two, then three, higher up to five, and decends to two, 1.5 x 2.5 cm, terminal leaflets slightly connate at their base; the margins and the lateral veins at the upper side with bristles. Male inflorescence, primary sheath tubular, closely sheathing, sparingly armed; partial inflorescences few; secondary sheaths unarmed; rachilla 2-4 cm long; male flowers 5 mm long; female inflorescence to 1 m long, primary

sheath free towards the distal end; partial inflorescence to 12 cm long; secondary sheath tubular; rachilla to 6 cm long; involucrophorum pedicelliform; involucre disc shaped. Fruits broadly ovoid-ellipitic, 3 x 2 cm, orange yellow on ripening, scales in 21 vertical rows, deeply channelled at the middle; endosperm ruminate.

Distribution: India (Meghalaya, Arunachal Pradesh, Assam), Bangladesh. Distributed in the evergreen forests.

Flowering: Not known. **Fruiting:** April - May.

Conservation Status: Near threatened

Specimens examined: Namgao, Arunachal Pradesh, 10.6.1989, Renuka 6608 (KFRI); Lailad, Khasi hills, Meghalaya, 25.4.1994, fr., Renuka & Vijayakumaran 7074 (KFRI).

Uses: Used extensively in furniture industry and handicrafts.

Calamus guruba Buch.-Ham. : C.F.P.von Martius, Hist. Nat. Palm. 3: 211. 1838; Becc. & Hook. f. in Hook.f., Fl. Brit. India 6: 449. 1892; Becc., Ann. Roy. Bot. Gard. (Calcutta) 11: 299. 1908 & Appendix Pl. 114. 1913; Basu, Rattans in India Monogr. Rev. 94. 1992.

Daemonorops guruba var. *hamiltonianus* Mart., Hist. Nat. Palm., ed. 2, 3: 206. 1845., nom. inval.

Daemonorops guruba (Buch.-Ham.) Mart., Hist. Nat. Palm. 3: 330. 1853.

Palmijuncus guruba (Buch.-Ham.) Kuntze, Revis. Gen. Pl. 2: 732. 1891.

Calamus nitidus Mart., Hist. Nat. Palm. 3: 211. 1838.

Calamus mastersianus Griff., Calcutta J. Nat. Hist. 5: 76. 1845.

Daemonorops guruba var. *mastersianus* (Griff.) Mart., Hist. Nat. Palm., ed. 2, 3: 206. 1845.

Palmijuncus nitidus (Mart.) Kuntze, Revis. Gen. Pl. 2: 733. 1891.

Calamus multirameus Ridl., Mat. Fl. Malay. Penins. 2: 202. 1907.

Calamus guruba var. *ellipsoideus* San Y.Chen & K.L.Wang, Acta Bot. Yunnan. 24: 202. 2002.

Vernacular Names: Sundi bet, Orna bet, Jali bet, Jai bet.

Cluster forming, medium diameter rattan. Stem 5 m long or more; with sheath 2 cm in diameter, without sheath 0.5 - 1.5 cm in diameter. Leaves ecirrate; sheath green, flagelliferous, armed with spines; spines to 2 cm long, flat, triangular, upwardly broad based, intermingled with many small ones; knee prominent; ocrea well developed in young sheaths, petiole present, to 25 cm long, petiole and rachis armed below and sides with a row of spines; leaflets regular, 36 x 2 cm, decreases in length distally, margins, lateral veins at the upper side and midrib at the lower side are provided with small spines, terminal leaflets connate at their base. Male inflorescence long flagellate, basal part armed; primary sheath free, spathular, sparingly armed, prolonged beyond the partial inflorescence; partial inflorescence to 15 cm long; secondary sheath tightly sheathing; rachilla small (to 1 cm); female inflorescence long flagellate; primary sheath spathular, free, prolonged beyond the partial inflorescence; partial inflorescence to 25 cm long; secondary sheath tightly sheathing; rachilla to 10 cm long. Infructescence long flagellate, primary sheath distal end free and papery, partial infructescence 20 cm long; secondary sheath tightly sheathing; partial inflorescence to 7 cm long; involucrophorum pedicelliform; involucre disc shaped. Fruit globose, 0.6 cm in diameter, greenish yellow; scales in 18 vertical rows, with dark brown margin, channelled slightly at the middle. Endosperm not ruminate.

Distribution: India (West Bengal, Assam, Meghalaya), Bangladesh, Thailand, Myanmar.

Flowering: November - December. **Fruiting :** April - May.

Conservation Status: Near threatened

Specimens examined: Manu Division, Tripura, 20.4.1994, Renuka & Vijayakumar 7070 (KFRI); fl., S. Coll. M.H. Acc. No.52736 (MH); fr., S. Coll. M.H. Acc. No. 52838 (MH); Mangalore, March 1911, Meebold 14310 (CAL); Watkyi, 1911, fl., Meebold 17145(CAL); Myitkyina, 25.1.1914, fr., Gilbert Rogers 315 (CAL); Soondari river, 11.04.1908,

male fl., Ribu 692 (CAL); Gajaldoba, Jalpaiguri, 26.4.1962, fr., Mukerjee 5596 (CAL); Rajabhat Khawa, Depot road, 14.5.1949, V. Nrayana Swamy 2402 (CAL); Culcutta, 6.3.1915, Debbarman 10812 (CAL); Teliamur, 21.2.1960, fl., Deb 2306 (CAL); Irong, Manipur, February 1906, Meebold 552 a (CAL).

Uses: Cane is used for making rough baskets. Split canes are good materials for making chairbottoms. One of the most commercially exploited canes of India

Calamus hookerianus Becc. Ann. Roy. Bot. Gard. (Calcutta) 11: 226. Pl. 70. 1908; Fischer in Gamble, Fl. Pres. Madras 3: 1568. 1931; Basu, Rattans in India Monogr. Rev. 82, 1992; Renuka, Rattans of Western Ghats - a taxonomic manual 30. 1992; Plate 12.

Vernacular Names: Velichooral, Vanthal, Kakkachooral, Kallan.

Clustering, moderate sized rattans. Stems to 10 m or more long, with sheaths to 4 cm in diameter, without sheaths to 2.5 cm, internodes to 26 cm. Leaves to 2 m long, ecirrate; sheaths brownish green, densely armed with spines; spines triangular, the largest to 2.5 long, 0.5 cm wide at the base, interspersed with numerous smaller spines and abundant brown tomentum, mouth of the sheath provided with long papery spines to 18 cm long; knee sometimes present, not conspicuous; ocrea to 8 cm, falling off eäsily; flagellum to 5 m long; petioles to 75 cm long; armed with spines; spines 1-10 cm long, brown or black, triangular; rachis with a single row of spines to 1.5 cm long or with reflexed spines; leaflets regular, the largest to 55 x 2.5 cm long - acuminate, tips armed with short bristles, narrowly lanceolate, midvein ciliate beneath from centre upwards, lateral veins ciliate above. Inflorescence to 5 m long; primary sheath closely sheathing, armed with small spines; partial inflorescence to 75 cm long; male branching to 3 orders; secondary sheath to 9 cm long, closely sheathing, narrow at base, expanded into a cup at the upper region, armed with one or two rows of small spines at the region where expansion begins; rachillae to 1 cm long; female branch to 2 orders;

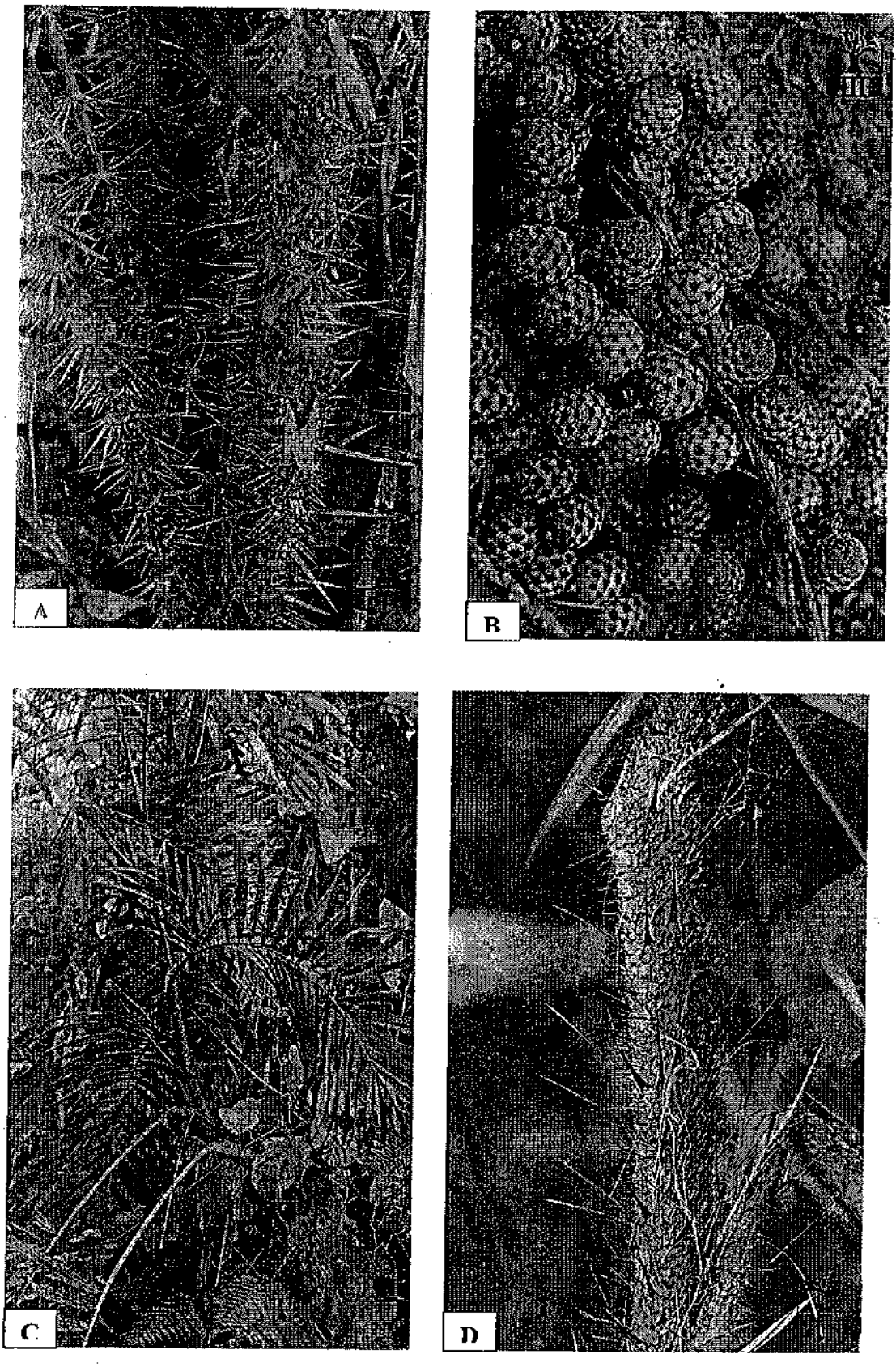


Plate 11. ***Calamus erectus*** **A. Leafsheath B. Infructscence**
Calamus flagellum **C. Habit D. Leafsheath**

rachillae to 15 cm long; involucrophorum sessile; involucre cup shaped. Fruits 1 x 0.8 cm, subglobose; scales in 18 rows, yellowish brown with a dark brown border; endosperm not ruminate.

Distribution: Endemic to Western Ghats; India (Tamil Nadu, Kerala).

Flowering: July-August. **Fruiting:** April-May.

Conservation Status: Least concern

Specimens examined: Arienkavu, 22.3.1982, fl., Sasidharan 1732 (KFRI); Pukuthipalam, Nelliampathy, 6.1.1983, fl., Renuka and Muktesh 2727 (KFRI); Karianchola, Parambikulam, 28.1.1983, fr., Muktesh 2503 (KFRI); Valayam, Achenkovil, 8.2.1983, fl., Nambiar and Renuka 2902 (KFRI); 8.2.1983, fl., Renuka and Nambiar 2904 (KFRI); 8.2.1983, fl., Renuka and Nambiar 2905; Thalapara, Arienkavu, 20.4.1983, Nambiar and Renuka 2926; Shendurnini valley, Thenmala, 20.4.83, Nambiar and Renuka 2929 (KFRI); Achenkovil, 21.4.1983, fr., Nambiar and Renuka 2930 (KFRI); 17.1.1985 Renuka 3431 (KFRI); Pothupara, Kodanad, 29.7.1983, Nambiar and Renuka 2948 (KFRI); Peechi, Trichur, 9.1.1984 Renuka 3009 (KFRI); Kottiyur, Wynad, 23.2.1984, Renuka 3030 (KFRI); Moozhiyar, Ranni, 23.5.1984, fl., Renuka 3155 (KFRI); Courtallum, 29.2.1988, fr., Renuka 4041 (KFRI); Mundandurai wildlife sanctuary, 1.3.1988, fr., Renuka 4045 (KFRI); Shencottah, 2.3.1988, Renuka 4046 (KFRI); Kaduvaperumukku, 26.4.1990, fl., Renuka 6619 (KFRI); Way to Sabarimala, 14.4.1989, fl., Anil Kumar 1668. (MH); Chokkenpatty Hills, Quilon, 23.2.1982, fl., Mohanan 73481 (MH).

Uses: A good medium diameter cane, extensively used in furniture industry and basket making.

Calamus karnatakensis Renuka & Lakshmana, R. I. C. Bull. 9: 10. 1990; Renuka, Rattans of the Western Ghats - a taxonomic manual. 33. 1992; Plate 13.

Clustering, medium diameter rattan. Stem to 20 m long or more, with sheaths to 3 cm in diameter, without sheaths to 1.5 cm. Leaf ecirrate, to 1.5 m long; sheath when mature yellow, lower part greenish brown

or greenish yellow, young sheaths with brown tomentum, densely armed with spines, spines stout, 2.5 cm long, sometimes forming half spiral, mouth of the sheath provided with long spines to 4 cm; knee prominent, wrinkled; ocrea to 6 cm long, with small spines; petiole to 30 cm long; rachis to 1 cm wide; leaflets 50x2.5 cm, regular, 3-veined, veins and margins spinulose, terminal pair united basally. Inflorescence long, flagellate; partial inflorescences many; primary and secondary sheaths tightly sheathing at first, later split open, sometimes becoming laminar; basal part of secondary sheath narrow, upper part funnel-shaped, spinulose; rachillae to 15 cm long; involucrophorum sessile, arising from inside the sheath, involucre sessile, cup-shaped, shalow. Fruit 8 mm across; globose; scales in 19 rows, yellow with chestnut brown border, light violet when ripe; endosperm not ruminate.

Distribution: Endemic to Western Ghats of India

Flowering: December - January. **Fruiting:** April - May.

Conservation Status: Near Threatened

Specimens examined: Kargal range, 13.5.88, fl., fr., Renuka 4068, 4069 (KFRI); Agumbe, 16.5.88, fr., Renuka 4076 (KFRI); 18.3.89, fl., Renuka 4094, 4095 (KFRI); Thalakaveri, 15.3.89, fr., Renuka 4088 (KFRI).

Uses: A good medium diameter cane, used in furniture industry. Distribution Karnataka, or Kerala.

Calamus khasianus Becc. Ann. Roy. Bot. Gard. (Calcutta) 11(1): 431. 1908; Basu, Rattans in India Monogr. Rev. 61–62. 1992.

Calamus inermis T. Anders. Jour. L. Soc. 21: 11.1869

C. latifolius (non Roxb.) Becc & Hook. f. in Hook. f., Fl. Brit. India 6: 436. 1892

Clump forming, large diameter rattan. Stem green, with sheaths to 4.5 cm in diameter, without sheaths 3 cm in diameter. Leaf cirrate, sheath green, armed with downwardly directed laminar spines; spines

to 6 cm long, single or in partial whorls, triangular with needle-like tip, flat, base upraised, decrease in size towards the basal portion, absent above the knee; knee prominent; ocrea slightly developed; leaflets grouped, at first groups of 2, then 3-4, higher up 3-2 and towards the tip single, 40-60 x 2-4 cm, basal ones long and narrow, while higher up length decreases and width increases, 3- nerved, margins with bristles. Male inflorescence to 1 m long, primary sheath tightly sheathing, armed; spines to 0.3 cm long; partial inflorescence 34 cm long; secondary sheath tubular, sometimes with small spines; rachilla to 5 cm long, flowers bifarious, 5 mm long; female inflorescence to 1.5 m long, primary sheath tightly sheathing, armed with spines, partial inflorescence 80 cm long; secondary sheath tubular, rachilla to 20 cm long. Fruit ovoid; scales in 18 vertical rows, light yellow on maturation; endosperm ruminate.

Distribution: India (Meghalaya), Evergreen forests of Garo Hills.

Flowering: November – December. **Fruiting:** April - May.

Conservation Status: Near Threatened

Specimens examined: William Nagar, Meghalaya, 2.5.1994, Renuka & Vijayakumarn 7077 (KFRI); Rangeet, Sikkim, Oct 1865 Kurz s.n. (CAL. Acc. No. 494086–88); Sikkim Himalayana (300–600 m) Anderson s.n. (CAL).

Uses: Fruit edible.

Calamus kingianus Becc. Ann. Roy. Bot. Gard. (Calcutta) 11(1): 197. 1908.

Cluster forming, medium diameter rattan. Stem with sheaths 1.5 cm in diameter, without sheaths 1.2 cm in diameter. Leaf eccirate; sheath green, flagelliferous, spiny; spines dimorphic, larger ones to 2.5 cm long, triangular, base bulbous, concave beneath, small ones irregular, needle like, numerous, intermingled with the larger ones; knee absent; ocrea slightly developed; petiole present, spiny along the sides, spines to 3 cm long, lower side with small spines; rachis armed

at the sides and below with a row of spines, spines to 1.5 cm long; leaflets grouped with long vacant spaces in between, 36 x 4 cm, terminal leaflets connate to the middle, 5 nerved, veins ciliated, margins bristly. Male inflorescence long flagellate; primary sheath sparingly armed; spines to 0.4 cm long; partial inflorescence to 20 cm long; secondary sheath cupular; rachilla to 2 cm, female inflorescence long flagellate; primary sheath not tightly sheathing; partial inflorescence to 22 cm long; secondary sheath cupular; rachilla to 8 cm long, 2 cm apart. Fruit globose, about 1 cm in diameter, sessile; scales greenish yellow with deep brown margins, shallowly channelled in the middle.

Distribution: India (Assam, Meghalaya).

Flowering: November - December. **Fruiting:** February - March.

Conservation Status: Vulnerable

Specimens examined: South Guwahati, Assam, 8.12.1993, male fl., Vijayakumaran 7062 (KFRI); South Guwahati, Assam, 8.12.1993, female fl., Vijayakumaran 7081 (KFRI); Lailad, Umling range, Meghalaya, 25.4.1994, female fl., Renuka and Vijayakumaran 7075 (KFRI); Naja hills, Manipur, Collected during the government demarcation survey 1881–82, Watt 7459 (CAL).

Uses: Goodcane used in furniture industry. Distribution Assam, or Meghalaya.

Calamus laccíferus Lakshmana & Renuka, J. Econ. Tax. Bot., 14: 705. 1990; Renuka, Rattans of the Western Ghats - a taxonomic manual 35. 1992; ; Plate 13.

Vernacular names: Neeru betha.

Clustering, medium diameter rattan. Stem to 15 m or more in length, very thin at the base, 0.5 to 0.8 cm in diameter, getting thicker upwards, distally with sheaths to 3.5 cm in diameter, without sheaths to 1.5 cm, basal nodes producing new shoots. Leaf to 2 m long, ecirrate; sheath green in the basal portions of the plant and greyish

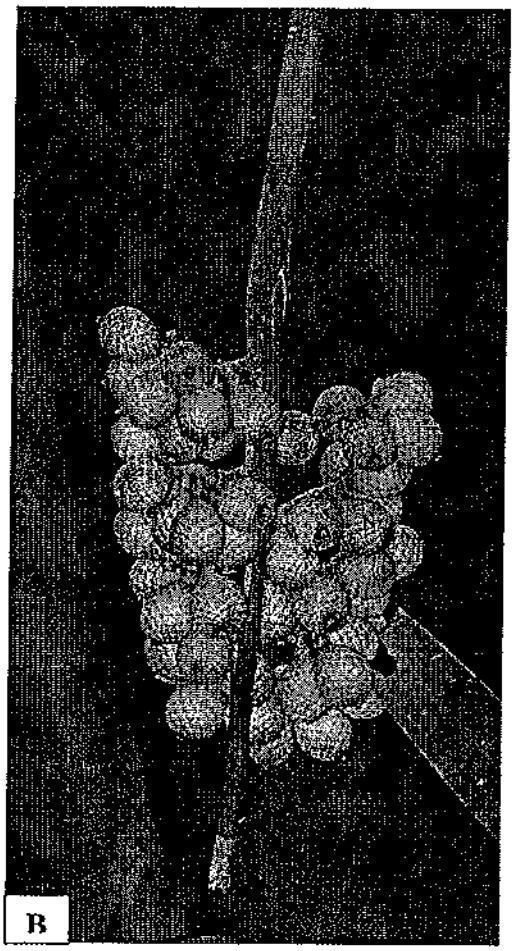


Plate 12. ***Calamus gambleii*** **A. Habit B. Infructscence ;** ***Calamus gracilus*** **C. Habit ;** ***Calamus hookerianus*** **D. Leafsheath**

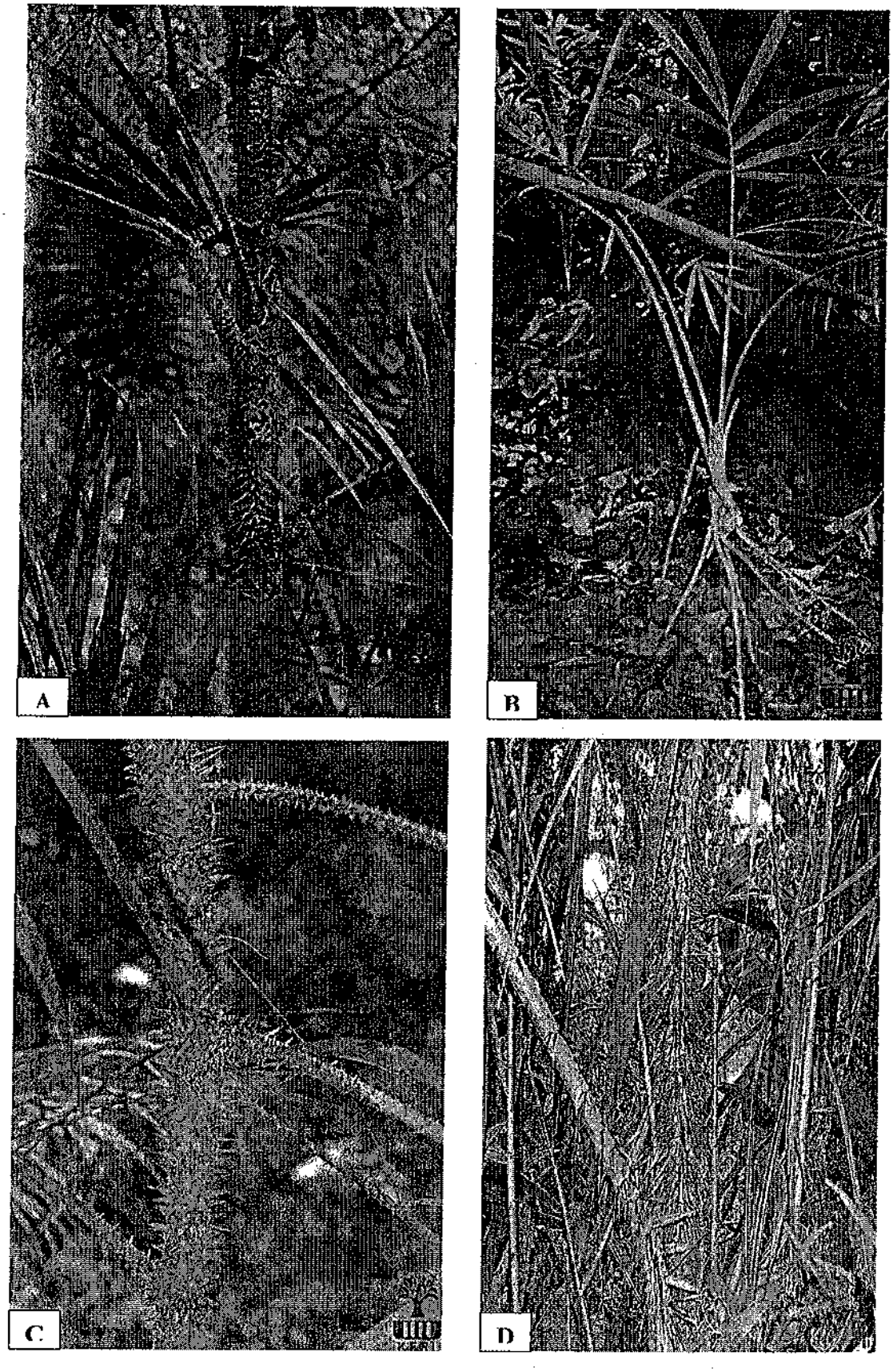


Plate 13. ***Calamus karnatakensis*** **A. Leafsheath ;** ***C. lacciferus*** **B. Aerial branching;** ***C. lakshmanae*** **C. Leafsheath;** ***C. longesetus*** **D. Leafsheath**

green distally, sparingly spiny, spines to 0.5 cm long, bulbous at base; knee very conspicuous, unarmed. Petiole 30-40 cm long, biconvex, spiny; rachis with recurved spines on the under surface, when cut exudes milky latex; leaflets 65 x 2.8 cm, gradually becoming smaller towards the tip, the terminal pair 20 x 1.2 cm, slightly united at the base, regular, linear - lanceolate, ciliated at tip, 3 - veined, midvein ciliated abxially on the upper half of leaflets, lateral veins ciliate abaxially on the upper half. Inflorescence long, flagellate; flagella often getting modified into suckers; primary sheath tightly sheathing, spiny; partial inflorescence to 15 cm long; secondary sheaths tubular, inflated at the mouth; rachillae to 5 cm long, arched and recurved, the upper ones gradually diminishing in length; involucrophorum stalked, conspicuously callous at its axilla next to the axis, involucre disc shaped; fruiting perianth pedicellate. Fruits globose, 1.2cm in diameter, scales in 19 rows, yellow with brown border, shiny, deeply channeled in the middle, endosperm ruminate.

Distribution: Endemic to India (Karnataka)

Flowering: November - December. **Fruiting:** May-June.

Conservation Status: Near threatened

Specimens examined: Kenganahonda, 15.5.88, fr., Renuka 4078 (KFRI); Agumbe, 18.3.89, Renuka 4096 (KFRI).

Uses: Not used commercially.

Calamus lakshmanae Renuka, J. Econ. Taxon. Bot. 14: 703. 1990; Renuka, Rattans of the Western Ghats- a taxonomic manual 37. 1992; Plate 13.

Vernacular Names: Halu betha.

Clustering, medium diameter rattan. Stem to 20 m long or more, with sheaths to 2.5 cm in diameter, without sheaths to 1 cm. Leaf to 1.5 m long, ecirrate; sheath yellowish green to green, densely armed with spines, spines to 1 cm long, yellowish, bulbous -based, pointing horizontally or upwards, distal younger sheaths less spiny and with brown markings; knee present; ocrea not seen. Leaf to 1.65 m long,

petiole to 22 cm, armed with small, sometimes curved spines; rachis biconvex towards the basal portion, triangular in the upper portion, with many small recurved spines; leaflets to 45 x 2 cm, regular, linear - lanceolate, tip not ciliate, terminal pair 17 x 0.8 cm, confluent to more than half of its length, 3 -veined, lateral veins ciliate on the dorsal surface, midvein ciliate below, spinulose at margin. Inflorescence long, pendulous; primary sheath tightly sheathing, with small spines, partial inflorescence to 60 cm long, attached well above the mouth of sheath; secondary sheaths to 3.5 cm long, tubular infundibuliform, lightly sheathing, narrow at base, inner side flat, distal region with 3 or 4 small prickles; rachillae to 10 cm long, attached above the mouth of secondary sheath; involucrophorum not stalked; involucre cup-shaped; fruiting perianth slightly callous at base. Fruit 1 x 0.7 cm, ovate, stigma 3 mm long; scales in 26 rows, when young bright green, channeled along the middle; endosperm ruminate.

Distribution: India (Karnataka). Endemic. Evergreen forests at about 85 m msl.

Flowering: December - February **Fruiting:** April - May.

Conservation Status: Neat threatened

Specimens examined: Makkut, 14.3.1989, fr., Renuka 4086 (KFRI).

Uses: A good cane used in furniture industry.

Calamus latifolius Roxb., Fl. Ind. ed. 1832, 3: 775. 1832; Becc. & Hook. f. in Hook. f., Fl. Brit. India 6: 445. 1892; Becc., Ann. Roy. Bot. Gard. (Calcutta) 11: 466. Pl. 171. 1908; Basu, Rattans in India Monogr. Rev. 65. 1992.

Palmijuncus latifolius (Roxb.) Kuntze, Revis. Gen. Pl. 2: 732. 1891.

Calamus humilis Roxb., Fl. Ind. ed. 1832, 3: 773. 1832.

Calamus macracanthus T.Anderson, J. Linn. Soc., Bot. 11: 10. 1869.

Palmijuncus humilis (Roxb.) Kuntze, Revis. Gen. Pl. 2: 733. 1891.

Palmijuncus inermis (T.Anderson) Kuntze, Revis. Gen. Pl. 2: 733. 1891.

Palmijuncus macracanthus (T.Anderson) Kuntze, Revis. Gen. Pl. 2: 733. 1891.

Calamus latifolius var. *marmoratus* Becc., Ann. Roy. Bot. Gard. (Calcutta) 12: 107. 1918.

Calamus inermis var. *menghaiensis* San Y.Chen, S.J.Pei & K.L.Wang, Acta Bot. Yunnan. 24: 202. 2002.

Cluster forming, medium diameter rattan. Stem with sheaths 2 cm in diameter, without sheaths 1 cm in diameter. Leaf 2.5 m long, cirrate, sheath green, non-flagelliferous, strongly gibbous above, more or less armed with very large, laminar, elastic, elongate, triangular, sublanceolate, solitary or grouped spines; spines to 3 cm long with upraised bases, and concave beneath, towards the basal portion, intermingled with very few small spines, scattered or in semicircles; petiole prominent, 10 -12 cm long, flat above, concave beneath, armed at the margins and below with a row of spines; spines to 1 cm long; rachis flat above, concave beneath, armed below with a row of solitary spines, spines to 2.5 cm long; leaflets grouped, with long vacant spaces in between the groups, 29 x 7.3 cm, terminal leaflets united at their base in young leaves. Male inflorescence simply decompound; partial inflorescence twice branched; rachilae 4 cm long with 8-12 male flowers; flowers 5 m long, calyx externally striated; female inflorescence simply decompound, rigid, erect, paniculate, not very diffuse, shorter than the leaves, about 60 cm long; primary sheaths 7-8 cm long, corriaceous, tubular, closely sheathing, the first compressed, with two acute and spinous edges, the uper ones more cylindraceous, slightly enlarged above, more or less armed on the outer side with rather robust subdeflexed spines, truncate and entire at the mouth and prolonged at one side into a triangular, more or less decayed and dorsaly keeled point; partial inflorescences rather robust, terminating in a short (about 1 cm long), tail -like appendix, the lower ones, the largest, 15-20 cm long, with 4-6 spikelets on each side; secondary sheaths tubular -infundibuliform, rachilla spreading, the

largest, 4-5 cm long, somewhat zig-zag sinous. Fruit globose, dull brown to blackish, to 1.5 cm in diameter; scales channeled in the middle.

Distribution: India (W. Bengal, Sikkim, Assam, Arunachal Pradesh, Meghalaya, Nagaland), Bangladesh.

Flowering & fruiting: Not known.

Conservation Status: Data deficient

Specimens examined: Dhonpur, Buxa Tiger Reserve Forest, North Bengal, 5.12.1993, Vijayakumaran 7059 (KFRI); Jorain, Assam, 1 23.7.1957, Deka, 10150 (CAL); Narpooh Reserve, Assam, 21.7.1957, fr., Deka 10117 (CAL); Tirap, Arunachal Pradesh, 1.9.1958, Panigrahi 15027 (CAL); Jorain, Assam, 23.7.1957, Deka 10150 (CAL).

Uses: A moerately strong cane used for making baskets, walking sticks and also for furniture frames.

Calamus leptospadix Griff., Calcutta J. Nat. Hist. 5: 49. 1845; Becc. & Hook. f. in Hook. f., Fl. Brit. India 6: 441. 1892; Becc., Ann. Roy. Bot. Gard. (Calcutta) 11: 142, 1908. & Appendix Pl. 14. 1913. Basu, Rattans in India Monogr. Rev. 67. 1992.

Palmijuncus leptospadix (Griff.) Kuntze, Revis. Gen. Pl. 2: 733. 1891.

Cluster forming, small diameter rattan. Stem 10 m long or more, with sheaths to 2 cm in diameter, without sheaths to 1 cm. Leaves 1 m long, ecirrate; sheath green, scurfy, sometimes longitudinally split from the knee downwards; spines to 3 cm long, partly seriate; knee present; ocrea present; petiole 45 cm long, petiole and rachis armed with scattered spines, spines 4 cm long; rachis covered with greyish indumentum; leaflets 25 x 1.3 cm, distal ones smaller, terminal pair free at the base, regular, closely set, narrowly lanceolate. Inflorescence long flagellate, primary sheath tightly sheathing or splitting open distally, armed with short spines; partial inflorescence 20-25 cm long; secondary sheaths tubular at base and enlarged distally; male rachilla 1.5 - 2 cm long, flowers 6-12, bifarious, closely set; female rachilla to 2 cm long, flowers closely set. Fruit globose, 1 cm in diameter; scales

in 18 vertical series, yellowish with a reddish margin, not channeled, endosperm homogenous.

Distribution: India (West Bengal, Sikkim, Meghalaya, Assam, Manipur, Nagaland, Arunachal Pradesh), Bhutan.

Flowering: May-June. **Fruiting:**

Conservation Status: Vulnerable

Specimens examined: William Nagar, Meghalaya, 2.5.94, Renuka, Vijayakumaran and Mohandas, 7078 a (KFRI); William Nagar, Meghalaya, 2.5.94, female fl., Renuka, Vijayakumaran and Mohandas 7078 (KFRI); Berreck Block, Kurzeong Division, North Andamans, 2.12.93, Vijayakumaran 7054 (KFRI); Tinkopani Reserve Forest, Assam, 10.6.89, female fl., Renuka 6609 (KFRI); Barata, Manipur, February 1906, fl., Meebol 5557 (CAL); Rajabhat Khawa Depot road, Jalpaiguri, 14.5.1949, fl., Narayana Swamy 2442 (CAL); Arunachal Pradesh, Deb, 11.7.1961, male fl., 26654 (CAL); Duphla hills, 1875, fl., Listen 277 (CAL); Duar reserve, Assam, 22.4.1958, male fl., Nath 13218 (CAL); Kobo, 5.12.1911, fr., Burkill 37035 (CAL); Dhasi Khati village, inner NEFA border, Assam, 16.02.1957, Panigrahi 5657 (BSI Shillong).

Uses: Mainly used for rough baskets. Split canes are durable and used for making chiar bottoms.

Calamus longisetus Griff., : Calcutta. J. Nat. Hist. 5: 36. 1845; Becc. & Hook. f. in Hook. f., Fl. Brit. India 6: 440. 1892; Becc., Ann. Roy. Bot. Gard. (Calcutta) 11: 134. Pl. 9. 1908; C. E. Parkinson, Forest Fl. Andaman Isl.: 266 (1923); Basu, Rattans in India Monogr. Rev. 102. 1992; Renuka, Manual of the rattans of Andaman & Nicobar Isl. 42. 1995; Plate 13.

Palmijuncus longisetus (Griff.) Kuntze, Revis. Gen. Pl. 2: 733. 1891.

Calamus tigrinus Kurz, J. Asiat. Soc. Bengal, Pt. 2, Nat. Hist. 43(2): 211. 1874.

Palmijuncus tigrinus (Kurz) Kuntze, Revis. Gen. Pl. 2: 733. 1891.

Clustering, large diameter rattan. Stem 20 m long or more, with sheaths 3.5 - 4.5 cm in diameter, without sheaths 3 cm. Leaf 2.5 m long, ecirrate; sheath pale green, fearfully armed with spines, spines black, downwardly pointed, flat, to 5 cm long, arranged in whorls, whorls of longer spines interspersed with whorls of smaller ones; knee present; ocrea not seen. Leaflets 35 x 56 to 2.4 -4.5 cm, grouped, linear - lanceolate, midvein prominent, margin spinulose; spines to 0.1 cm long, midrib with a row of cilia at the lower side, cilia 2 cm long. Inflorescence long flagellate, male inflorescence 60 cm long; primary sheath tubular, loosely sheathing, distal end lacerate, armed with black tipped spines; secondary sheath unarmed, lacerate at mouth, rachillae 10-12 cm long; male flowers 8-11 mm long, 3-4 mm thick; female inflorescence, primary and secondary sheaths as in the male; rachillae 10-16 cm long. Fruit ovoid, 3x2.7 cm, mottled like a leopards skin; scales in 12 vertical rows, endosperm not ruminate.

Distribution: India (South Andamans), Myanmar, Bangladesh, Thailand, Malay Peninsula.

Flowering: November - December. **Fruiting:** April - May.

Conservation Status: Least Concern

Specimens examined: Middle Andamans, 4.5.1974, fr., Balakrishnan 1350 (CAL);Dong Islands, Andamans, 15.12.1915, male fl., Parkinson 780 (CAL); Wumberleygung, South Andamans,. 6.4.88, fr., Renuka 4060 (KFRI); Mannarghat, South Andamans, 4.4.92, fr., Vijayakumaran 6626 (KFRI); Ray Hills, North Andaman, 27.10.1964, Ellis and Ramamurthy 18965 (MH); S.Andaman, 22.12.1892, Dr. King's Collector, Acc. No., 53174 (MH).

Uses: Used in furniture industry. The tribal people of Andamans use the leaves for thatching. Fruits are edible.

Calamus meghalaygensis A. Henderson Taiwania 52: 155 (2007). Synonyms: *Calamus floribundus* var. *depauperatus* Becc., Ann. Roy. Bot. Gard. (Calcutta) 11: 79. 1908.

Stems to 2 m long and 0.5-0.6 cm diameter (with leaf sheaths). Leaf sheaths green with brown tomentum, sparsely covered with brown, flattened, horizontally spreading spines to 1 cm long; knees present; ocreas present, less than 0.5 cm long, densely bristly; flagella present, to 2 m long; petioles 6-18 cm long, sparsely covered laterally and abaxially with recurved spines to 0.5 cm long; rachis 9-24 cm long, abaxially with few, recurved, solitary spines; pinnae 4-5 per side of rachis, lanceolate, arranged in distant groups or solitary, 13-23 cm long, 2-3.5 cm wide, minutely spiny along the margins, the apical pair free or briefly joined at their bases; cirri absent. Inflorescences to 1 m long, flagellate; partial inflorescences inserted above the mouth of the partial inflorescence bracts; partial inflorescence bracts closely sheathing the main axis, with recurved spines, bristly at the apex; staminate inflorescences branched to two orders, with up to 3 partial inflorescences; rachillae 0.5-1 cm long; rachillae bracts distichously arranged, to 1 mm long, more or less glabrous; floral bracteoles to 0.5 mm long; staminate flowers to 2 mm long, to 20 per rachilla, arranged alternately and distichously along the rachillae; calyx 1.5 mm long, tubular except for the 3-lobed apex; corolla 2 mm long, with 3 valvate petals free to the base; pistillode 1 mm long; pistillate inflorescences branched to two orders, with up to three partial inflorescences, each with up to 12 rachillae; rachillae 1-2.5 cm long; rachillae bracts distichously arranged, to 2.5 mm long, with brown hairs; pistillate flowers to 20 per rachilla, borne alternately and distichously along the rachillae; sepals to 3 mm long, connate basally for ca. two-thirds their length, lobed above; petals to 3 mm long, free; fruits not seen, according to Basu (1992) globose, to 1 cm diameter, yellowish.

Distribution: India (Nenkra, Garo Hills, Meghalaya).

Flowering: September - November. **Fruiting:** April - May.

Conservation Status: Least Concern

Calamus metzianus Schltdl., : Linnaea 26: 727. 1855; Becc. & Hook. f. in Hook. f., Fl. Brit. India 6: 462. 1893; Becc., Ann. Roy. Bot. Gard. (Calcutta) 11: 221. 1908 & Appendix Pl. 67. 1913; Renuka, Rattans of the Western Ghats- a taxonomic manual 37. 1992; Basu, Rattans in India Monogr. Rev. 88. 1992; Plate 14.

Calamus rudentum Mart., Hist. Nat. Palm 3: 340. 1823–1853.

Vernacular Names: Odiyan chooral.

Clustering, small diameter rattan. Stem with leafsheath about 2 cm in diameter, without sheaths to 1 cm. Leaves ecirrate; 1m or more long; leafsheath pale green, densely armed with irregularly spaced, triangular, 1-2 cm long, yellow spines and much shorter spinules; knee conspicuous; petiole to 5 cm long, armed with spines; spines yellow with balck tip; rachis armed with claw-like spines. Leaflets linear-lanceolate, tapering at base, equidistant on rachis, the middle ones to 37 x 2 cm, gradually getting smaller distally, prominently 3 nerved, midnerve strongly spinulose on both sides from middle upwards, lateral nerves smooth, margins slightly bristly. Female inflorescence flagelliform; primary bract narrow, closely sheathing, obliquely truncate at apex, armed with numerous claws; axial part of inflorescence flat on one side and convex on the other, armed with clusters of black claws; partial inflorescence 4-5, 25 cm long, arising well above the mouth of the sheath; secondary sheaths 2.5 cm long, narrow at base; rachillae mostly 10-15 in number, 3 cm long, involucrophorum sessile, involucre disc shaped; female flowers about 3 mm long, almost immersed in its own bract, attached at the base of one above. Male inflorescence flagelliform; partial inflorescences simple; male rachillae alternate. Fruits broadly ovoid to oblong, abruptly contracted into a 3mm long beak, 1.7 x 1.1 cm; fruiting perianth flattened; fruit scales in 17 longitudinal series, light yellow with white border and brown apex, distinctly chanelled at middle with erosely toothed margins; seed ovoid, compressed, solitary, 9 x7 mm, smooth; endosperm not ruminate.

Distribution: India (Tamil Nadu, Kerala, Karnataka).

Flowering: November-January. **Fruiting:** May-June.

Conservation Status: Near threatened

Specimens examined: Talumkolli, Nilambur, 27.3.1984, fr., Renuka 3061 (KFRI); Pattakarimbu, Nilambur, fl., Renuka 4083, 4084 (KFRI); South of Honaver, 19.04.1992 fr.,Renuka 7001(KFRI); Nilambur, 03.12.2003, Sreekumar 24212 (KFRI); Haripad, 15.05.1989, Renuka 4098 (KFRI).

Uses: It is one of the small diameter canes of South India but unlike others its cane is very weakand breajs easily and is therefore unsuitable for furniture work. It hs some local uses like rough basket making.

Calamus nagbettai R.R.Fernald & Dey Indian Forester 96: 223. 1970; Basu, Rattans in India Monogr. Rev. 88. 1992; Renuka, Rattans of the Western Ghats- a taxonomic manual 41. 1992. Sasidh. & Anto. J. Econ. Tax. Bot., 21: 247. 1997; Plate 14.

Vernacular Names: Nagabetha.

Clustering, large diameter rattan. Stem to 25 m long or more, with sheaths to 4.5 cm in diameter, without sheaths to 3 cm, with black patches at the basal portion. Leaves green, juvenile ones brown, 5 m long, cirrate, seedling leaves ecirrate, cirrus to 1.5 m long, armed with stout claws; sheath yellowish green to green, lower half densely armed with spines; spines diamorphic, in groups of 2-3, 3x0.5 cm, narrow, triangular, black, flat, intermingled with bristle-like spines, upper portion of the sheath with few spines, mouth with long spines to 4 cm long, intermingled with narrow shorter spines, young sheaths with brown tomentum; knee not prominent; petiole to 45 cm long, spiny; spines 2 cm long; rachis spiny on the basal portion, spines 2 cm long, upper portion armed with claw-like spines; leaflets 50 x 2 cm, regular, linear-lanceolate, veins ciliate on both surfaces, Female inflorescence branching to 2 orders; primary sheath tightly sheathing, prolonged at the distal end into a lanceolate point, with small spines; partial inflorescence to 70 cm long; secondary sheath tightly sheathing,

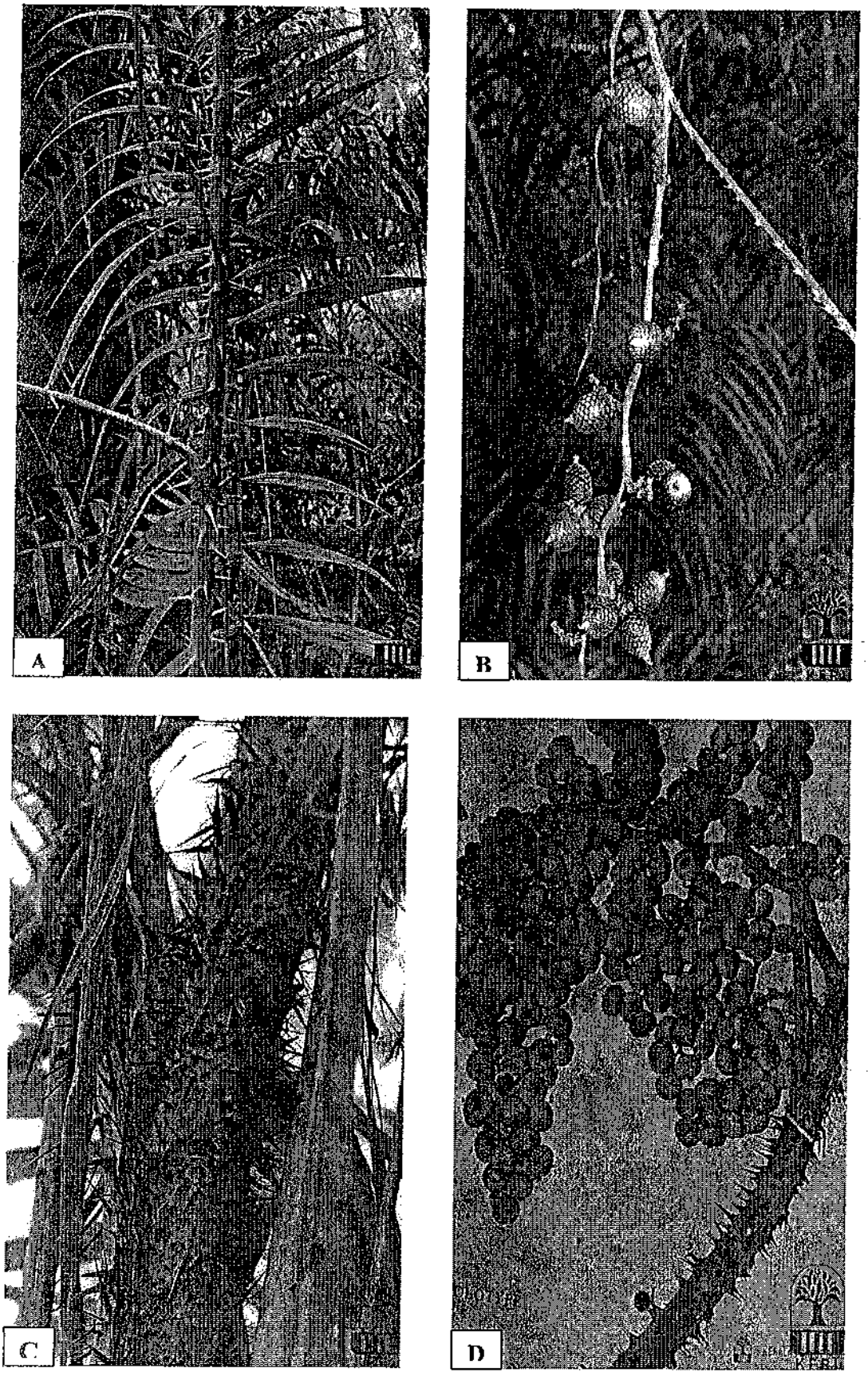


Plate 14. *Calamus metzianus* A. Leafsheath ; B. Infructscence; *C. nagbettai* C. Leafsheath; *C. neelagiricus* D. Infructscence

unarmed; involucrophorum slightly stalked; involucre cup-shaped; fruiting perianth explanate. Fruit ovoid, 1.6 x 0.9 cm; scales in 15 vertical rows, brown with a thin, dark brown margin, deeply channeled in the middle; endosperm ruminate.

Distribution: India (Karnataka, Kerala). Evergreen forests at about 450 m.

Flowering: December - January. **Fruiting:** May-June.

Conservation Status: Vulnerable

Specimens examined: Subramaniya forests, 16.5.88, fr., Renuka 4077 (KFRI).

Uses: A very robust cane, not avialable in sufficient quantities. Distribution Karnataka, or Kerala. Conservation Status: Vulnerable.

Calamus nambariensis Becc. Ann. Roy. Bot. Gard. (Calcutta) 11(1): 433. 1908.

Calamus nambariensis var. *alpinus* S.J.Pei & S.Y.Chen, Acta Phytotax. Sin. 27: 141. 1989.

Calamus nambariensis var. *furfuraceus* S.J.Pei & S.Y.Chen, Acta Phytotax. Sin. 27: 142. 1989.

Calamus nambariensis var. *menglongensis* S.J.Pei & S.Y.Chen, Acta Phytotax. Sin. 27: 141. 1989.

Calamus nambariensis var. *xishuangbannaensis* S.J.Pei & S.Y.Chen, Acta Phytotax. Sin. 27: 141. 1989.

Calamus nambariensis var. *yingjiangensis* S.J.Pei & S.Y.Chen, Acta Phytotax. Sin. 27: 140. 1989.

Cluster forming, medium diameter rattan. Stem with sheaths 4 cm in diameter, without sheaths 2 cm in diameter. Leaf 3.5 m long, cirrate; sheath yellowish green, turns to a light - cinnomon colour when dry, spiny; spines 2- 3 cm long, triangular, broadly subulate, transversely subseriate, horizontal or slightly deflexed; knee prominent; ocrea very small; petiole present, very short on upper portions, armed at margins; rachis biconvex, armed at the sides and below with a row of

spines; spines to 0.7 cm long with a black tip; leaflets unequidistant, sub-opposite, 10-12 cm apart, the distance decreases towards the upper portion, 37 x 4.5 cm, decreases in size distally, margins bristly. Male inflorescence simply decompound; partial inflorescences with alternate, 3-4 cm long rachillae; each with distal cushion at the base, arching above; male flowers 3 mm long, 14-15 male flowers on each side of the rachilla; rachilla sinuous, incurved, about 6-10 cm long, attached to the mouth of the basal bract. Fruit globose, 2.5 cm in diameter, scales in 21 vertical rows.

Distribution: India (Arunachal Pradesh).

Flowering & Fruiting: Not known

Conservation Status: Vulnerable

Specimens examined: Kamlao, Manmao Division, Arunachal Pradesh, 9.6.1989, Renuka 6607 (KFRI).

Uses: Cane used in furniture industry.

Calamus neelagiricus Renuka Rheedea 7: 69. 1997; Plate 14.

Solitary, moderate sized rattan. Stem reaching up to 25 m, with sheaths 2.5-5 cm diameter, without sheaths 3 cm, internodes to 21 cm long. Leaf ecirrate, to 2 cm long; sheath green, spiny; spines 1 cm long, sturdy with a bulbous base; knee present; ocrea inconspicuous; flagellum 3-4 m long. Petiole to 25 cm, petiole and rachis armed on the dorsal side with spines; spines 0.5 cm long, sturdy, bulbous based, ventral side spiny at the point of attachment of leaflet with the rachis; leaflets long acuminate, regular, 46 x 2 cm, midvein ciliate dorsally, lateral veins ciliate ventrally, cilia to 0.3 cm, apical leaflets free. Inflorescence flagellate, to 2.5 cm long, up to 6 partial inflorescences, heavy with profuse fruiting, pendulous; partial inflorescence 30 cm long; primary sheaths closely sheathing, completely armed with sturdy spines; rachillae to 13 cm long; strongly recurved and coiled; secondary sheaths closely sheathing. Fruit oblate, 1 x 0.5 cm; fruiting perianth pedicellate, scales straw-yellow when dry, chanelled in the middle, in 21 series; endosperm ruminate.

Distribution: Endemic to Neelagiri Biosphere, Silent Valley; India.

Flowering: Not known. **Fruiting:** May-June.

Conservation Status: Crtically Endangered

Specimens examined: Silent valley, Kerala, 10.3.1997, fr., Anto 7100 (KFRI).

Uses: Not available in plenty and hence not much used. Sine this is endemic inside the Neelagiri Biosphere, extraction also is not possible. Distribution Kerala.

Calamus nicobaricus Becc. J.D.Hooker, Fl. Brit. India 6: 446. 1892; Becc., Ann. Roy. Bot. Gard. (Calcutta) 11 : 249. 1908 & Appendix Pl. 84. 1913; Renuka, Manual of the rattans of Andaman & Nicobar Isl. 42. 1995; B.K. Sinha., Fl. Great Nicobar Isl.: 462 (1999).

Vernacular Names: Dahya.

A slender clustering rattan. Stem with leafsheaths 7-14 mm in diameter, cleaned stem yellowish green in colour; internodes 10-25 cm long. Leaves ecirrate, 60-90 cm long; leafsheath with distinct knee, obliquely truncate at mouth, scurfy outside, armed with numerous 1-2.5 cm long, flattened spines and similar broad-based deflexed spines; flagellum filiform; ocrea very short, truncate, smooth outside; leaflets equidistant, linear, subulately acuminate, with conspicuous upper midnerve, bristly on both sides; lateral nerves smooth; middle leaflets 18-25 cm long, 10-12 mm broad at middle. Fertile parts unknown.

Distribution: India (Great Nicobar Islands). Endemic.

Flowering: Not known **Fruiting:** Not known

Conservation Status: Possibly Extinct; No reports on recent collection.

Uses: It is much used by the natives and is in great demand by ship-traders, who take it to the Straits (*ex* Beccari).

Calamus palustris Griff., Calcutta J. Nat. Hist. 5: 60. 1845; Becc. & Hook. f. in Hook.f., Fl. Brit. India 6: 1892; Becc., Ann. Roy. Bot. Gard. (Calcutta) 11: 401. Pl.173, 1908; C. E. Parkinson, Forest Fl. Andaman Isl.: 263 (1923); Basu, Rattans in India, Monogr. Rev. 63. 1992; Renuka, Manual of the rattans of Andaman & Nicobar Isl. 45. 1995. Plate 15.

Palmijuncus palustris (Griff.) Kuntze, Revis. Gen. Pl. 2: 733. 1891.

Vernacular Names: Dunda beth.

Solitary, medium diameter rattan. Stem to 20 m long or more, with sheaths 2.5 cm in diameter, without sheaths 1.5 cm. Leaf 2.5 - 2.9 m long, cirrate; sheath pale green, with horizontal green markings, armed with spines, spines broad-based, flat, deflexed, to 2.5 cm long, arranged irregularly with smaller ones; knee prominent; ocrea slightly developed; petiole very short in mature leaves, 8-10 cm long, armed with small spines; rachis with small spines on the upper side, margins spiny; with spines upto 0.8 cm long, lower side with a row of spines at the base and half whorls of recurved black spines towards tip; leaflets 30 x 3.5 to 46 x 6.1 cm, grouped, lanceolate, midrib not prominent, margin ciliate. Inflorescence long flagellate; male inflorescence 1.5 m long, primary sheath tubular, enlarged distally, loosely sheathing, partial inflorescence to 50 cm long; secondary sheath closely sheathing; rachilla 2.5 cm long, male flowers 4 mm long; female inflorescence, primary sheath tightly sheathing, armed with recurved spines to 0.6 cm long; partial inflorescence to 50 cm long; secondary sheath tightly sheathing, armed with spines, spines to 0.2 cm long; rachilla 8-10 cm long; female flowers 4 mm long; involucre cup-shaped. Fruit ovoid, 1.5 x 1 cm; scales in 19 vertical rows, dirty straw coloured, superficially channeled in the midddle; endosperm not ruminate.

Distribution: India (Andaman islands), Myanmar, Thailand.

Flowering: October -November. **Fruiting**: April - May.

Conservation Status: Near threatened

Specimens examined: Wumberleygung, South Andamans, 6.4.88, fr., Renuka 4079 (KFRI); 4th KM, Little Andamans, 13.4.92, male fl., Vijayakumaran 6636 (KFRI); Mannarghat, South Andamans, 1.4.1993, male fl., Renuka & Vijayakumaran 7030 (KFRI); February 71, fl., Kurz 3319 (CAL); North Andamans, 29.3.1977, fr., Balakrishnan 5335 (CAL) Middle Andamans, 4.5.1974, fl., Balakrishnan 1351(CAL).

Uses: This *Calamus* is used by the natives of the Andamans to make knives known by the name of Wai-cho (Man, 'The Andaman Islanders.', *ex* Becc.).

Calamus prasinus Lakshmana & Renuka, J. Econ. Taxon. Bot. 14: 705. 1991

Vernacular Names: Ontibetha.

Solitary, high climbing rattan. Stem with sheaths to 3 cm in diameter, without sheaths to 1.2 cm; Leaf ecirrate, to 2.5 m long including the petiole; sheath pale green, densely armed with spines to 1 cm long; knee conspicuous. Petiole to 30 cm long, biconvex, armed with small prickles, recurved spines underneath; rachis triangular, petiole and rachis when cut exudes milky latex; leaflets 50 x 20 cm, terminal pair united basally, shiny green, shallow linear pits underneath when fresh, 3- veined, veins ciliate on the upper half, lateral veins ciliate above, midvein ciliate beneath, cilia up to 1 cm long. Fruit globose; scales in 26 rows, deeply chanelled along the middle, yellow, shiny, bright green when young; endosperm ruminate.

Distribution: India (Karnataka). Endemic. Evergreen forests at about 530 m.

Flowering: November-December. *Fruiting:* May-June.

Conservation Status: Near Threatened

Specimens examined: Sampaje, 20.5.88, fr., Renuka 4082 (KFRI); Magunde, 17.3.89, fr., Renuka 4092 (KFRI).

Uses: A good quality cane, used in furniture industry. Distribution Karnataka.

Calamus pseudofeanus S.K.Basu, : S.K.Basu, J. Econ. Taxon. Bot. 13: 133. 1989.

A slender climber; stem without leafsheath smooth, light yellow in colour, 2-4 cm in diameter near base; internodes smooth, to 20 cm long. Leaves ecirrate; leaf sheath with flagellum; rachis slender, bifaced, upper margins of rachis infrequently armed with 2 mm long broad – based hooks; under surface armed with scattered, broad based 1 mm long spines; leaflets alternate to subopposite; inequidistant, lower leaflets oblanceolate, to 30 cm long, 5 cm broad at widest part, wedge-shaped at base, apiculae at apices, prominently 5-nerved, nerves slightly bristly on upper side, spinulose at margines; middle leaflets elliptic to broadly lanceolate, to 20 cm long, 6cm broad at middle, narrowly cuneate at base; upper leafletes sometimes 2-3 lobed at distal part; terminal leaflets irregularly connate at base, some times one attached slight above the other. Female inflorescence flabelliform; partial inflorescence twice branched; rachillae scorpioid, to 8 cm long, 16-20 in number, each attached about 1 cm above the mouth of the respective basal bracts; secondary bracts funnel shaped; involucrophorum not pedicelliform, with a neuter flower on one side; involucre disc-like. Fruit globose to sub-globose, 1.5 x 1 cm, abruptly beaked with 3 distinct stigmatic projections; fruiting perianth cup-like at base; fruit scales deep yellow, wedge- shaped with lip-like postichous part distinctly channeled at middle; seed ovoid, 10 x 8 mm; endosperm ruminate.

Distribution: India (Tamil Nadu). Endemic.

Flowering: Fruiting:

Conservation Status: Not known; No recent collections.

Specimens examined: South Coimbatore, 17.10.05, fr., Dist. Forest Officer 23503 (CAL).

Uses: The cane is strong and can be suitably utilized for making furniture. Intensive survey of this psecies is needed for assessing its cultivation prospects.

Calamus pseudorivalis Becc. Ann. Roy. Bot. Gard. (Calcutta) 11(1): 222. 1908; C. E. Parkinson, Forest Fl. Andaman Isl.: 265 (1923); Renuka and Vijayakumaran, Rheedea 4: 139. 1994; Renuka, Manual of the rattans of Andaman & Nicobar Isl. 48. 1995; B.K. Sinha., Fl. Great Nicobar Isl.: 462 (1999); Plate 15.

Clustering, medium diameter rattans. Stem to 30 m long, with sheaths 2.25 cm in diameter, without sheaths 0.5 - 1.3 cm. Leaf to 1 m long; sheath green, densely armed with spines, spines persistent, dimorphic with broad-based, triangular - acute and slender, bristly spines interspersed, the latter shedding off at a later stage, spines to 0.8 cm long; knee present; ocrea not seen. Leaf to 1 m long, ecirrate; petiole absent; rachis triangular, spiny; leaflets 45 x 2 cm, gradually becoming smaller towards the tip, terminal pair confluent, regular, linear lanceolate, spinulose at margin, midvein spiny. Male inflorescence not seen. Female inflorescence long flagellate; primary sheath tubular; partial inflorescence to 60 cm long; secondary sheaths tubular; rachila to 13 cm long; involucre cup shaped; fruiting perianth 0.3 cm long. Fruit ovoid, 1.5 x 1 cm, scales in 21 vertical rows, shiny yellow, turning violet on ripening, deeply channelled in the middle; endosperm not ruminate.

Distribution: India (Great Nicobar).

Flowering: November - December. ***Fruiting:*** April - May.

Conservation Status: Least Concern

Specimens examined: Nicobar, Man s.n. (K, Cibachrome); 13th Km, East West Road, Great Nicobar, 10.4.93, fr., Renuka & Vijayakumaran 7040 (KFRI).

Uses: Used in furniture industry locally. Not exploited much due to the transportation problem to the main land.

Calamus ***pseudotenuis*** Becc. J.D.Hooker, Fl. Brit. India 6: 445. 1892; Becc., Ann. Roy. Bot. Gard. (Calcutta) 11: 223. 1908 & Appendix Pl. 69. 1913; Fischer in Gamble, Fl. Pres. Madras 3: 1567. 1931. Basu, Rattans in India Monogr. Rev. 80–82. 1992. Renuka, Rattans of the Western Ghats- a taxonomic manual 44. 1992; Plate 15.

Clustering, moderate sized canes, climbing high into the canopy. Stems 7 m or more long, with sheaths to 3.5 cm in diameter, without sheaths to 2.5 cm, internodes to 35 cm long. Leaf to 1.6 m, ecirrate; sheath yellowish green, grayish green when young, spines to 3.5 cm long, pointing in different directions, yellow, needle-like, intermingled with thin smaller spines, brown tomentum present between spines, mouth of the sheath with 3-4 longer spines, spines to 6 cm long; knee sometimes present; ocrea 10 cm long; flagellum to 3 m long. Petiole to 22 cm long, armed with spines; spines to 3 cm long, yellow; rachis spiny, spines to 3 cm long, sometimes claw-like; leaflets 50 x 2.5 cm, regular, narrowly lanceolate, long acuminate, viens sparsely ciliate beneath. Male inflorescence 3 m long, branching to 3 orders; primary sheath tightly sheathing, mouth sometimes split open, with small spines; partial inflorescences several, to 6 cm long; secondary sheath 2 cm long, narrow basally, expanding distally; rachillae to 1 cm long; female inflorescence 3 m long, branching to 2 orders, partial inflorescence to 70 cm long; primary sheath tightly sheathing, splitting open at the mouth, armed with spines to 3 mm long; rachillae to 8 cm long; secondary sheaths about 3 cm long, narrow at base and expanding upwards, armed with minute spines; involucrophorum very short, involucre shallowly cupular. Fruit 1.5 x 0.8 cm, subovoid, scales in 18 rows, greenish yellow with a dark brown border, endosperm not ruminate.

Distribution: India (Karnataka, Kerala, Tamil Nadu), Sri Lanka.

Flowering: October – November. **Fruiting:** April - June

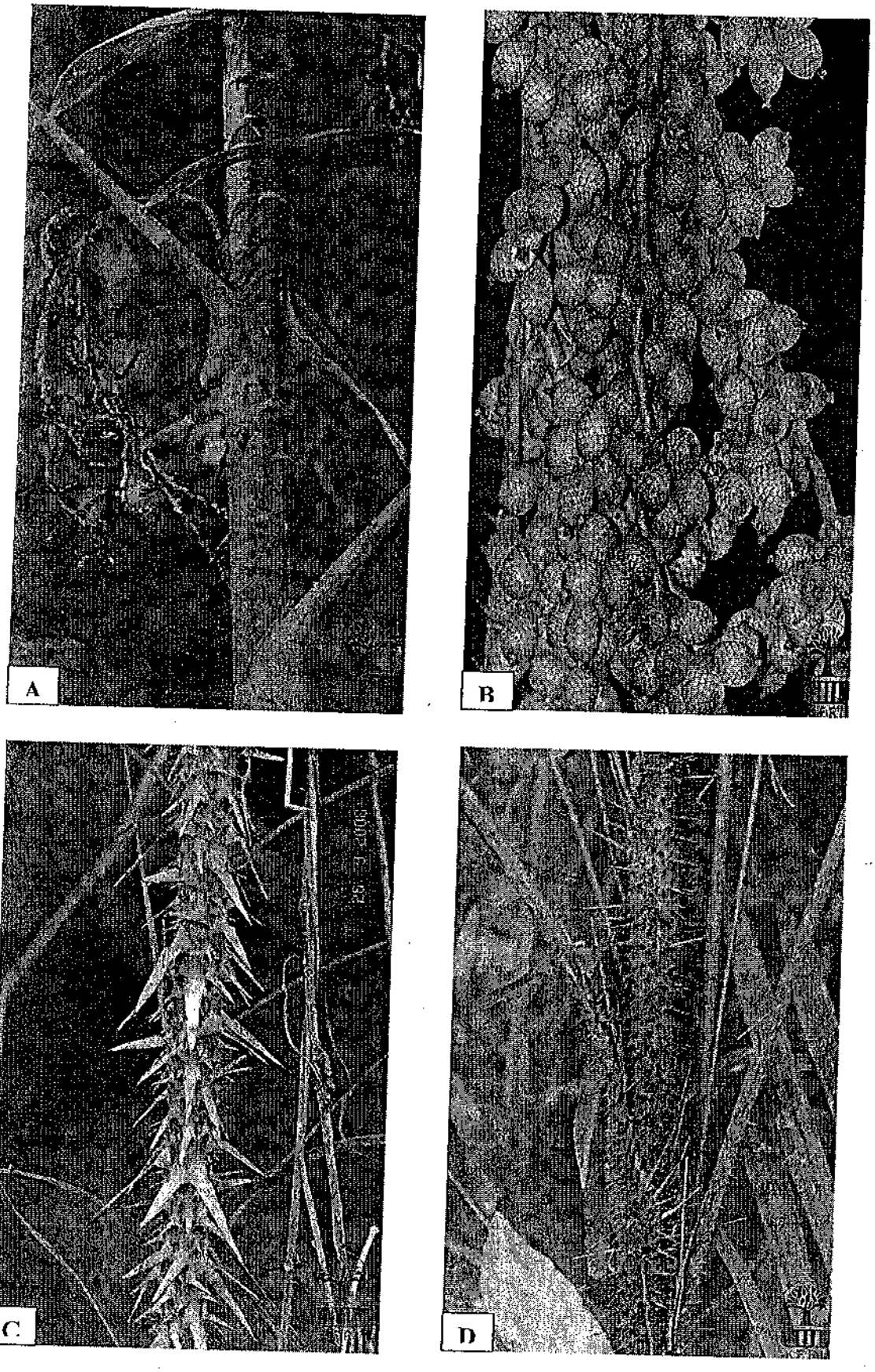


Plate 15. *Calamus palustris* **A. Leafsheath ; B. Infructscence;** *C. pseudorivalis* **C. Leafsheath;** *C. neelagiricus* **D. Infructscence**

Conservation Status: Least Concern

Specimens examined: Kozhikkanam, Peermedu, 24.11.82, fr., Nambiar and Renuka 2620 (KFRI); Valananchankanam, Peermedu, 24.11.82, fl., Nambiar and Renuka 2625 (KFRI); 25.11.82. fl., Nambiar and Renuka 2628 (KFRI); 25.11.1982, fl., Nambiar and Renuka 2629 (KFRI); 25.11.82, fl., Nambiar and Renuka 2630 (KFRI); Attappadi, Palakkad, 27.2.85, fl., Renuka 3471 (KFRI); 27.2.85, fr., Renuka 3472 (KFRI); Mankulam, 15.3.88, fl., Renuka 4053 (KFRI); Nelliampathy, 15.5.90, fr., Renuka 4099 (KFRI); Thekkady, 21.3.90, fl., Renuka 6611 (KFRI); Near Suryakanthi river, Bonacaud, 22.5.1979, fl., Mohanan 63210 (MH); Forest near Bonacaud, Thiruvananthapuram, 21.8.75, fl., Joseph 46467 (MH); Way to Chenunugi, Thiruvananthapuram, 8.3.1979, fl., Mohanan 61741 (MH); Kottur R.F., Thiruvananthapuram, 3.4.1973, fl., Joseph 44016 (MH); Pamba Dam to Vandiperiar, 12.3.1980, fr., Vivekanandan 66190 (MH); Vazhathope, Idukki, 18.2.1982, fl., Raju 71257 (MH); Muthikulam, Palakkad, 27.4.1966, fr., Vajravelu 62924 (MH); Parambikulam to Vazhachal, 19.4.1977, fr., Ramamurthy 49383 (MH); Chandanathode, Kannur, 17.4.1966, fr., Ellis 27108 (MH); Kariyanshola, Coimbatore, 31.1.1962, fr., Joseph 13831 (MH); Upper Kodayar, Kanyakumari, 18.3.1981, fr., Henry and Swaminathan 70332 (MH); Singamparai forest, Siruvani R.F., Palakkad, 24.1. 1984, fl., Vajravelu 77758 (MH); Arabithittu R.F., Koorg, 19.2.1984, fl., Vajravelu 77800 (MH); Way to Walayar Estate, Thinnaveli, Tamil Nadu, 24.2.1960, fr., Sebastine 9925 (MH).

Uses: Used in furniture industry and for basket making. Distribution Karnataka, or Kerala, or Tamil Nadu.

Calamus renukae Joemon Jacob, Mohanan et Kariyappa

Clustering cane, climbing to canopy; stem reaching up to 25 m in height, with sheath 5-5.5 cm and with out sheath 4-4.5 cm in diameter towards upper nodes, with out sheath 1.8-2 cm at basal nodes; internodes to 20 cm long. Leaf sheath pale green or greenish brown, densely brown tomentose towards the apex, densely spiny;

spines brown, up to 1.5 cm long, flat, bulbous at base, arranged in groups intermingled with smaller solitary ones, grouped ones arranged in semi circular series; knee large and conspicuous, densely spiny; ocrea absent; flagellum up to 6 m long; primary sheath of flagellum about 40 cm long, slightly flat, biconvex densely armed with seriate and solitary spine, brown tomentose; spines on the secondary sheath and flagella black, backwardly pointed, arranged in groups of three. Leaves up to 1.8 m long, ecirrate; petiole to 35 cm long; rachis biconvex; rachis and petiole spiny and brown tomentose on both sides; spines grouped and solitarily intermingled, a few adaxial spines longer, up to 1.3 cm long and bulbous based; leaf lets regular, to 56x3.5 cm, narrowly lanceolate, acuminate, spinulose on margins, tips armed with short bristles, ciliate on three veins on the dorsal side and mid vein on ventral side; cilia up to 1 cm long, black at base; apical leaflets free. Female inflorescence stout, to 2-3 m long, flagellate, with up to 4 partial inflorescence; primary sheath brown, stout, up to 30 c m long, slightly compressed, closely sheathing, tubular and funnel shaped, densely armed with spines and brown tomentum; partial inflorescence 15 to 30 cm long, apparently panicled, producing secondary branches and a few basal secondary branches again branching to produce tertiary branches; secondary branches 10-13 cm long; tertiary branches 2-8 cm long, recurved; secondary sheath unarmed, closely sheathing. Female flowers numerous; involucrophore stalked; involucre disc shaped. Fruits numerous, globose, 1.8–2 cm in diameter; scale reddish brown, channelled in the middle in 24 rows; perianth persistant; endosperm ruminate; male inflorescence not seen. Dis

Distribution: India (Silent valley National Park, Palakkad, Kerala)

Flowering: October – November. **Fruiting:** April - June

Conservation Status: Not evaluated

Specimens examined: Way to Sispara, 17.05.08, fr., Joemon Jacob and Kariyappa 57491 (KFRI).

Calamus rheedei Griff., Calcutta J. Nat. Hist. 5: 73. 1845; Palms Brit. E. India. 36, 83. 1850; Becc. & Hook. f. in Hook. f., Fl. Brit. India 6: 452. 1892; Becc. Ann. Roy. Bot. Gard. (Calcutta) 11: 95, 313. Pl. 226. 1908; Plate 16.

Daemonorops rheedei (Griff.) Mart., Hist. Nat. Palm. 3: 330. 1853.

Palmijuncus rheedei (Griff.) Kuntze, Revis. Gen. Pl. 2: 732. 1891.

Vernacular Names: Kattu chooral.

Clustering, moderate sized or slender rattan. Leaves ecirrate; petiole and rachis rather densely clawed; leaflets narrowly lanceolate, arranged in 4 groups of 3 leaflets each, with long vacant spaces interposed; one leaflet of each group on one side of the rachis and two of the other, 5 leaflets terminate the rachis, terminal pair free at base. Inflorescence pendulous; primary sheaths split open; partial inflorescence shorter than the sheath. Fruit ovoid or ellipsoid, 2 x 1.2 cm.

Distribution: India (North Kerala).

Flowering and Fruiting: Not known.

Conservation Status: Not known

Uses: The seed of this *Calamus* dried and powered *'genunm ulcera sanat'* (Rheede).

Calamus rotang L., Sp. Pl.: 325. 1753; Mart., Hist. Nat. Palm. 3: 334. Pl. 122, f. 12. 1823–1853; Bl. In Rumphia 3: 33. 1849; Dalzell & Gibson, Bombay Fl. 278 :1861; Becc. & Hook. f. in Hook. f., Fl. Brit. India 6: 447. 1892; Becc., Ann. Roy. Bot. Gard. (Calcutta) 11: 98, 269. 1908; Fischer in Gamble, Fl. Pres. Madras 3: 1568. 1931; Basu, Rattans in India Monogr. Rev. 86. 1992; Renuka, Rattans of the Western Ghats- a taxonomic manual 49. 1992.

Rotanga calamus Crantz, Inst. Rei Herb. 1: 127. 1766.

Rotang linnaei Baill., Hist. Pl. 13: 299. 1895.

Draco rotang Crantz, Duab. Drac. Arbor.: 16. 1768.

Calamus monoecus Roxb., Fl. Ind. ed. 1832, 3: 783. 1832.

Calamus roxburghii Griff., Calcutta J. Nat. Hist. 5: 43. 1845.

Palmijuncus monoecus (Roxb.) Kuntze, Revis. Gen. Pl. 2: 733. 1891.

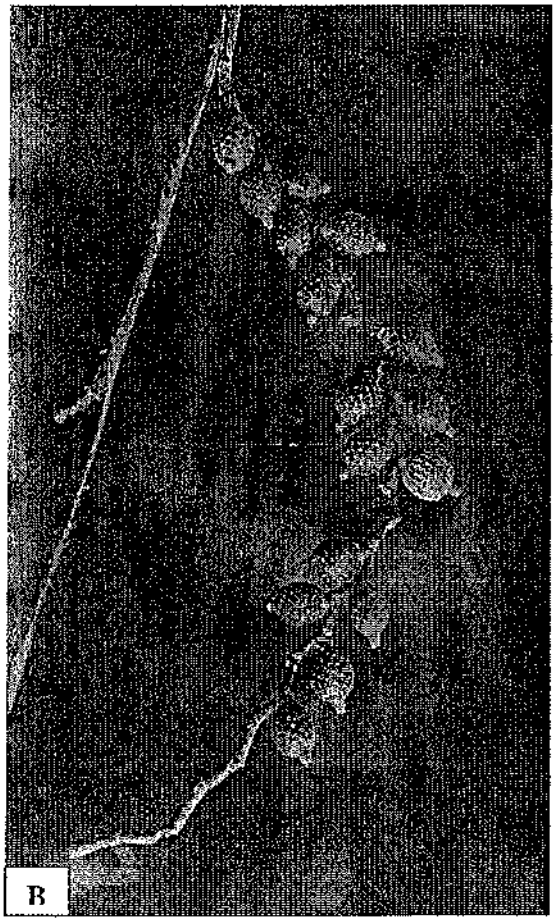
Clustering, small diameter rattan. Stem to 10 m long, with sheaths to 1.3 cm in diameter, without sheaths to 1 cm, internodes to 45 cm long. Leaf to 80 cm, ecirrate; sheath green, spiny, spines to 1 cm long, needle-like, yellow; knee prominent; flagellum to 2.5 m long; petiole absent; rachis spiny; spines to 1 cm long, yellow with black tip; leaflets 35 x 2 cm, regular, long acuminate, tip armed with bristles, margins spinulose, median vein ciliate beneath from centre upwards. Inflorescence to 3 cm long; primary sheath closely sheathing, armed with minute spines; partial inflorescences 4-5, to 70 cm long; secondary sheaths 2.5 cm long, tapering at the base and expanding into a cup at the upper region; male rachillae to 3 cm long, recurved, female rachillae to 8 cm long. Involucrophorum not stalked; involucre cup shaped. Fruit ovoid, scales in 21 rows, straw yellow; faintly channeled along the middle, endosperm not ruminate. Seedling leaf fan-shaped.

Distribution: India (Andhra Pradesh, Tamil Nadu), Sri Lanka. A species restricted to the plains along the river banks, streams etc.

Flowering: September – October. **Fruiting:** March – May.

Conservation Status: Near Threatened

Specimens examined: Mukkomb, Trichy, Sreekumar 22432 (KFRI); Chingel pet Dist, Gamble 163285 (Cibachrome Kew!). Sriharikotta, Gamble 12821 (MH), Gamble 73178 (MH), Kurnool Dist, Near R. Krishna, Ellis 25527 (MH), Tirupathi, Kambakam Hills, Ellis 1374 (MH); De Zoysa 82 (KFRI), Hellige & Pinnapola 6815, 6816 (KFRI); Krishnanandi, 24.8.1965, fr., Ellis 25527 (MH); Kodambalkan hills, 12.4.1987, fl., Renga Charyulu1374 (MH); South Arcot, Chidambaram, 4.4.1978, fl., Mathai 12760 (MH); Anaikkatty, Coimbatore, 29.7.1930, Leaf sheath, Narayanaswamy 4447 (MH); Meenmutty, Kulamavu, 28.1.1983, fl., Pandurangan 76660 (MH); Sri Lanka, S. Coll. M.H. Acc No. 52735 (MH); July 1883, Acc. 73178,



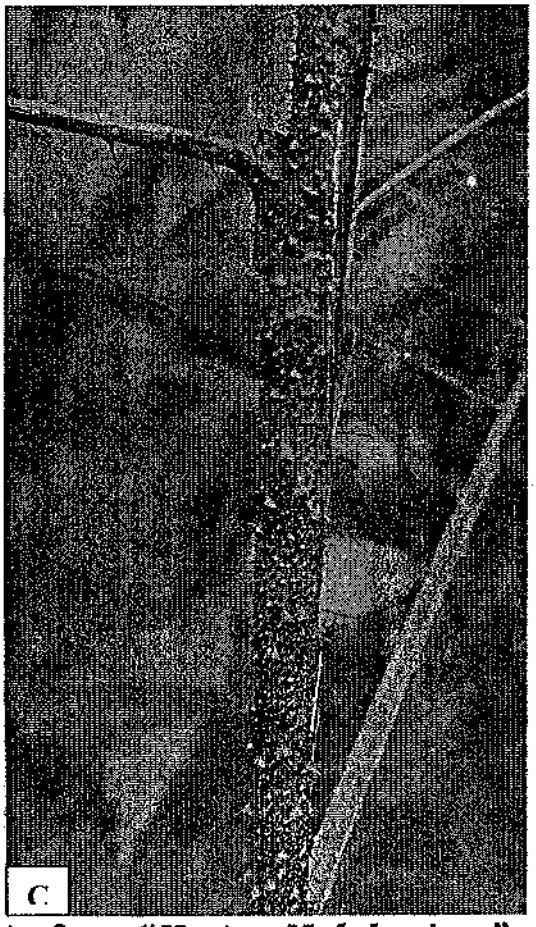


Plate 16. ***Calamus rheedii*** **A. Photo from "*Hortus Malabaricus*" ; *C. stoloniferus* B. Infructscence; *C.tenuis* C. Leafsheath**

Gamble 12821 (MH); Nadquem Forest , Goa, 26.4.1963, fl., Kanodia 88280 (CAL); Banks of Amaravathi River, Manthore, S. Coimbatore, 24.5.1912, female fl., Fischer 3447 (CAL);

Uses: Used for making rough baskets for plucking tea leaves and for carrying building materials. Split canes are largely used for making bags, 'jhapi', a kind of small bucket used in villages for measuring grain, and for making chair bottoms. The young leaves are also eaten as a vegetable by tribal people.

Calamus semierectus Renuka & Vijayak., Rheedea 4: 122. 1994; Renuka, Manual of the rattans of Andaman & Nicobar Isl. 48. 1995.

Solitary, large diameter rattan. Stem to 15 m long, basal part stand erect, rest climbing, with sheaths 5 cm in diameter, without sheaths 3 cm in diameter, basal nodes with exposed roots. Leaves to 2 m long, cirrate, juvenile leaf not cirrate; sheath yellow, armed with spines, spines jet black, in tufts below the knee, arranged on a raised rim in semicircles, mouth of the sheath with longer spines; knee present; ocrea not seen; petiole armed with black spines; rachis with small spines to 0.5 cm long; leaflets 55 x 3.5 cm, regular, linear lanceolate, 3 cm veined, veins ciliate on the ventral side, cilia to 0.8 cm long. Inflorescence long flagellate; primary sheath upper part papery; partial inflorescence to 50 cm long; secondary sheath upper part papery; splits open; involucrophorum present, involucre cup shaped; fruiting perianth stalked. Fruit ovoid - elliptic, 1.5 x 1 cm; scales in 15 vertical rows, brown with light brown margin, not channeled in the middle; endosperm not ruminate.

Distribution: India (Car Nicobar). Evergreen forests at Car Nicobar.

Flowering: November - December. **Fruiting:** April - May.

Conservation Status: Near Threatened.

Specimens examined: Car Nicobar, 7.4.1993, fr., Renuka and Vijayakumaran 7037 (KFRI).

Uses: Used in the construction of huts, leaves are used for thatching.

Calamus shendurunii Anto, Renuka & Sreek., Rheedea 11: 37. 2001.

Clustering, medium sized rattan. Stem reaching to 20 m, with sheaths up to 2 cm diameter, without sheaths up to 1.5 cm diameter, internodes up to 25 cm long. Leaf ecirrate, to 1 m long; sheath dark green, shining, spiny; spines very few, 1-4, scattered, with bulbous base, tip black, 1 cm long; knee conspicuous, devoid of spines; flagellum up to 2 m long; petiole 25 cm long, armed on the dorsal side; rachis chanelled on the dorsal side, ridges spiny, armed on the ventral side with recurved spines; spines 1 cm long, sturdy, bulbous based; leaflets long acuminate, regular, 35 x 3 cm; midvein setose ventrally, setae up to 1 cm long, lateral and mid veins setose dorsally towords the tip, setae up to 0.5 cm long, apical leaflets basally united. Inflorescence flagellate, 2 m long, partial inflorescences 3-4, up to 20 cm long, slender; primary sheaths closely sheathing, mouth of the sheath with bristles, secondary sheath spiny; rachillae to 5 cm long. Fruit globose or ob-pyriform, 1 x 1.8 cm, with stalk like involucrophores, stalk to 2 mm long, the pedicel of the neuter flower persistent, represented by a small projecting tubercle, scales in 25 ventral rows, pale green, without any border, shiny, shallowly chanelled along the middle; endosperm ruminate.

Distribution: India (Kerala). Endemic to Shendurni Valley.

Flowering: Not known. **Fruiting:** April- may.

Conservation Status: Vulnerable

Specimens examined: Shenduruny valley, Kollam district, 15.4.99. fr., Anto 6680 (KFRI); Vilakkumaram, Rosemala, Kollam District, 21.9.2000, Sreekumar 20621 (KFRI).

Uses: Used in furniture industry.

Calamus stoloniferus Renuka, J. Econ. Taxon. Bot. 14: 701, 1990; Renuka, Rattans of the Western Ghats- a taxonomic manual 49. 1992; Plate 16.

Vernacular Names: Jedu betha.

Clustering, stoloniferous, medium diameter rattan. Stem with sheaths 3 cm in diameter, without sheaths 1.2 cm. Leaf 1.75 m long, ecirrate; sheath green, sparingly spiny, spines to 2 cm long; knee present, devoid of spines; ocrea present in young stages; petiole 15 - 85 cm long; rachis spiny, spines to 2.5 cm, distally with recurved spines below; leaflets 45 x 3.5 cm, seedling leaflets upto 5.5 cm wide, linear lanceolate, the terminal pair confluent basally, apical 5-6 leaflets crowded together, more obtuse, margin spinescent, 3-5 veined, midvein sparsely ciliate. Inflorescence long, flagellate; primary sheath in male inflorescence expanded into a laminar structure at the mouth, in female inflorescence tapering at the mouth; secondary sheath tightly sheathing, in male produced into a point at one side at the mouth, not spiny; male and female rachillae to 9 cm long, attached at the mouth of the sheath; involucrophorum not stalked; involucre cup-shaped. Fruit, spherical 1 cm across, scales in 16 rows, yellow with brown border; not channeled; endosperm not ruminate.

Distribution: India (Karnataka). Endemic. Evergreen forests at about 85 m.

Flowering: November - December. **Fruiting:** March - April.

Conservation Status: Near threatened

Specimens examined: Makkut, 14.3.1989, fr.; Renuka 4085 (KFRI).

Uses: A good quality cane, but not available in sufficient quantities.

Calamus tenuis Roxb., Fl. Ind. ed. 1832, 3: 780. 1832; Becc. & Hook. f. in Hook. f., Fl., Brit. India 6: 447. 1892; Becc., Ann. Roy. Bot. Gard. (Calcutta). 11. 262. 1908, & Appendix Pl. 94. 1913; Basu, Rattans in India Monogr. Rev. 84. 1992; Plate 16.

Palmijuncus tenuis (Roxb.) Kuntze, Revis. Gen. Pl. 2: 734. 1891.

Calamus amarus Lour., Fl. Cochinch.: 210. 1790., provisional synonym.

Calamus heliotropium Buch.-Ham. ex Kunth, Enum. Pl. 3: 210. 1841.

Calamus royleanus Griff., Calcutta J. Nat. Hist. 5: 40. 1845.

Calamus horrens Blume, Rumphia 3: 43. 1847.

Calamus stoloniferus Teijsm. & Binn., Cat. Hort. Bot. Bogor.: 75. 1866, nom. inval.

Palmijuncus amarus (Lour.) Kuntze, Revis. Gen. Pl. 2: 733. 1891.

Palmijuncus heliotropium (Buch.-Ham. ex Kunth) Kuntze, Revis. Gen. Pl. 2: 733. 1891.

Palmijuncus horrens (Blume) Kuntze, Revis. Gen. Pl. 2: 733. 1891.

Palmijuncus royleanus (Griff.) Kuntze, Revis. Gen. Pl. 2: 732. 1891.

Rotang royleanus (Griff.) Baill., Hist. Pl. 13: 299. 1895.

Cluster forming, medium diameter rattan. Stem with sheaths 2.5 cm in diameter, without sheaths 1.5 cm in diameter. Leaves ecirrate; sheath flagelliferous, green, with oblique white patches sparingly armed with spines; spines black, basal portion upraised, concave beneath, solitary, or grouped, if in groups one just below the other, knee prominent; ocrea present; petiole well developed, armed at the sides and below with solitary spines; spines black, 2 cm long; rachis armed at the sides and below with a row of spines, spines 1 cm long, those at the lower side recurved; leaflets regular, 25 x 1.5 cm, linear, margins and veins bristly, terminal leaflets free. Male inflorescence slender, rachilla 2-3 cm long; male flower 4 m long; female inflorescence slender, long flagellate; primary sheath tightly sheathing, first primary sheath armed at the margins and on one side; partial inflorescence to 21 cm long; secondary sheath tightly steathing; rachilla to 5 cm long, decrease in length distally; involucrophorum pedicelliform; involucre disc shaped. Fruit broadly ovoid, 1.4 x 1 cm; scales in 15 vertical rows, grey white on ripening, with a dark brown border towards the apex; channeled at the middle; endosperm not ruminate.

Distribution: India, Myanmar, Bangladesh, South Vietnam. Common at moist damp areas and paddy fields at Tripura and North Bengal.

Flowering: September to October. **Fruiting:** April - May.

Conservation Status: Least Concern

Specimens examined: Jagadappur, 21.5.02, Sreekumar & Dinesh 22686 (KFRI); Motturonwala, 4.11.1921, fl., Ramachandrasethi 145 (MH); Sri Lanka, S. Coll. M.H. Acc. No. 62064 & 62065 (MH); Chttagong Hill Tracts, Bengladesh, 1880, male fl., Gamble 7768 (MH); Thinnevely district, Male fl., Sebastian 9925 (CAL); Niashangarha, Utter Pradesh, 10.12.1986, Khanna and Saran 38625 (CAL); Dharama Nagar, Tripura, 21.04.1994 fr., Renuka 7071 b (KFRI).

Uses: One of the most commercially exploited canes of the Indian subcontinent. Ripe fruits are edible and sold in the village markets of Bengal. Locally known as *Pani bet*..

Calamus thwaitesii Becc. J.D.Hooker, Fl. Brit. India 6: 441.-1892; Becc., in Ann. Roy. Bot. Gard. (Calcutta) 11: 137. 1908. & Appendix, Pl. 10, 11. 1913. Basu, Rattans in India Monogr. Rev. 104. 1992; Renuka, Rattans of the Western Ghats- a taxonomic manual 51. 1992; Plate 17.

Calamus thwaitesii var. *canaranus* Becc., Ann. Roy. Bot. Gard. (Calcutta) 11: 71 (1908).

C. thwaitesii Becc. & Hook f. var. canaranus Becc., Ann. Roy. Bot. Gard. (Calcutta) 11: 138. 1908.

C. longisetus Thw. (non Griff.) Enum. Plant. Zeylan. 330. 1864.

Vernacular Names: Pannichooral, Vandichooral, Thandiyan chooral, Handi betha, Thadiperambu.

Robust, clustering and high climbing canes. Stems to 20 m or more in length, with sheath to 6 cm in diameter, without sheaths to 3.5 cm, internodes to 45 cm long, sometimes with brown spots. Leaf to 3 m long, ecirrate; sheath yellow, densely armed with spines, spines arising from a raised rim-like surface, the largest 3 x 0.7 cm, flat, smaller spines scattered in between, black with yellow base, knee absent; ocrea absent; flagellum to 9 m long; petiole to 35 cm long, petiole and rachis yellowish, armed with spines, spines arranged in oblique whorls, flat, black; leaflets numerous, variable in

arrangement, usually grouped, the longest to 80 x 45 cm, sharply spinulose along the margins and upper side of midviens, midvein beneath with long bristles to 1 cm long. Inflorescence to 6 m long; primary sheath up to 10 cm long, splits open distally, densely armed with spines, spines arranged in a semi circular row, reflexed; partial inflorescence 70 cm long; secondary sheaths tightly sheathing, 3 – 4 cm long, in male rachillae to 8 cm long, flowers distichous, in female rachillae to 15 cm long; involucrophorum not stalked; involucre cup – shaped. Fruit ovoid, 2 x 1.3 cm, scales in 12 vertical rows, with median grooves, yellow with deep brown margins; endosperm not ruminate.

Distribution: India (Kerala, Tamil Nadu, Karnataka, Goa, Maharashtra), Sri Lanka. Evergreen, semievergreen and moist deciduous forests, between 75 – 900 m.

Flowering: November – January. **Fruiting:** February – May.

Conservation Status: Least Concern

Specimens examined: Vazhachal, Thrissur, Kerala, 9.1.82, Renuka, 1891 (KFRI); Dhoni hills, Palakkad, Kerala, 8.9.82, Nambiar and Renuka 1949 (KFRI); Tambadi, Surla beat, Kollen Range, Goa, 20.4.92, fr., Renuka 7003 (KFRI); Kuruppam kovil mala, Shenkottah, Tamil Nadu, 2.3.88, male fl., Renuka 4047 (KFRI); Chimmini dam area, Thrissur, 19.3.81, male fl., Nambiar 1285 (KFRI); Kollathirumedu, Thrissur 3.3.88, male fl., N Sasidharan 4822 (KFRI); Achenkovil, Kollam, 8.2.83, fl., fr., Nambiar and Renuka, 2903 (KFRI); Arippa, Thiruvananthapuram, 17.1.85, Renuka, 3430 (KFRI); Achenkovil, Kollam, 8.2.83, fr., Nambiar and Renuka, 2903 (KFRI); Panampuzha, Nilambur, Kerala, 2.7.84, fl., Renuka, 3060 (KFRI); Achenkovil, Kollam, Kerala, 8.2.83, fl., Nambiar and Renuka, 2905 (KFRI); Dhoni hills, Kerala, 8.9.82, Nambiar and Renuka 1950 (KFRI); Galle, Srilanka, 15.5.86, fl., Zoysa 031 (KFRI); Kandanalkkappu, Nilambur, Kerala, 18.9.82, Renuka 1954 (KFRI); Dhoni hills, Palakkad, Kerala, 8.9.82, Nambiar and Renuka 1952 (KFRI); Thanoor, Kargal Range, Karnataka, 13.5.88, fr., Renuka 4071 (KFRI); Thanoor,

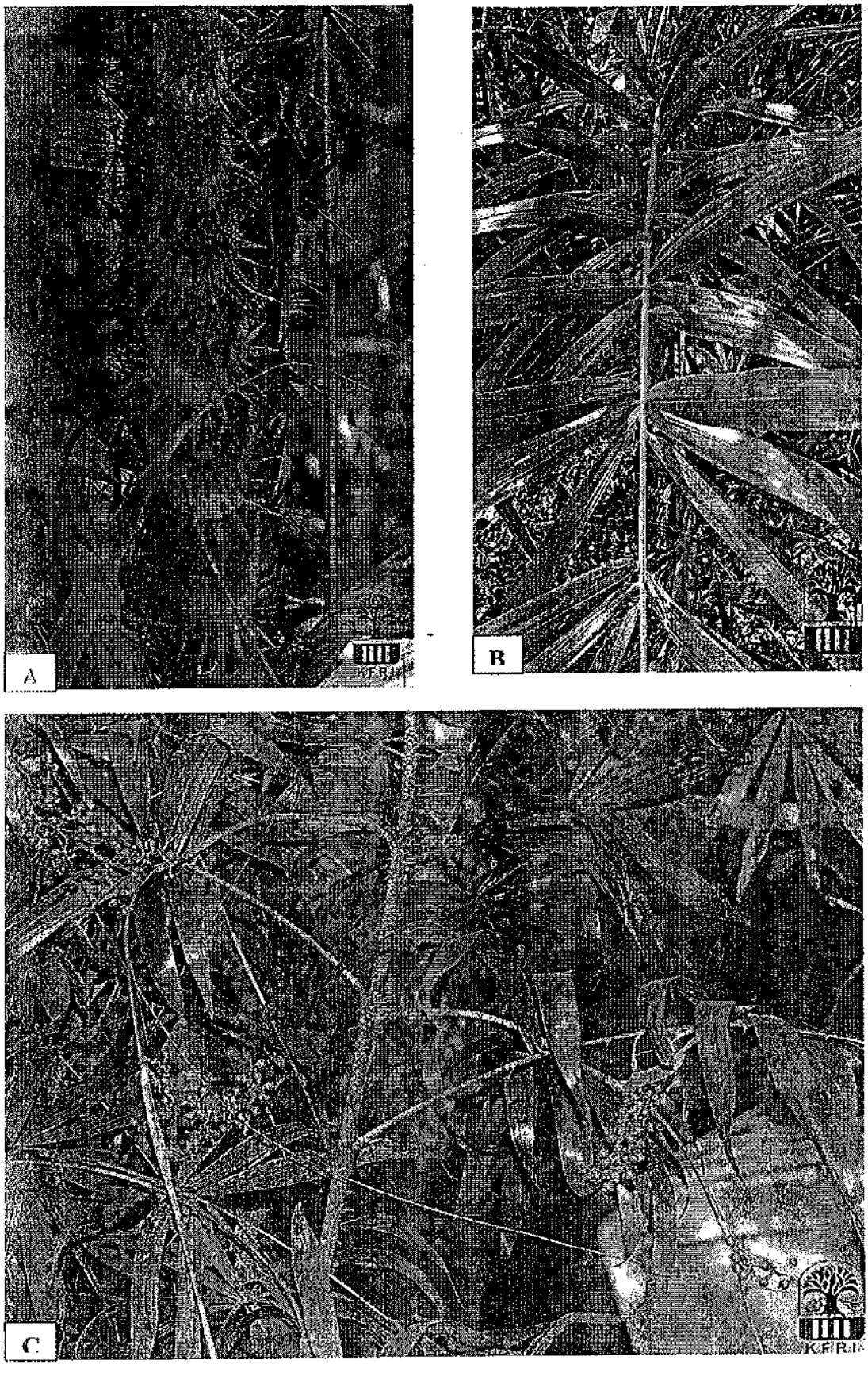


Plate 17. ***Calamus thwaitesii*** **A. Leafsheath B. Leaf**
C. travancoricus **C. Plant showing Infructscence**

Kargal Range, Karnataka, 13.5.1988, fl., Renuka 4070 (KFRI); Dhoni hills, Palakkad, Kerala, 31.1.83, Nambiar and Renuka 2502 (KFRI); Vazhaperiar, Kollam, Kerala, 25. 2. 88, fr., Renuka 4038 (KFRI); fl., S. Coll. M.H. Acc. No. 73155 (MH); S. Coll. M.H. Acc. No. 52760 (MH); Kottiyur, Kannur, 22.1.1979, fl., Ramachandran 59158 (MH); Quilon Dist., 20.7.1979, Mohanan 63196 (CAL)

Uses: This is the thickest cane available along the Western Ghats, one of the best quality canes used in furniture industry.

Calamus travancoricus Bedd. ex Becc. : J.D.Hooker, Fl. Brit. India 6: 452. 1893; Becc., Ann. Roy. Bot. Gard. (Calcutta) 11 : 310. 1908, & Appendix Pl. 121. 1913. Basu, Rattans in India Monogr. Rev. 122. 1992; Renuka, Rattans of the Western Ghats- a taxonomic manual 53. 1992; Plate 17.

Vernacular Names: Arichooral, Kiri betha.

A slender clustering rattan. stem 10 m long, with leafsheaths 8-10 mm in diameter, without leafsheaths 5-7 mm in diameter; internodes up to 20 cm long. Leaves ecirrate, 50 cm long; leafsheath without knee, armed with 5 mm long, straight spines; ocrea distinct, thin, upper margins bristly; petiole armed with a few longer spines along the margins; leaflets 20-30, in opposite groups of 2-5 leaflets in each group, deflected from the rachis in one plane, not pointed to different direction, narrowly oblanceolate, to 18 cm long, 10 – 15 mm broad at middle. Inflorescence flagelliform, slender, axial portion aculeate; primary bract longer than smaller partial inflorescences, enclosing the fertile parts completely until splitting longitudinally; male rachillae 7-8 mm long, delicate, sinuous, with 7-8 distichous flowers; female partial inflorescences 7-10 cm long, shorter than bracts; female rachillae simple, zig-zag, 12-15 mm long, with 3-4 distinct female flowers on each side; involucrophorum shortly pedicelliform, conspicuous in infructescence. Fruit globose, 8-10 mm long; scales

with deep brown margins, faintly chanelled at middle; endosperm homogenous.

Distribution: India (Kerala, Tamil Nadu). Endemic.

Flowering: October-November. **Fruiting:** May-June.

Conservation Status: Near Threatened

Specimens examined: Arienkavu, 22.3.1982, young fr., Sasidharan 1731 (KFRI); 19.4.1983, young fr., Nambiar and Renuka 2925 (KFRI); Edamalayar, Malayattoor, 29.7.1983, Nambiar and Renuka 2949 (KFRI); Moozhiyar, Ranni, 23.5.1984, fr., Renuka 3154 (KFRI); 9.10.1985, fl., Renuka 4002 (KFRI); Chelakkayam, Pathanamthitta, 27.4.1984, fr., Vajravelu 80619 (MH); Moozhiyar, 3.9.1977, fl., Nair 50861 (MH); 24.9.1928, Fischer, Acc. No. 73161 (MH); Moozhiyar, Kottayam, 3.9.1977, fl., Nair, 50861 (CAL).

Uses: A very good quality cane, used in furniture as well as handicraft industries.

Calamus unifarius var. *pentong* Becc. : Bot. Zeitung (Berlin) 17: 158. 1859; B.K. Sinha., Fl. Great Nicobar Isl.: 463 (1999);

Palmijuncus unifarius (H.Wendl.) Kuntze, Revis. Gen. Pl. 2: 734. 1891.

Solitary, medium diameter rattan. Stem to 20 m long, with sheaths 3.5 cm in diameter, without sheaths upto 2 cm, green when exposed. Leaf to 5 m long, cirrate; sheath yellowish green with numerous small spines; spines to 0.5 cm long, 3-4 spines grouped together, the groups arranged vertically or horizontally; knee prominent; ocrea not seen; petiole absent; rachis armed with small spines; leaflets alternate, regular, 35 x 6 cm, apical leaflets 40 x 4 cm, drooping, elliptic, usually 5 veined, tips and margins armed with short bristles. Inflorescence long flagellate; male inflorescence much branched; rachilla 3 cm long; female inflorescences simply decompound; primary sheaths tightly sheathing, armed with small spines; partial inflorescence to 25 cm long; secondary sheaths to 2 cm long, funnel -shaped; rachillae to 8 cm long, decreasing in length distally; involucrophorum slightly

stalked, involucre disc-shaped, fruiting perianth persisting. Fruit oblong, 1.5 x 1 cm, scales in 17 vertical rows, ivory white with brown border, slightly channeled; endosperm not ruminate.

Distribution: India (Great Nicobar). Endemic.

Flowering: November - December. **Fruiting:** April - May.

Conservation Status: Near Threatened

Specimens examined: Galathea Wildlife Camp, Nicobar, 12.4.1993, fr., Renuka & Vijayakumaran 7045 (KFRI).

Uses: Cane is not strong and durable. It is seen from the cultivated specimens that the mature cane splits after drying.

Calamus vattayila Renuka, Citation: Curr. Sci. 56: 1012. 1987; Basu, Rattans in India Monogr. Rev. 128.1992; Renuka, Rattans of the Western Ghats- a taxonomic manual 53. 1992; Plate 18.

Vernacular Names: Vattayila.

Solitary, small diameter rattan. Stem to 30 m long, with sheaths to 2.5 cm in diameter, without sheaths 1.8 cm, internodes to 27 cm. Leaf ecirrate, to 1 m long; sheath dark green, sparingly spiny, spines to 2 cm long, sometimes pointing upwards; knee conspicuous; ocrea small, 0.5 cm long; flagellum dark green, 4 m long; petiole to 25 cm, armed with spines to 1 cm long; rachis armed with claw-like spines in 3 rows; leaflets alternate, 40 x 10 cm, elliptic, dark green, 6 veined, tips armed with short bristles. Female inflorescence in heavy bunches, to 1 m long; primary sheath slightly flattened, biconvex, with short stout spines to 0.5 cm long; partial inflorescence to 40 cm long, shorter upwards; secondary sheath 2.5 cm long, funnel-shaped, with short stout spines; rachillae to 9 cm long, decreasing in length distally; involucrophorum sessile; involucre cup-shaped, fruiting perianth explanate. Fruit 2.5 x 0.8 cm, oblong; stigma to 0.4 cm long, scales in 27 rows, longer than broad, not channeled, chestnut brown; endosperm ruminate.

Distribution: India (Kerala, Karnataka, Tamil Nadu). Evergreen forests between 200 to 750 m, very sporadic.

Flowering: September - October. **Fruiting:** April - May.

Conservation Status: Endangered

Specimens examined: Chittar valley, Achenkovil, 9.2.1983, Renuka and Nambiar 2907 (KFRI); Kottiyur, Wynad, 23.2.1984, Renuka and Nambiar 3029 (KFRI); Moozhiyar, Ranni, 9.10.1985 fl., Renuka 4001 (KFRI); Thenmala, 11.10.1985, Renuka 4032 (KFRI); Sholayar, 18.4.1989, fr., Sasidharan 5421 (KFRI).

Uses: A good quality cane used in furniture industry, but not available in required quantities.

Calamus viminalis Willd. Sp. Pl. 2: 203. 1799; Basu, Rattans in India, Monogr. Rev. 117. 1992; Renuka, Manual of the rattans of Andaman & Nicobar Isl. 55. 1995; Plate 18.

Palmijuncus viminalis (Willd.) Kuntze, Revis. Gen. Pl. 2: 732. 1891.

Rotang viminalis (Willd.) Baill., Hist. Pl. 13: 299. 1895.

Calamus fasciculatus Roxb., Fl. Ind. ed. 1832, 3: 779. 1832.

Calamus extensus Mart., Hist. Nat. Palm. 3: 210. 1838., nom. illeg.

Calamus pseudorotang Mart. ex Kunth, Enum. Pl. 3: 207. 1841.

Calamus litoralis Blume, Rumphia 3: 43. 1847.

Palmijuncus fasciculatus (Roxb.) Kuntze, Revis. Gen. Pl. 2: 733. 1891.

Palmijuncus litoralis (Blume) Kuntze, Revis. Gen. Pl. 2: 733. 1891.

Palmijuncus pseudorotang (Mart. ex Kunth) Kuntze, Revis. Gen. Pl. 2: 732. 1891.

Calamus viminalis var. *fasciculatus* (Roxb.) Becc. in J.D.Hooker, Fl. Brit. India 6: 444. 1892.

Calamus fasciculatus subvar. *andamanicus* Becc., Ann. Roy. Bot. Gard. (Calcutta) 11(1): 207. 1908.

Calamus fasciculatus subvar. *bengalensis* Becc., Ann. Roy. Bot. Gard. (Calcutta) 11(1): 206. 1908.

Calamus fasciculatus subvar. *cochinchinensis* Becc., Ann. Roy. Bot. Gard. (Calcutta) 11(1): 207. 1908.

Calamus fasciculatus subvar. *pinangianus* Becc., Ann. Roy. Bot. Gard. (Calcutta) 11(1): 207. 1908.

Calamus viminalis var. *andamanicus* Becc., Ann. Roy. Bot. Gard. (Calcutta) 11(1): 207. 1908.

Calamus viminalis var. *bengalensis* Becc., Ann. Roy. Bot. Gard. (Calcutta) 11(1): 206. 1908.

Calamus viminalis var. *cochinchinensis* Becc., Ann. Roy. Bot. Gard. (Calcutta) 11(1): 207. 1908.

Calamus viminalis subvar. *pinangianus* Becc., Ann. Roy. Bot. Gard. (Calcutta) 11(1): 207. 1908.

Vernacular Names: Jungli beth.

Clustering, medium-diameter rattan. Stem to 20 m long or more, with sheaths to 1.8 cm in diameter, without sheaths to 1.3 cm. Leaves 1 m long or more, ecirrate; younger part and sheaths covered with a white powder; sheath green, sparingly armed with spines, spines to 0.5 cm long; knee present; ocrea slightly developed; petiole and rachis armed at sides with spines, spines straight, 1.25 - 3.45 cm long, leaflets 12.5 to 23.5 x 1.2 to 2.2 cm, fasciculate, narrowly lanceolate, midvein prominent. Inflorescence long, drooping; primary sheath tightly sheathing, with spines to 0.8 cm long; partial inflorescence to 30 cm long; secondary sheath tightly sheathing, unarmed; rachilla to 15 cm long, 2 cm apart. Fruit globose, 0.9 cm in diameter, scales in 18 vertical rows, green, turns grey white on maturity; deeply channeled; endosperm not ruminate.

Distribution: India (Andaman Islands, West Bengal, Bihar, Orissa, Andhra Pradesh, Sikkim, Tripura), Bangladesh, Myanmar, Thailand, Malay Peninsula, Java.

Flowering: November - December. **Fruiting:** April - May.

Conservation Status: Least Concern

Specimens examined: Wrightmyo, South Andamans, 5.4.1988, Renuka 4054 (KFRI); Wumberleygung, South Andamans, 6.4.1988,

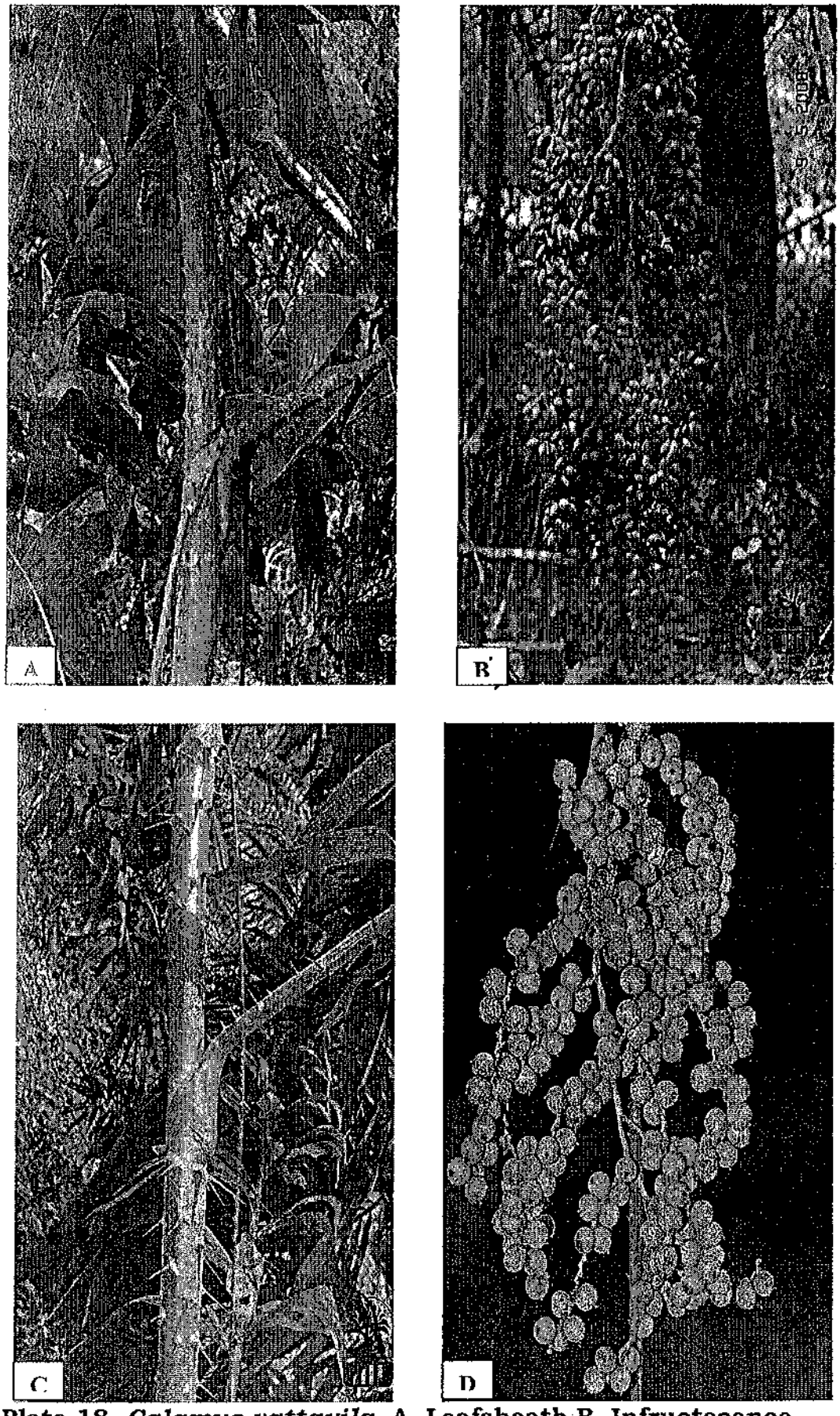


Plate 18. ***Calamus vattayila*** **A. Leafsheath B. Infructscence**
C. viminalis **C. Leafsheath D. Infructscence**

fr., Renuka 4061 (KFRI); Mannarghat, South Andamans, 7.4.1992, fr., Vijayakumaran 6630 (KFRI); Long Island, Andamans, 22.1.1959, fr., Thothathri 9115 (MH); Near Vedurupalli, Visakapattanam, Andhra, 27.10.1972, fl., Subba Rao 42756 (MH); Forest near Iralegedda, 18.5.1979, fr., Subba Rao 62464 (MH); Andra, 17. 10. 1986, male fl., Rao & Narasimhan 84370 (CAL).

Uses: It is the most used cane of India. The strong canes are used for making baskets and various other articles of local uses. Split canes are used as chairbottom. Its fruits are edible and pith from the lower part of the stem can be eaten as vegetable. Leaves are also used as fodder for elephants.

Calamus wightii Griff., Griff., Palms Brit. E. Ind.: t. 216C. 1850.

Palmijuncus wightii (Griff.) Kuntze, Revis. Gen. Pl. 2: 733. 1891.

Calamus huegelianus Mart., Hist. Nat. Palm. 3: 338. 1853.

Daemonorops melanolepis Mart., Hist. Nat. Palm. 3: 331. 1853.

Calamus melanolepis (Mart.) H.Wendl. in O.C.E.de Kerchove de Denterghem, Palmiers: 237. 1878.

Palmijuncus huegelianus (Mart.) Kuntze, Revis. Gen. Pl. 2: 733. 1891.

Palmijuncus melanolepis (Mart.) Kuntze, Revis. Gen. Pl. 2: 733. 1891.

Clustering, medium diameter rattans. Stem to 30 m long or more, with sheaths to 3 cm in diameter, without sheaths to 2 cm. Leaf to 2 m long, ecirrate; sheath brownish green, densely armed with spines, spines solitary or subseriate, the largest 10-15 mm long interspersed with abundant brown tomentum; knee present; ocrea very short; petiole to 30 cm long, green when dry, armed with spines; spines similar to those of the sheaths, gradually transformed into hook like spines upwards; rachis armed below with hook like spines; leaflets 50 x 2.5 cm, upper leaflets smaller, regular, long acuminate, narrowly lanceolate, the terminal pair less acuminate, free at the base.

Inflorescence long, flagellate; primary sheath closely sheathing, armed with small straight spines; partial inflorescences erect, the largest 30-40 cm long, rather densely panicled; secondary sheaths tubular infundibuliform, ciliate at the mouth; rachillae 5-7 pairs, distichous, rigid, arched, inserted just at the mouth of the spathes, with a distinct axilary callus; involucrophorum more or less distinctly pedicelliform, involucre slightly concave; female flowers rather large, 6 mm long. Fruit 15-18 mm across, almost spherical; scales in 21 rows, not channelled, shiny, quite black; endosperm ruminate.

Distribution: India (Tamil Nadu). Endemic. Evergreen forests between 1300-2000 m. Sispara in the Nilgiri Mountains, Naduvatum in Tamil Nadu.

Flowering: Not known. **Fruiting:** October – November

Conservation Status: Endangered

Specimens examined: Sispara, 11.3 1997, fl., fr., Anto, 7092 (KFRI); Sispara Ghats, sept 1883, fr., Acc. 73185 (MH); Acc. 73182, 1883, leaf (MH); Coonoor, March 1883, Gamble 11585 (MH); Kulamavu; 4.10.1983, fl. Mohanan 79989 (MH); Painavu, Idukki, 20.2.1983, Mohanan 76267 (MH); Pattikadu R.F, Somwarpet Range, 18.2.1984, fr., Vajravelu, 77794 (MH); Neelagiri Dist., Tamil Nadu, 18.6.1983, Gamble 14242 (CAL)

Uses: Reported to be a good quality cane.

Caryota L., Sp. Pl. 1189. 1753. Gen. Pl. ed. 5. 497. 1754; Brandis, For. Fl. 550. 1874; Alexander, Fl. Pl. Ind. 357. 1894; Becc. & Hook. f. in Hook. f., Fl. Brit. Ind. 6:422. 1894; Brandis, Ind. Trees 654. 1906; Talbot, For. Fl. Bomb. Sind 2:558. 1911; Benthall, Trees Calc. 453.1946; Bailey, Man. Cult. Pl. (reprint ed.) 171.1966; Cowen, Fl. Trees Shrubs Ind. 104. 1969; Moore, Jr. in Gentes Herbarum 11 (2):132.1973.

Moderate to large, solitary or clustered, hapaxanthic, monoecious palms. Stems with more or less elongate internodes, obscured a first by persistent fibrous leaf bases and sheaths, usually becoming bare, conspicuously ringed with narrow leaf scars, striate. Leaves induplicately bipinnate (except in juveniles), marcescent or abscising under their own weight; sheath triangular, eroding opposite the petiole into a mass of strong black fibers, ligule like extension frequently present, disintegrating into strong black fibers, the sheath surface covered in a dense felt of indumentum amd caducous chocolate-brown scales; petiole scarcely to well developed, channeled adaxially, rounded abaxially, bearing indumentum; secondary rachises similar in form to the primary rachis, arranged regularly except rarely in 1 or 2 species where the most proximal few crowded; leaflets vey numerous, borne almost regularly along the secondary rachises, obliquely wedge shaped with no distinct midrib, upper margins deeply praemorse, blade concolorous, with broad bands of caducous chocolate-brown scales abaxially, transverse veinlets obscure. Inflorescences bisexual, solitary, produced in a basipetal sequence, interfoliar and sometimes infrafoliar, usually branched to 1 order or rarely spicate, usually pendulous; peduncle circular in cross-section, densely scaly; prophyll tubular at first, soon splitting, 2-keeled, relatively small, densely tomentose and scaly; peduncular bracts to ca.8, conspicuous, large, enclosing the inflorescence in bud, coriaceous, tubular at first, tending to split irregularly, usually densely tomentose and scaly; rachillae spirally arranged, densely

crowded, usually scaly, each subtended by a small, low triangular bract; distal portion of rachilla bearing close or rather distant, spirally arranged, protandrous triads, each subtended by an inconspicuous rachilla bract; floral bracteoles shallow, rounded. Staminate flowers usually elongate, symmetrical; sepals 3, distinct, coriaceous, imbricate; petals 3, valvate coriaceous, connate at the very base; stamens 6-ca. 100, the filaments short, basally sometimes connate, anthers latrorse; pistillode absent. Pistillate flower globular; sepals 3, coriaceous, rounded, imbricate, connate at the very base; petals 3, coriaceous, valvate; staminodes 0-6; ovary rounded or somewhat 3-angled, trilocular with 1-2 locules fertile, stigma trilobed, apical. Fruit globose, 1-2 seeded, with apical stigmatic remains; epicarp smooth, becoming dull, bright or dark colored at maturity, mesocarp fleshy, filled with abundant, irritant, needlelike, crystals, endocarp not differentiated. Seeds basally attached, irregularly spherical or hemispherical, somewhat grooved or smooth, endosperm ruminate; embryo lateral.

Distribution:- Genus consists of 13 species; distributed from India throughout South east Asia and the West Pacific to Vanuatu. In India 4 species occur.

Notes: - The leaf is unique, being the most conspicuous bipinnate leaf in the palms.

Key to the species

1a. Stem cluster forming, not robust, leaf sheath mostly persistent, inflorescence not large, with to 60 flowering branches..... *mitis.*

1b. Stem solitary, robust, distinctly annulate, more or less clean, inflorescence large, with 1-20 flowering branches..... 2

2a. Terminal leaflets deeply incised, papery, sharply toothed at margins, ...*urens.*

2b. Terminal leaflets not deeply incised, obtuse, and dentate at margins.....3

3a. Secondary leaflets with deeply jagged margins.....*maxima*

3b. Secondary leaflets with scarcely jagged margins.....*obtusa*

Caryota mitis Lour., Lour., Fl. Cochinch.: 697. 1790. Mart., Hist. Nat. Palm. 3,195. 1823–1853; Becc. & Hook. f. in Hook. f., Fl. Brit. India 6: 423.1850; Brandis Ind. Trees, 654. 1906 ; Plate 20.

Caryota furfuracea Blume ex Mart., Hist. Nat. Palm. 3: 195. 1838.

Caryota propinqua Blume ex Mart., Hist. Nat. Palm. 3: 195. 1838.

Caryota sobolifera Wall. ex Mart., Hist. Nat. Palm. 3: 194. 1838.

Drymophloeus zippellii Hassk., Tijdschr. Natuurl. Gesch. Physiol. 9: 170. 1842.

Thuessinkia speciosa Korth., Fl. Ned. Ind. 3: 41. 1855.

Caryota javanica Zipp. ex Miq., Fl. Ned. Ind. 2: 41. 1856., nom. illeg.

Caryota griffithii Becc., Nuovo Giorn. Bot. Ital. 3: 15 (1871).

Caryota griffithii var. *selebica* Becc., Malesia 1: 75. 1877.

Caryota nana Linden, Ill. Hort. 28: 16. 1881.

Caryota speciosa Linden, Ill. Hort. 28: 16. 1881.

Vernacular Names: Madi pathi (Hindi, Andamans).

Clustering, monoecious, hapaxanthic palm. Stem 3.5 - 12 m high, 10 - 13 cm in diameter, soboliferous, forming very thick, compact tufts, greenish, distinctly annulate. Leaves borne along upper half of stem, 1.2 - 2.7 m long, spreading, glaucescent, greenish, petiole 1-1.5m, leaflets 10 - 18 cm long, very obliquely cuneiform, erose, toothed, the upper margin acute, regularly and rather obtusely jagged; spathes concealing the whole peduncle, almost boat shaped. Inflorescence protandrous, to 90 cm long, rachillae vary 20-60, 25-65 cm; male flowers very numerous, 10 mm long, oblong, flesh coloured, with reddish points; calyx cup shaped, sepals broad, imbricate; petals coriaceous, striate, purple to maroon; stamens 12-24 or many; filaments very short, united at the base; anthers linear, adnate, generally slightly mucronate; female flowers smaller than males, to 5mm, sepals rounded, 3mm, with a brown intramarginal line and

ciliate edges; petals twice as long as the sepals, 5-5 mm, valvate, coriaceous, brown; staminodes three, yellowish, tips glandular; ovary roundish ovate with three obtuse angles. Fruits globose, 1.3 cm in diameter, purple black or reddish, surrounded at the base by the perianth.

Distribution: Burma, Andaman Islands, Malay archipelago; in lowland rain forests, secondary forests, disturbed areas, and often cultivated; below 1000 m; widely planted as an ornamental..

Flowering and Fruiting: The palm flowers once in its lifetime. Several inflorescences are produced in a basipetal order and the palm dies after the last inflorescence mature.

Conservation Status: Vulnerable

Specimens examined: Rutland Islands, S. Andamans, 22.1.1982, Vasudeva Rao 8655 (CAL); Bagghola Forest, Orissa, 7.12.1962, leaf, fr., G. V. S. Rao, 29977 (BSI Shillong); Lamia Bay, North Andaman, 15.10.2008, Linto & Manohara 25014 (KFRI); Mount Harriet, South Andamans, 12.9.2008, Linto 25004 (KFRI); Shadipur, Port Blair, 22.10.2008, fr., Linto 25019 (KFRI); BSI Howrah, 18.02.2008, fl., fr., Linto 24290 (KFRI); Chidiyatapu, Andamans, 2.4.2001, Sreekumar & James 22614 (KFRI); South Andamans, 8.4.1988, fr., Renuka 4065 (KFRI)

Uses: Cultivated in the gardens for beautification of landscape. The core of the stem contains starch. Leaves are used by the old settlers of Andamans as thatches and for making fancy items. Splitted cane is also used for making garlands and for decorating places of religious ceremonies.

Caryota obtusa Griff. : Griff., Calcutta J. Nat. Hist. 5: 480. 1845; Palms Brit. E. Ind.170. 1850; Mart., Hist. Nat. Palm. 3, 195. 1823–1853; Becc. & Hook. f. in Hook f., Fl. Brit. India 6: 422. 1892; Brandis, Ind. Trees, 654. 1906; Plate 21.

Caryota rumphiana var. *indica* Becc., Malesia 1: 75. 1877.

Caryota obtusidentata Griff., Palms Brit. E. Ind.: t. 236A, B. 1850.

Caryota gigas Hahn ex Hodel, Palm J. 139: 51. 1998., without diagnostic latin descr.

Solitary, hapaxanthic, monoecious palm. Stem tall, stout, 45 - 60 cm in diameter. Leaves very large; leaflets cuneate, very unequal sided, coriaceous when dry, remarkably striato-plicate, the upper margin not caudate; spines very short, very obtuse. Inflorescences interfoliar, protandrous, flowers arranged in triads- a female flower between two males; male flower sepals rounded, scurfy, ciliate; petals 2.5 times larger than sepals; stamens many; anthers linear, slightly mucronate; female flower calyx as in the male; petals much smaller, valvate; staminodes 3, opposite to the sepals; ovules solitary, erect; stigma 3 lobed.

Distribution: Upper Assam.

Flowering and Fruiting: The palm flowers once in its lifetime. Several inflorescences are produced in a basipetal order and the palm dies after the last inflorescence mature.

Conservation Status: Vulnerable

Specimens examined: Simdhaara village, Assam 17.12.1957, fr., V.N. Naik, 5350 (BSI Shillong); K & G Hills, Assam, 15.12.1915, leaf, fr., Upendranath Kanjilal, 6393 (BSI Shillong); Mousinram village, Meghalaya, 26.04.09, Linto 25021(KFRI); Near Moosmai cave, Shillong, 28.4.09, Linto 25034 (KFRI); Cherrapunjee, 7.2.2008, Linto & Anand 24289 (KFRI); Mizoram, 09.08.2004, Sreekumar 24201 (KFRI)

Uses: The inhabitants of the Mishmi Mountains use the central soft portion of the trunk as food.

Caryota urens L., L., Sp. Pl. 1189. 1753; Mart., Hist. Nat. Palm. 3, 193. Pl. 107, 108, 162 1823 – 1853; Griff., Calcutta. J. Nat. Hist. 5, 479. 1845 and Palms Brit. E. Ind. 159. 1850; Becc. & Hook. f. in Hook. f., Fl. Brit. India 6: 422. 1892; Fischer in Gamble, Fl. Pres. Madras.

1560. 1931. Moore & Dransfield, Taxon 28: 70. 1979. Rheede, Hort. Malab. I: Pl. 11. 1678; Plate 21.

Vernacular Names: Ana pana, chunda pana (Malayalam).

Solitary, hapaxanthic, monoecious palm. Stem 16-20 m high and to 60 cm in diameter, leaf scars annular. Leaves 3-4 m long, induplicately bipinnate; sheath triangular, eroding opposite the petiole into a mass of strong black fibres, sheath surface covered with indumentum and brown scales; petiole well developed bearing indumentum; secondary rachis similar to the primary rachis; leaflets very numerous, borne on the secondary rachis, obliquely wedge shaped with no distinct midrib, but several major veins diverging from the swollen base, upper margin deeply praemorse with broad bands of caducous, chocolate brown scales adaxially. Inflorescence 3-4 m long, bracts about 45 cm long, produced in basipetal sequence, infrafoliar, pendulous, peduncle densely scaly, curved, stout, rachillae simple, very long, pendulous, level topped resembling a huge docked horse tail; staminate flowers elongate, symmetrical, sepals coriaceous, rounded, imbricate; petals valvate, coriaceous, connate basally, considerably exceeding the sepals; stamens many (40-45); filaments short; anthers linear, connective sometimes prolonged into a point; pistillate flowers globular; sepals coriaceous, rounded, imbricate, connate basally; petals coriaceous, valvate, connate into a tube in the basal half; staminodes 6; ovary trilocular with 1-2 fertile locules; ovule hemiantropus, sepal glands basal; stigma trilobed. Fruit globose, 1.8-2 cm in diameter, red at maturity, mesocarp fleshy, with irritant needle like crystals, endocarp not differentiated; seeds hemispherical, smooth, endosperm ruminate.

Distribution. India, Myanmar, Sri Lanka, Malaysia.

Flowering and fruiting: The palm flowers once in its lifetime. Several inflorescences are produced in a basipetal order and the palm dies after the last inflorescence mature.

Conservation Status: Least Concern

Specimens examined: Panamkutty, Idukki, 4.5.1984, fl., Mohanan 81781 (MH); Aickad, Adoor, Quilon, 15.11.1979, fl., Mohanan 68314 (MH); Forest area Bonacaud, Thiruvananthapuram, 20.10.1973, fl., Joseph 44517 (MH); Kallur , S. Kanara, 29.12.1938, Raju 6304 (MH); Khasia, Meghalaya, S. Coll. M. H. Acc. No. 72647 (MH); Silasagar Dt., Assam, 13.11.1964, leaf, fr., S. K. Kataki, 41569 (BSI Shillong); Boragharo, Orissa, 20.8.1931, fl., Narayanaswamy 5992 (MH); Thrissur, Kerala, 20.12.96, fl., Anto 6667 (KFRI); Maridinilli, Andhra, 29.5.01, Sreekumar and Dinesh 22699 (KFRI); Karadippara, Peechi, Thrissur, Kerala, 26. 11.87, N. Sasidharan 4723 (KFRI); Bhavanipattanam, Orissa, 16. 5. 02, fl., Sreekumar and Dinesh 22683 (KFRI).

Uses: Leafsheath fibres are strong and used for making ropes, brushes etc. The core of the stem contains huge quantity of edible starch, the sap from the cut end of the peduncle is sweet and made into jaggary and fermented into toddy. The very young leafbud is edible. Karbis (Mikirs) of Assam uses the seed as masticatory.

Caryota maxima Blume ex Martius, Hist. Nat. Palm. 3: 195.1838.

Caryota aequatorialis (Beccari) Ridley; *C. bacsonensis* Magalon; *C. furfuracea* Blume var. *caudata* Blume; *C. furfuracea* var. *furcata* Blume; *C. macrantha* Burret; *C. obtusa* Griffith var. *aequatorialis* Beccari; *C. ochlandra* Hance; *C. rumphiana* Martius var. *javanica* Beccari; *C. rumphiana* var. *oxydonta* Beccari; *C. rumphiana* var. *philippinensis* Beccari.

Stems solitary, to 30 m tall, 25–64 cm in diam., columnar. Leaves borne along upper half of stem; petioles 8–30 cm; rachis 2.7–4.2 m; primary pinnae to 27 per side of rachis, pendulous; secondary pinnae 12–27 per side of secondary rachis, with deeply jagged margins. Inflorescences borne among leaves, to 3.5 m; rachillae 80–170, 1.5–

2.1 m; male flowers to 15 mm; sepals ca. 5 mm; petals yellowish, 12–15 mm; stamens 80–100; female flowers to 10 mm; sepals ca. 5 mm; petals 6–8 mm. Fruits dull reddish or orange, globose, to 2.5 cm in diam., 1- seeded.

Distribution

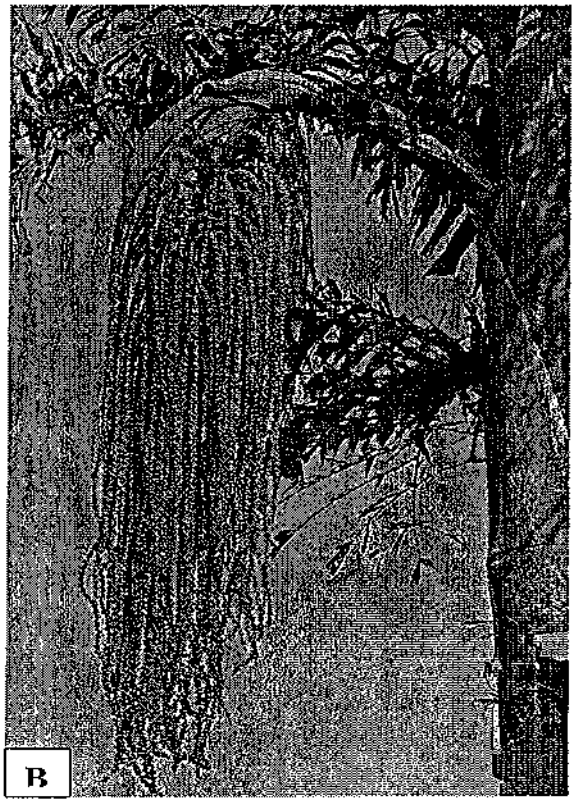
Lowland to montane rain forests or disturbed areas, often planted or naturalized; 200–1800 m. Guangdong, Guangxi, Hainan, Yunnan [Bhutan, India, Indonesia (Java, Sumatra), Laos, Malaysia (Peninsular), Myanmar, Thailand, Vietnam.

Flowering and fruiting: The palm flowers once in its lifetime. Several inflorescences are produced in a basipetal order and the palm dies after the last inflorescence mature.

Conservation Status: Least Concern

Uses:

The palm heart is eaten; the stems are used to make implements; and the sheath fibers are used for tinder.



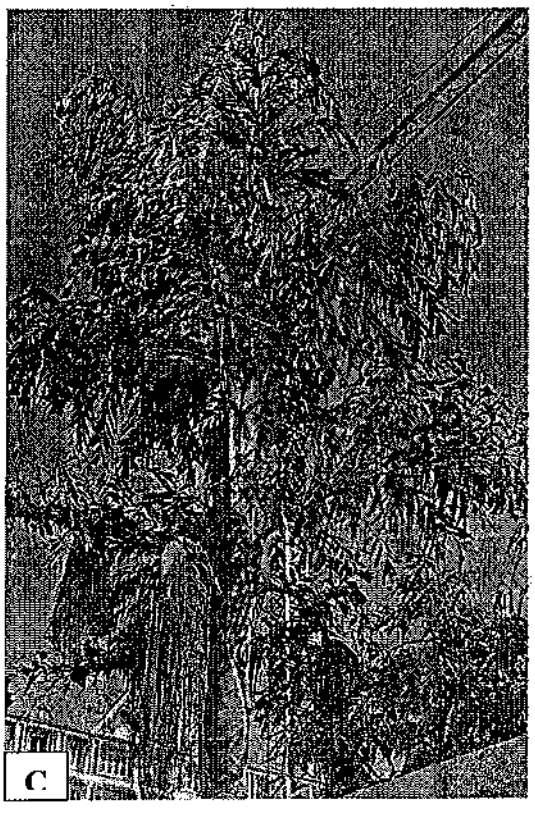
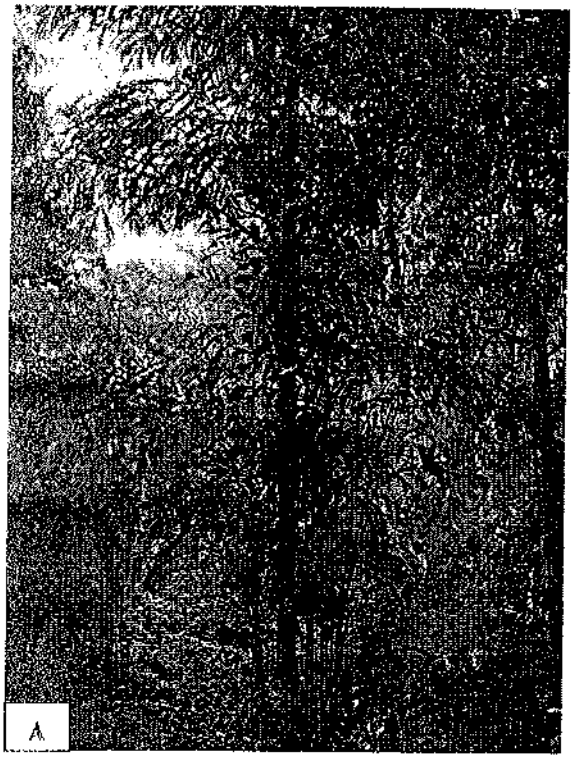
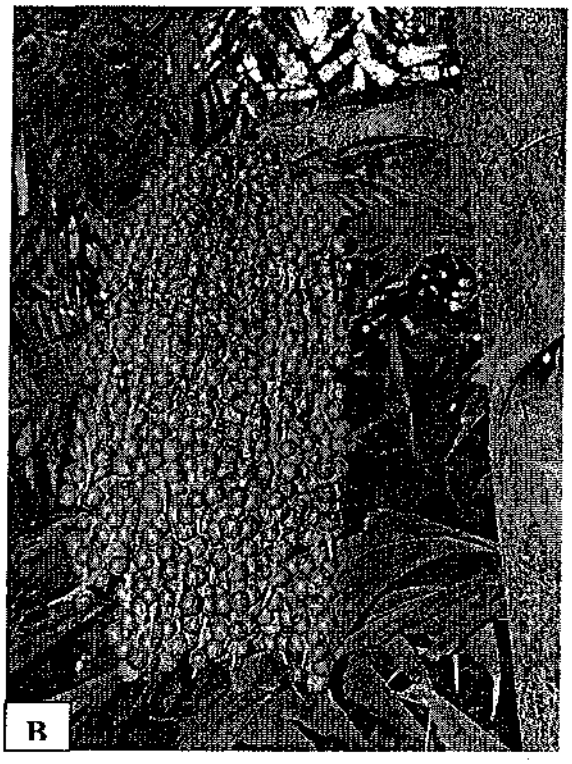


Plate 19. ***Caryota obtusa*** **A. Habit ;** ***Caryota urens*** **B. Female inflorescence C. Habit**





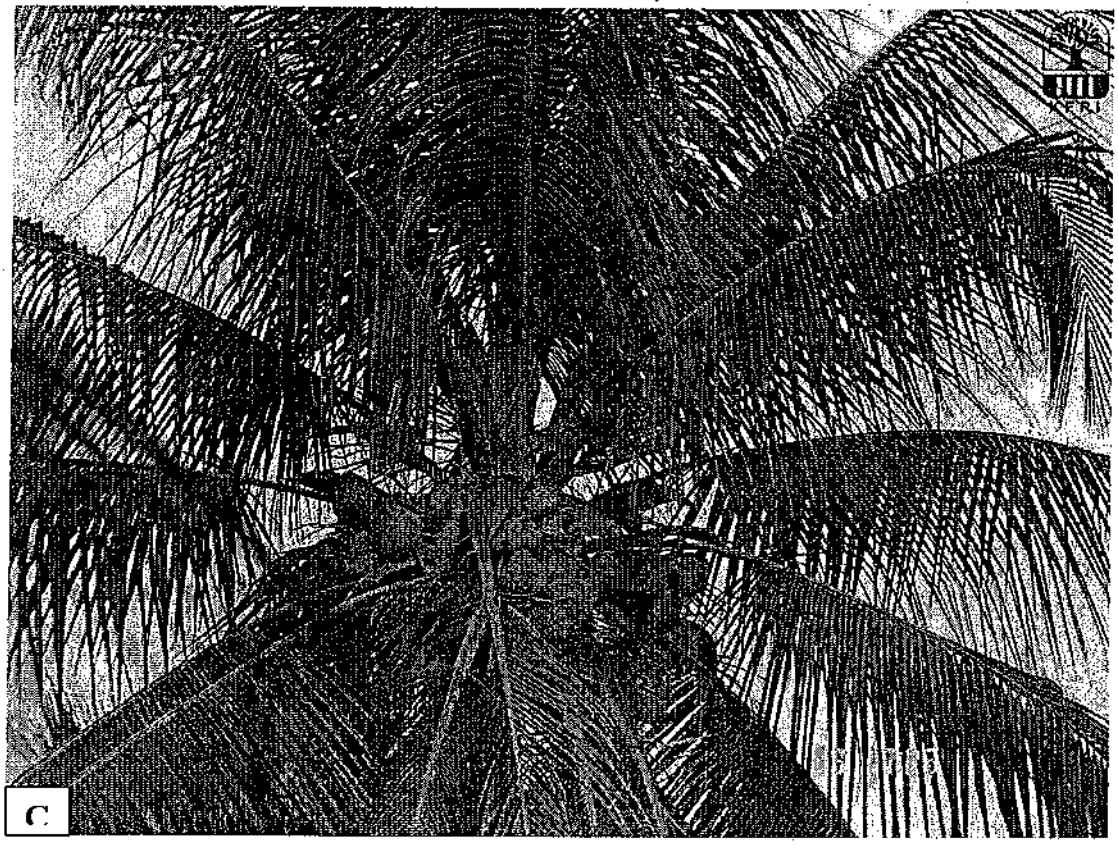


Plate 20. ***Caryota mitis*** **A. Habit B. Infructscence C. Infructscence**
Cocos nucifera **C. Trunk with coconuts.**

Cocos L., Species Plantarum 1188. 1753 .

Calappa Steck, Dissertatio Inauguralis Medica de Sagu 9. 1757.
Coccus P. Miller, The Gardener's Dictionary A bridged from the Folio Edition 4. 1754.

Moderate, solitary, unarmed, pleonanthic, monoecious palm. Stem erect, often curved or slanting, becoming bare and conspicuously ringed with leaf scars. Leaves numerous, pinnate, neatly abscising; sheath fibrous, forming a woven supportive network with a conspicuous, tongue like extension opposite the petiole, eventually disintegrating and becoming open; petiole short to long, adaxially channelled, abaxially rounded; leaflets very numerous, single fold, regularly arranged in one plane, usually rather stiff, linear, acuminate, usually bifid with slightly asymmetrical tips, adaxially glabrous, abaxially with abundant, dot like scales and very small ramenta along the midrib, midrib prominent adaxially, transverse veinlets evident. Inflorescences solitary, interfoliar, axillary , branched to 1 order, protandrous; peduncle elliptic in cross-section, robust, elongate, bearing scattered scales; prophyll tubular, 2-keeled laterally, opening apically, becoming fibrous, tomentose, persistent; peduncular bract inserted near the prophyll, very large, tubular, entirely enclosing the inflorescence in bud, splitting abaxially, becoming boat-shaped, beaked, thick, woody, adaxially smooth, abaxially with longitudinal, shallow grooves and caduceus tomentum; rachis more or less equalling the peduncle bearing spirally arranged rachillae, each subtended by an inconspicuous triangular bract and with a swollen base; rachillae robust, pendulous at first, later spreading with a basal bare portion and none or a few basal triads and pairs or solitary staminate flowers distally; rachilla bracts and floral bracteoles inconspicuous. Staminate flowers asymmetrical, narrowly ovoid, moderate, sessile; sepals 3, distinct, rather unequal, imbricate, triangular, keeled; petals much longer than the sepals, thick, rather

leathery, distinct, valvate, irregularly boat-shaped, acute; stamens 6, filaments rather short, distinct, awl-shaped, fleshy, erect, anthers deeply sagittate basally, shallowly so at the apex, elongate, medifixed, versatile, latrorse; pollen elliptic, monosulcate or occasionally trichotomosulcate, exine tectate, finely reticulte; pistillode with 3, slender. Pistillate flowers very large, globose in bud, becoming very broadly ovoid at anthesis; sepals 3, distinct, imbricate rounded; petals similar to and somewhat longer than the sepals, lacking valvate apices, very leathery; staminodial ring low, membranous, not lobed; gynoecium trilocular at the very base, triovulate, broadly ovoid, obscurely 3- angled, extremely fibrous distally, stigmas 3, very short, borne in a slight depression, ovule anatropous, very small, laterally attached. Fruit very large, ellipsoidal to broadly ovoid, indistinctly 3-angled, dull green, brown, brilliant-orange, yellow, to stigmatic remains apical; epicarp smooth, mesocarp very thick and fibrous, dry, endocarp thick and woody spherical to narrow ovoid, indistinctly 3-angled with 3 longitudinal an operculum. Seed almost always 1 only, very large, with a narrow layer of homogeneous ebdosperm; embryo basal.

Distribution:- A genus with one species widely cultivated throughout tropics; naturally found in certain Islands of Andaman and Nicobars. Origin of the genus is uncertain but probably western Pacific (Buckley and Harries 1984). Found in Belize, Benin, Bismarck Archipelago, Borneo, Caroline Islands, Central American Pacific Islands, Chile North, Costa Rica, Fiji, Gabon, Gilbert Islands, Hawaii, India, Jawa, Leeward Islands, Line Islands, Madagascar, Malaya, Maldives, Maluku, Marcus Island, Marianas, Marquesas, Marshall Islands, Mauritius, Nauru, New Guinea, Nicaragua, Niue, Ogasawara-shoto, Philippines, Phoenix Islands, Puerto Rico, Queensland, Réunion, Samoa, Seychelles, Society Islands, Solomon Islands, Sri Lanka, Thailand, Togo, Tokelau-Manihiki, Trinidad-Tobago, Tuamotu, Tubuai Islands, Tuvalu, Vanuatu, Wallis-Futuna Islands.

Notes: Latinization of the Portuguese word, coco, originally used for a bugbear or ape, in reference to the face-like appearance of the partially dehusked endocarp (Dransfield *et al.*, 2008).

Cocos nucifera L. : L., Sp. Pl. 1188. 1753; *Dalzell & Gibson, Bombay Fl.* 279 :1861; Becc. & Hook. f. in Hook. f., Fl. Brit. India. 6: 482. 1893. Fischer in Gamble, Fl. Pres. Madras 3: 1557. 1931; Plate 20.

Palma cocos Mill., Gard. Dict. ed. 8: 2. 1768., nom. illeg.
Calappa nucifera (L.) Kuntze, Revis. Gen. Pl. 2: 982. 1891.
Cocos indica Royle, Ill. Bot. Himal. Mts.: 395. 1840.
Cocos nana Griff., Not. Pl. Asiat. 3: 166. 1851.
Cocos nucifera var. *synphyllica* Becc., Agric. Colon. 10: 586. 1916.

Vernacular Names: Thengu (Mal.).

Solitary, pleonanthic, monoecious palm. Stem erect or inclined, irregularly ringed, attains a height of 30 m; 50 –70 cm in diameter. Leaves pinnate, borne in a terminal crown, 5-7 m long, arching, drooping; leaf sheath heavy, semi woody, form thick nets along the margins; petiole grooved on upper side with smooth margins; leaflets oblong-lanceolate, about 1 m long, about 200 pairs per leaf; midnerve prominent on upper side. Inflorescence interfoliar; peduncular bract large, woody; peduncle stout; flower branches simple, stiff borne on short axis; female flowers basal, very large, globose to conical with 6 staminodes forming a low ring. Fruits large, about 30 cm long, 1-seeded with bony endocarp having 3 pores near the base; mesocarp with dense layer of fibres; epicarp smooth, light green, pale green or yellowish green in colour turning to light brown when ripe; endosperm homogenous, white, surrounding transparent homogenous fluid.

Distribution: Pantropic. Grows mostly near the seacoasts. Naturally occurring in Andaman Islands

Flowering & fruiting: Almost round the year.

Conservation Status: Least Concern

Specimens examined: BSI Compound, Poona, 17.11.1960, fl., John Cherian 68210 (CAL); Rajan Bag, Satpati Palgav Range, Maharashtra, 14.1.1968, Billore 113550 (CAL); Quilon Dist., 18.7.1979, fl., Mohanan 63178 (CAL); Agarthala, 30.9.1914, P.M.Debbarman 121 (CAL).

Uses: The white endosperm is delicious and nutritious and eaten raw as wholesome food; endosperm after drying is shredded and consumed after mixing with other dry fruits. After drying the endosperm separates out from the endocarp along with its outer coating and the whole thing is called copra. The dried copra is utilized for extraction of coconut oil which is used as cooking medium or used for making soap, cosmetics, shampoos, shaving creams etc. Coconut oil cake is an excellent food for livestock. Coconut water is a refreshing drink. The sweet sap extracted from the peduncle is made into jaggery or for brewing into wine and vinegar. The rough fibre (coir) extracted from the husk of the fruits is used for making ropes, mats, carpets or blended with rubber for making soft durable bed mattresses. The strong mid nerve of the leaflets is extracted and used for making brooms, baskets and various other household items employing rural artisans. leaflets are used for thatching village homes. The hard wood sliced out from the stem of old trees is extensively used in South India for cabinet making, for concrete shuttering or used as fuel. It is reported that apart from the cocnut water, root, bark, flowers and leaf charcoal have medicinal properties. The soft downy substance from the lower surface of the leaves is used as styptic. The astringent roots are used for curing dysentery and other intestinal ailments. There are several varieties of coconut trees seen in india characteristic by their dwarf or tallness, mode and duration of fruiting season, size of the fruits and yield.

Corypha L., Sp. Pl. 1187. 1753.

Codda- pana Adanson, Familles des Plantes 2: 25, 541. 1763 (type as above.)

Taliera Martius, Palmarum Familia 10. 1824. Type: *T. bengalensis* Sprengel (= *Corypha taliera* Roxburgh).

Gembanga Blume in T.F.L. Nees, Flora 8 (2); 580, 678. 1825. Type: *G. rotundifolia* Blume (= *Corypha utan* Lamarck.)

Massive, solitary, armed, hapaxanthic, hermaphroditic, tree palms. Stem erect, closely ringed with leaf scars sometimes in distinct spirals. Leaves induplicate, costapalmate, marcescent in immature individuals; sheath sometimes with lateral lobes, later sometimes with a conspicuous triangular cleft below the petiole, the margins tending to erode into fibers; petiole massive, long, covered with caducous indumentum, deeply channeled adaxially, abaxially rounded, margins with well defined teeth; adaxial hastula well defined teeth; adaxial hastula well developed, abaxial hastula rather irregular; blade regularly divided to half of its radius into single-fold segments, filaments present at upper folds in young leaves, segments with prominent longitudinal veins, abundant transverse veinlets and caducous floccose indumentum along the folds, indumentum more abundant abaxially. Inflorescences terminal, above the leaves , pyramidal, compound, composed of first-order branches equivalent to the axillary inflorescences of pleonanthic palms, the first-order branches subtended by leaves with reduced blades or by tubular bracts, and emerging from their mouths or through their mouths or through an abaxial split, branched to the 4th order, all branches ending as rachillae; prophyll of first-order branches 2-keeled, empty; first order bracts tubular, the proximal 0- several empty, other bracts inconspicuous, triangular, each subtending a second or higher order branch; rachillae bearing spirally arranged, adnate cincinni of up to 10 flowers; floral bracteoles minute. Flowers borne on short stalks formed by the base of the calyx and the receptacle; calyx tubular

basally, imbricate, stamens 6, the 3 antesepalous free, the 3 antepetalous adnate basally to the petals, filaments tapering from a fleshy base; anthers short, somewhat sagittate basally, medifixed, latrorse; pollen elliptic, monosulcate or very rarely trichotomosulcate, with finely reticulate; gynoecium tricarpellate, syncarpous, triovulate, ovary globose, distinctly 3-grooved, style elongate, slightly 3 grooved, stigma scarcely differentiated, ovule hemianatropous. Fruit globose, single-seeded with basal abortive carpels and stigmatic remains; epicarp smooth, mesocarp fleshy, endocarp thin, usually remaining attached to the seed. Seed globose with basal hilum; endosperm homogeneous, with or without a central hollow; embryo apical.

Distribution:- The genus consists of 5 species found mainly in South East Asian region, ranging from southern India and Sri Lanka, to the Bay of Bengal, and Indochina through Malesia to northern Australia; mainly found in villages, town areas are mostly planted. India is represented with 3 species.

Notes:- Distinguished by toothe petiole margins, flowers in adnate cincinni, and syncarpous ovaries. Species of Corypha are most striking palms beacause of their massiveness. The inflorescence is the largest among seed plants; the number of flowers has been estimated as ten million. See Tomilson and Soderholm (1975) for a discussion of flowering, fruiting, and inflorescence structure.

Corypha taliera Roxb. Roxb., Pl. Coromandel 3: 51. 1820. Mart., Hist. Nat. Palm. 3, 231.1823–1853; Griff., Calc. Journ. Nat. Hist. 5, 317.1845 and Palms Brit. E. Ind. 114, t. 220, E. F. 1850; Wall. Cat 8616; Becc. & Hook. f. in Hook. f., Fl. Brit. India 6: 428. 1892. Brandis Indian tress, 658. 1906.

Taliera bengalensis Spreng., Syst. Veg. 2: 18. 1825.

Taliera tali Mart. ex Blume in J.J.Roemer & J.A.Schultes, Syst. Veg. 7: 1306. 1830.

Corypha martiana Becc. ex Hook.f., Fl. Brit. India 6: 429. 1892.

Corypha careyana Becc., Webbia 5: 7 1921.

Vernacular names: Tara, Tallier (Beng.)

Solitary, monocarpic, hapaxanthic, hermaphrodite palm. Stem erect about 10 m long, 60-70 cm in diameter near base, . Leaves costapalmate, to 6 m long; leafbase does not split at the base; petiole about 3 m long, 18 cm broad at base; leafblade almost rounded, not deeply divided, about 2.5 m long from hastula to the tip of the middle segment; segments mostly 80 in number; free segments, to 120 cm long, to 12 cm broad at middle; middle segments unequally bilobed at apices; lateral segments acuminate. Inflorescence terminal, pyramidal about 6 m long; ultimate flower branches pale yellow, 40-80 cm long, slightly angular at sterile basal part; flowers in clusters of 3-6; each 5 mm long, pale yellow; calyx 2 mm long, lobes unequal, obtuse, hyaline; petals slightly incurved, fleshy, 3 mm x 1 mm; stamens upto the height of petals; filaments 2 mm long; anthers dorsifixed, ovate-oblong to elliptic-oblong, 1.5 mm long. Fruits shortly pedicellate by thickening of receptacle; mesocarp non-fibrous; greenish yellow; seed 2.5 cm in diameter, endosperm homogenous, germination remote tubular.

Distribution: India (Bengal). Endemic.

Flowering & fruiting:

Conservation Status: Possibly extinct; no recent collections

Uses: The leaves are used for writing upon with pointed steel bodkins; also for tying the rafters of the native houses as they are strong and durable. Distribution West Bengal. Conservation Status: Extinct in the Wild.

Corypha umbraculifera L., : L., Sp. Pl.: 1178. 1753; Gaertn. Fruct. i. 18, Pl. 7. 1792; Mart., Hist. Nat. Palm. 3: 232, Pl. 108, 127. 1823–1853; Griff., Calcutta. J. Nat. Hist. 5: 319. 1845; Palms Brit. E. Ind. 115. 1850; Becc. & Hook. f. in Hook. f., Fl. Brit. India 6: 428. 1892., C.

E. Parkinson, Forest Fl. Andaman Isl.: 263 (1923); Blatt., Palms Brit. Ind. 72. 1926. Gamble, Fl. Pres. Madras. 561. 1931 ; Plate 21.

Corypha guineensis L., Mant. Pl. 1: 137. 1767.

Bessia sanguinolenta Raf., Sylva Tellur.: 13. 1838.

Vernacular Names: Kudappana (Malayalam).

Monocarpic, hapaxanthic, solitary, hermaphroditic palm. Stem 10-20 m high, 50 cm in diameter, with distinct leaf scars. Leaves very large, orbicular, 3-5 m in diameter, cleft to the middle into 80-100 linear lanceolate 2 fid lobes, sheath with lateral lobes, later with conspicuous triangular cleft below the petiole; petioles about 3 m long, massive, covered with caducous indumentum, adaxially deeply channelled, abaxially rounded, margins with well defined teeth. Inflorescence terminal, about 6 m long, the first order branches subtended by leaves with reduced blades and tubular bracts, emerging through an abaxial split, branched to the 4th order, all branches ending as rachillae; rachillae being spirally arranged; flowers arranged in cincinni; calyx fleshy; corolla connate at the base, ovate, acute, imbricate; stamens 6, the 3 antisepalous free, the 3 antipetalous adnate basally to the petals; filaments subulate; anthers dorsifixed; ovary syncarpous, triovulate; ovule hemianatropus; style elongate; stigma scarcely differentiated. Fruit globose, 3 cm in diameter, usually only one carpel develops with two abortive ones at its base; seeds smooth, polished, very hard.

Distribution: Peninsular India, Sri Lanka.

Flowering and Fruiting: The palm flowers once in its lifetime and dies out after the maturity of fruit.

Conservation Status: Least concern

Specimens examined: Monipally, Kottayam, Kerala, 22.7.93, fl., Vijayakumaran and Renuka 7048 (KFRI); Panamkutty, Idukki, 4.5.1984, fl., Mohan 81780 (MH)

Uses: About 100 kg of edible starch can be extracted from the core of Talipot palm. A mature tree also yields about 100 litres of sweet sap per day for several days from the cut end of the inflorescence. Leaves

are used for covering the roof of grain storages, mud huts etc. The tender leaves are used for making mats, hats and umbrellas. Stem fibres are strong, can be used for making ropes. Basal section of the stem is made into hollow cylinder for making "Drum" a musical instrument used by the tribal people in some parts of Sri Lanka. The hard solid endosperm of the seed is Ivory-like and used for making buttons and beads. Some ancient Hindu and Buddhist scriptures were written on Talipot leaves. The Talipot palm is also the national floral emblem of Sri Lanka.

Corypha utan Lam. Lam., Encycl. 2: 131. 1786 ; Plate 21.

Taliera sylvestris Blume in J.J.Roemer & J.A.Schultes, Syst. Veg. 7: 1307. 1830., nom. illeg.

Corypha sylvestris (Blume) Mart., Hist. Nat. Palm. 3: 233. 1838.

Gembanga rotundifolia Blume, Flora 8: 580. 1825.

Taliera gembanga Blume in J.J.Roemer & J.A.Schultes, Syst. Veg. 7: 1307. 1830., nom. illeg.

Corypha elata Roxb., Fl. Ind. ed. 1832, 2: 176. 1832.

Corypha gebang Mart., Hist. Nat. Palm. 3: 233. 1838.

Corypha gembanga (Blume) Blume, Rumphia 2: 59. 1839.

Taliera elata (Roxb.) Wall., Rep. Calcutta Bot. Gard. to G.A. Bushby: 29. 1840.

Corypha macropoda Kurz ex Linden, Cat. Gén. 1871: 87. 1871.

Corypha macropoda Linden ex Kurz, J. Asiat. Soc. Bengal, Pt. 2, Nat. Hist. 43(2): 197. 1874.

Corypha macrophylla Roster, Bull. Soc. Tosc. Ortic. 29: 81. 1904.

Livistona vidalii Becc., Webbia 1: 343. 1905.

Solitary, monocarpic, hapaxanthic, hermaphrodite palm. Stems erect, dark grey in colour, with distinct spiral marking, about 20 m long, to 40 cm in diameter at base. Leaves costapalmate, typically ascending from the stem; petiole slenderer than other species, 3-4 m long, uppermost part of the peiole triangular in cross-section; leafblade half

orbicular, deeply divided into 2-2.5 m long segments; segments about 90 in number; outer segments acuminate, split into two slender points; middle segments broad with two obtuse lobes at apices. Inflorescence terminal, pyramidal, about 4.5 m long; ultimate flower branches (rachillae) 10-15 cm long, pale yellow when fresh. Flowers bisexual, in clusters of 5-7; each 4.5 mm long, pale yellow at anthesis; calyx 2 mm long; lobes rounded, fleshy; solid basal part elongates after anthesis; petals boat shaped, 3 mm x 1.5 mm, stamens, to 4 mm long; opposite filaments incurved, subulate; anthers cordate-ovate, ovary 2.5 mm long; style 1.5 mm long; stigma 3 dentate. Fruits falsely pedicellate; 'pedicel' 3 mm long; abortive tuberculiform carpels conspicuous, seed globose, 1.5 cm in diameter.

Distribution: India (W. Bengal, Andaman Islands), Burma, Malaysia, Indonesia, Papua, New Guinea, Phillippines, and Northeast Australia.

Flowering and Fruiting: The palm flowers once in its lifetime and dies out after the maturity of fruit.

Conservation Status: Not evaluated

Uses: Dried leaves are used as thatch. The coarse fibre from the petiole is used for making ropes. The strong petiole itself serves the purpose of roof support. Young and tender leaves are used for making baskets brooms, bags, hats, floor mats etc. The inner core of the system yields edible starch.

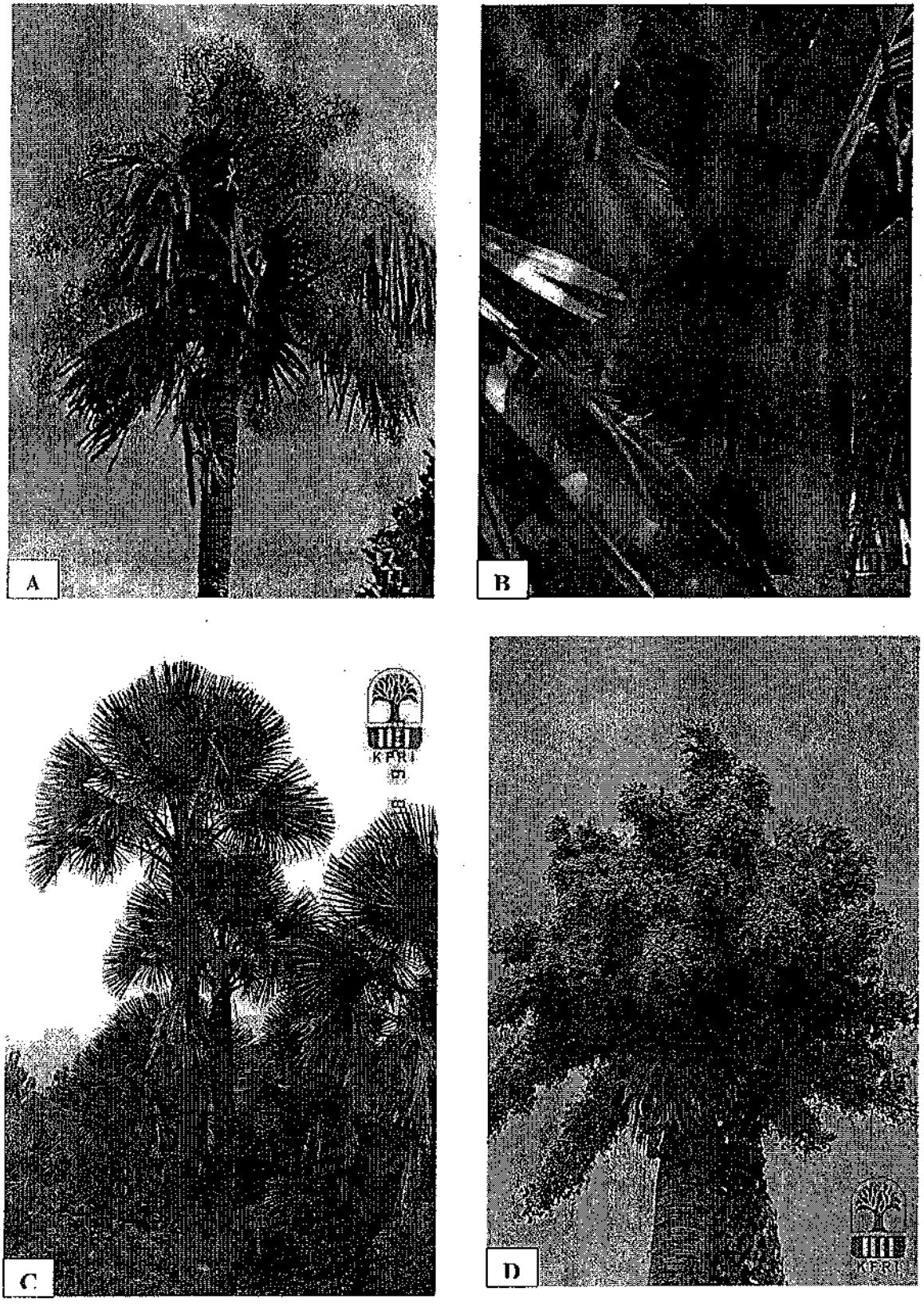


Plate 21. ***Corypha umbraculifera*** **A. Habit B. Leafbases**
Corypha utan **C. Habit D. Infructscence**

Daemonorops Bl. in Schultes & J. H Schultes, Syst. Veg. 7: 1333. 1830. Becc. In Hook.f., Fl.Brit. Ind. 6: 642. 1893; Becc. in Ann. Roy. Bot. Gard. Calcutta 12: 25. 1911.

Solitary or Clustered, spiny, acaulescent, erect, or high climbing, hapaxanthic or pleonanthic, dioecious rattans. Leaves pinnate, very rarely bifid, usually with a terminal cirrus except in a few acaulescent species and in juvenile individuals; ocrea rarely present; knee present in climbing species; flagellum absent; petiole usually well developed, grooved to rounded adaxially, rounded abaxially, variously armed; rachis and cirrus; leaflets single-fold, regularly arranged. Inflorescences male and females superficially similar, but within the genus of two basic types, one with all bracts enclosed within the outermost bract or prophyll, splitting along their length to expose the flowers or the other with bracts borne on a somewhat elongate inflorescence tubular in mud that at flowering splitting along their entire length to leave no tubular portion and frequently falling; bracts variously armed. partial inflorescences usually shorter than the extending bract; bractoles and 'involucres' inconspicuous; male flowers with small cup - shaped calyx with small lobes; corolla split; stamens 6, slightly epipetalous, pistillode minute; sterile male flower found with each female flower; female flower usually larger than the male with calyx truncate or shallowly 3-lobed; corolla with 3 petals; staminodes 6, borne at the mouth of the corolla tube, with empty anthers; gynoecium incompletely trilocular, trivulate, ovary variable in shape, scaly, stigmas 3, recurved, fleshy, ovules basally attached, anatropous. Fruit variously rounded, obpyriform, turbinate, cylindrical or oblate with apical stigmatic remains; epicarp covered in near vertical rows of reflexed, sometimes resinous scales, mesocarp thin, endocarp not differentiated. Seed, usually only 1 reaching maturity, angular or rounded, covered with thick, sweet or sour and bitter sarcotesta, endosperm deeply ruminate; embryo basal.

Distribution: - India, China, Malaysia, Indonesia, Thailand, Burma, Laos, Vietnam, Cambodia, Brunei and Philippines.

Key to the species

1a. Leaf sheath with numerous, black or brown flat spines.....2
1b. Leaf sheath sparingly spiny.....5
2a. Leaf lets powdery beneath; fruit oblong.....*wrightmyoensis*
2b. Leaflets not white powdery beneath; fruit ovoid.....3
3a. Flower braches of the female inflorescence sinuous .....*manii*
3b. Flower braches of the female inflorescence not sinuous.....4
4a. Leaf lets up to 3 cm broad at the middle, outer bract with slender criniform spines.....*jenkinsiana*
4b. Leaf lets more than 3 cm broad at the middle, outer bract with flat, pectinate spines .....*kurziana*
5a. Large diameter cane, spines on the sheath 2-3 cm long, leaves 2m long.....*aurea*
5b. Medium diameter cane, spines on the sheath 1.5 cm long, leaves 1m long .....*rarispinosa*

Daemonorops aurea Renuka & Vijayak., Rheedea 4: 122. 1994; Renuka, Manual of the rattans of Andaman & Nicobar Isl. 58. 1995; Plate 21.

Clustering, large diameter rattan. Stem 20 m long or more, with sheaths 3.5 cm in diameter, without sheaths 2 cm in diameter. Leaves 2 m long, cirrate; sheath yellowish green, very sparingly armed, 8-10 spines on a sheath below the knee; knee very stout and prominent; ocrea not seen; petiole 30 cm long, spiny along the margins, spines 1 cm long; leaflets regular, the largest 45 x 2.5 cm, lateral veins ciliate, cilia 0.5 cm long. Inflorescence erect, 30 cm long, all inner bracts enclosed in the outermost; outer most bracts armed with black spines;

spines 3 cm long. Fruit globose, 1.5 cm in diameter; scales in 18 vertical rows, golden yellow even in younger stages, deeply chanelled in the middle; endosperm ruminate.

Distribution: India (South Andamans). Endemic. In evergreen forests of Shola Bay, South Andamans.

Flowering: Not known. **Fruiting:** April- May.

Conservation Status: Vulnerable.

Specimens examined: Shoal bay, South Andamans, 2.4.1993, fr., Renuka and Vijayakumaran 7050 (KFRI).

Uses: used in furniture industry. Distribution Andaman Islands.

Daemonorops jenkinsiana (Griff.) Mart. Hist. Nat. Palm. 3: 327. 1853; Becc. & Hook. f. in Hook. f., Fl. Brit. India 6: 462. 1893; Becc., Ann. Roy. Bot. Gard. (Calcutta) 12: 41, Pl. 1. Part 2. 1911; Plate 21.

Calamus jenkinsianus Griff., Calcutta J. Nat. Hist. 5: 81. 1845.

Palmijuncus jenkinsianus (Griff.) Kuntze, Revis. Gen. Pl. 2: 733. 1891.

Calamus nutantiflorus Griff., Calcutta J. Nat. Hist. 5: 79. 1845.

Daemonorops nutantiflora (Griff.) Mart., Hist. Nat. Palm. 3: 326. 1853.

Palmijuncus nutantiflorus (Griff.) Kuntze, Revis. Gen. Pl. 2: 732. 1891.

Daemonorops pierreana Becc., Rec. Bot. Surv. India 2: 220. 1902.

Daemonorops schmidtiana Becc., Bot. Tidsskr. 29: 98. 1909.

Daemonorops jenkinsiana var. *tenasserimica* Becc., Ann. Roy. Bot. Gard. (Calcutta) 12(1): 44. 1911.

Clustering, large diameter rattan. Stem with leafsheath, to 3 cm or more in diameter; internodes, to 20 cm long, striated. Leaves cirrate, to 5 m long; leafsheath with distinct knee, scurfy outside, armed with

densely packed, 3 cm long sharp, black needle like spines; petiole scurfy, channelled above, convex below; rachis flat to bifaced; armed below with clusters of half whorled black tipped claws; leaflets ensiform, 20-30 on each side, tips end in small bristles; midnerve and lateral nerves spinous above; occasionally spinous below. Inflorescence subaxillary, not very broadly fusiform; bracts reddish to reddish brown in colour; flower branches densely scurfy at base; male flowers oblong in bud, 5 mm x 2.5 mm; calyx cupular, hairy at tips; corolla with 3 oblanceolate petals; stamens 6; filaments subulate, connate and thickened at base; rachillae in female inflorescence, to 8 cm long, sinuous; female flowers ovoid to globose, 5-5.5 mm long. Fruits globose, 1.8 cm in diameter; fruits scale yellowish in colour with distinct darker marginal lines; seed globose, about 8 mm in diameter; endosperm ruminate.

Distribution: India (West Bengal, sikkim, Assam, Megalaya), Bangladesh, Bhutan.

Flowering: July - September *Fruiting:* December – May.

Conservation Status: Near Threatened

Specimens examined: Rikshabari block, Kurzeong, West Bengal, 1.12.1993, fr., Vijayakumarn 7052 (KFRI); Maklay, Rani, Guwahati Assam, 7. 12. 93, fr., Vijayakumaran 7060 (KFRI); Lower toridu range, Lataguri, North Bengal, 3. 12. 93, Vijayakumaran 7055 (KFRI); Taliamara Division, Ambassa, Tripura, 19. 4. 94, fr., Renuka, Vijayakumaran and Mohandas 7065 (KFRI); Lailad umling range, Meghalaya, 25. 4. 94, Renuka and Vijayakumaran 7072 (KFRI); Chekopara, 2.2.1879, fl., Gamble 6659 A (MH);Chirang Reserve Forest, Near Haltugaon, 22.4.1957, Rolla Seshagiri Rao 7124(CAL); Nambur forest, Assam, feb. 1906, fr., Meebold 10861 (CAL);Danaur, Assam, 8. 4.1914, fl., Upendranath Kanjilal 3765 (CAL).

Uses: It is one of the most useful cane species utilised as raw material for the furniture industries.

Daemonorops kurziana Becc. Hook f., Fl. Brit. India 6: 463. 1893 and Ann. Roy. Bot. Gard. (Calcutta) 12 : 60; 1991; C. E. Parkinson, Forest Fl. Andaman Isl.: 267 (1923); Basu, Rattans in India Monogr. Rev. 44. 1992; Renuka, Manual of the rattans of Andaman & Nicobar Isl. 58. 1995; Plate 21.

Vernacular Names: Sanka Beth.

Clustering large diameter rattan. Stem 20 m long or more, with sheaths 5 cm in diameter, without sheaths 4 cm in diameter. Leaf 3 m long or more, cirrate; sheath yellowish green, densely armed with spines; spines brown, dimorphic, larger ones 2.5 cm long, base 0.8 cm broad, flat, triangular, papery, brownish with upraised base, smaller ones 1.5 x 0.2 cm, spines above the knee uniform, 1.5 x 0.2 cm, mouth of the sheath with numerous, papery spines, spines to 6 cm long; knee prominent; ocrea not seen; petiole long, margines spiny; spines to 1 cm long, 3 cm broad; rachis with a single row of reflexed spines at the lower side, upper side with small spines, spines to 0.5 cm long; leaflets regular, the largest to 50 x 3 cm, margins with bristles, midrib prominent, lateral veins ciliate above towards the distal end. Inflorescence erect, covered by an armed sheath; partial inflorescence to 15 cm long; primary sheath long, broad, free, unarmed; rachilla to 7 cm long. Fruit globose, 2 cm; scales in 18 vertical rows, orange yellow on ripening, broader dark brown, deeply channelled in the middle; endosperm ruminate.

Distribution: India (South Andamans). Common species in the evergreen forest.

Flowering: November-December. **Fruiting:** April-June.

Conservation Status: Near Threatened

Specimens examined: Tharmugali, Wandoor, South Andamans, 8.4.1988, fr., Renuka 4062 (KFRI); Dugong Creek, Little Andaman, 12.1.1977, fl., Bhargava 5119 (CAL); Wrightmyo, South Andamans, 9.1.1974, Balakrishnan 748 (CAL).

Uses: extensively used in furniture industry.

Daemonorops manii Becc. J.D.Hooker, Fl. Brit. India 6: 463. 1893 and Ann. Roy. Bot. Gard. (Calcutta) 12 : 45. 1911, Pl. 2. Part 2, 1911; C. E. Parkinson, Forest Fl. Andaman Isl.: 267 (1923); Basu, Rattans in India Monogr. Rev. 42. 1992; Renuka, Manual of the rattans of Andaman & Nicobar Isl. 61. 1995.

Clustering, medium diameter rattan. Stem 20 m long or more, with sheaths 3 cm in diameter, without sheaths 1.5-2 cm in diameter. Leaves 3 m or more, cirrate; sheath light yellow, armed with spines, spines black, triangular, flat, unequal, 3 cm long, scattered or subseriate; knee prominent; petiole 30 cm long, armed with straight, unequal, black spines at the margins; rachis armed with series of solitary or seriate black tipped claws; leaflets regular, 30 x 1.5 cm, closely set, veins ciliate from the middle upwards, margin spinulous. Female inflorescence erect, 30 cm long with a rigid unarmed peduncle; all the inner bracts enclosed with in the outermost, bract with black spines, inner ones glabrous; partial inflorescence 8-10 cm long, rachilla very rigid with zig-zag sinuous axis. Fruits spherical, 1.5 cm across; scales in 18 vertical rows, brown, channelled in the middle; endosperm ruminate.

Distribution: India (Andaman and Nicobar Islands)

Flowering: Not known **Fruiting:** April-June.

Conservation Status: Near Threatened

Specimens examined: Wright Myo, South Andamans, 2.4.1992, fr., Vijayakumaran 6632 (KFRI).

Daemonorops rarispinosa Renuka & Vijayak. Rheedea 4: 125. 1994; Renuka, Manual of the rattans of Andaman & Nicobar Isl. 61. 1995.

Clustering medium diameter rattan. Stem 20 m long or more, with sheaths 2.5 cm in diameter without sheaths 2 cm in diameter. Leaves

to 1 m long, cirrate; sheath light yellow, sparingly armed with downwardly directed spines, spines 1.5 cm, triangular, flat; knee prominent; ocrea not seen; petiole spiny at margins, spines 1 cm long; rachis with a row of reflexed spines at the adaxial side; leaflets narrow, regular, 40 x 1.7 cm., green, midrib prominent, margins with bristles, lateral veins ciliate above. Inflorescence erect, 40 cm long , covered by a primary armed bract. Fruit globose, 1.3 cm in diameter; scales in 18 vertical rows, golden yellow, chanelled; endosperm ruminate.

Distribution : India (Little Andamans). Endemic.

Flowering: Not known **Fruiting:** April-June.

Conservation Status: Vulnerble

Specimens examined: 20th km, Little Andamans, 14.4.1992, fr.,Vijayakumaran 6637 (KFRI).

Uses: used in furniture industry and also for making 'lathies'.

Daemonorops wrightmyoensis Renuka. & Vijayak. Rheedea 4: 125. 1994.

Clustering, large diameter rattan. Stem 20 m long or more, with sheaths 4.5 cm in diameter, without sheaths 3 cm in diameter. Leaf 3 m or more, cirrate; sheath yellow at the knee, armed with spines; spines dimorphic, spines below the knee brown, to 4 x 0.5 cm, triangular, flat, base upraised, spines above the knee black, to 0.2 x 1 cm; knee prominent; ocrea not prominent, mouth of the sheath with few papery spines, spines to 6 cm long; petiole armed below and margins with a row of spines; leaflets regular, to 55 x 2 cm, white powdery beneath, midrib prominent, margins with bristles, lateral veins ciliate above except the basal portion. Inflorescence erect; all inner bracts enclosed within the outermost; male inflorescence 60-80 cm long, ultra decompound, male flowers 4 mm long; female inflorescence 30 cm long. Fruit oblong, 1 x 1.5 cm; scales in 18

vertical rows, brown with dark brown tips, slightly channelled; endosperm ruminate.

Distribution: Evergreen forests at Wrightmyo, South Andamans.

Flowering: Not known. **Fruiting:** April-June.

Conservation Status: Vulnerble

Specimens examined: Wrightmyo, South Andamans, 5.4.1988, fr., Renuka 4055 (KFRI); Wrightmyo, South Andamans, 5.4.1988, male fl., Renuka 4057 (KFRI).

Uses: used in the furniture industry.

Hyphaene Gaertn., Fruct. 1:28. 1788. Boiss., Fl. Or. 5: 46. 1811; Beccari in Agric. Col. 2:152. 1908; and in Palm. Borass. 23. 1924; Post, Fl. Syria Pales. Sinai 2:556. 1932; Tackholm, St. Fl. Egypt 448. 1956; Hutch., Fl. W. Trop. Afr. 3:169. 1968.

Dwarf to large, solitary or clustered, spiny, pleonanthic, dioecious, acaulescent, creeping, shrubby or tree palms. Stem closely ringed with slightly raised leaf scars, usually branching several times by equal forking (dichotomy), rarely , unbranched , and then sometimes the trunk ventricose; trunk surface in juveniles with a lattice of old leaf bases, later becoming bare. Leaves induplicate, costapalmate, marcescent,later abscising under their own weight; sheath soon becoming open, densely tomentose, later with a conspicuous triangular cleft below the petiole, margins fibrous;petiole robust, covered in caduceus indumentums, adaxially channelled, abaxially rounded , the margins armed with robust, triangular, reflexed or upward pointing spines; adaxial hastula well developed, often asymmetrical, abaxial hastula absent; blade divided to about 1/3 its length along the adaxial ribs into single fold segments, these further shallowly divided along the abaxcial rribs; interfold filaments often abundant wax, and also bearing minute dotlike scales and caduceus indumentums, particularly along the ribs, midrib prominent, longitudinal veins close, transverse veinlets inconspicuous. Inflorescences interfoliar, the staminate and pistillate basically similar, though the pistillate more robust and with fewer branches; peduncle bearing a basal, 2-keeled, tubular prophyll and usually 2 empty, tubular peduncular bracts with triangular limbs, bearing abundant caduceus indumentum when young; rachis longer than the peduncle; rachis bracts like the peduncular but each subtending a first-order branch; first-order branches basally bare, semicircular in cross section, included in the subtending bract, terminating, in the staminate inflorescence, in a group of 1-6 or rarely more rrachillae,

each subtended by a low bract, in the pistillate inflorescence terminating in 1-3 rachillae; rachillae catkinlike, bearing a tight spiral off rounded, densely hairy, striate bracts, connate laterally and partially adnate to the axis to produce pits, densely filled with a pile of hairs. Staminate flowers borne in a cincinnus of 3 flow of hairs. Staminate flowers borne in a cincinnus of 3 flowers, ,embedded in the hairs, one flower emerging at a time, each bearing a small membranous bracteole; calyx tubular at the base with 3 elongate hooded, membranous lobes; corolla with a conspicuous stalk like base almost as large as the calyx lobes, bearing at its tip 3 ovate, hooded, valvate, striate lobes; stamens 6, borne at the base of the lobes, the filaments connate at their swollen bases, tapering above, anthers medifixed, versatile, latrose to introrrse; pistillode minute, 3 lobed. Pistillate flowers borne singly with a bracteole in each pit, on a short densely hairy pedicel, the pedicel sometimes considerably elongating after fertilization; sepals 3, distinct, rounded, imbricate; sepals 3, distinct, rounded, imbricate, membranous, striate; petals 3, similar to sepals; staminodial ring epipetalous, 6 toothed , the teeth bearing sagittate, , flattened, empty anthers; gynoecium globose, tricarpellate, triovulate, stigmas 3, short, septal nectarines present, opening by pores distally, ovules orthotropous, attached adaxially at the base of each carpel. Fruit borne on enlarged pedicel with persistent perianth segments, normally developing from 1 carpel, rarely 2 or 3, the fruit then 2-or 3-lobed, with basal stigmatic remains, the whole fruit very variable in shape, shouldered, distally expanded, usually asymmetrical, rarely ovoid or spherical; epicarp smooth, dull or shining, often pitted with lenticels, colored various shades of brown, mesocarp fibrous, often aromatic, dry but sweet, endocarp well developed, hard, stony. Seed basally attached, endosperm homogeneous with a central hollow; embryo apical opposite a thinner area of the endocarp.

Distribution:- A genus with about eight species distributed in India, Africa, Arabia, Madagascar and possibly in Sri Lanka also; India is represented with one species *H. dichotoma* distributed in Gujarat and Maharashtra.

Notes: The genus can be distinguished by the elongate costapalmate leaf, often silvery, by the lack of an abaxial hastula, by petiolar spines, and by the frequent presence of dichotomous branching, long, more or less slender inflorescences , and distinctive brown fruits.

Hyphaene dichotoma (White) Furtado(White) Furtado, Gard. Bull. Singapore 25: 301. 1970.

Ravana Tal. Indian Doum Palm.
Borassus dichotomus White in J.Graham, Cat. Pl. Bombay: 226. 1839.
Hyphaene indica Becc., Agric. Colon. 22: 173. 1908.
Hyphaene taprobanica Furtado, Gard. Bull. Singapore 25: 302. 1970.
Vernacular names :- Ravana Tal (Hindi)

Solitary, pleonanthic, dioecious palm. Stem closely ringed with slightly raised leaf scars, branching several times by dichotomous forking. Leaves costapalmate; leafblade orbicular; petiole armed at margins; segments to 120 cm long, bilobed at apices, lobes acuminate more or less stiff at apices. Inflorescence interfoliar, unisexual, peduncular bracts leathery, sheathing at base; upper part triangular, acuminate, densely tomentose outside; male rachillae digitate, terete. Pistillate inflorescence less branched; female flowers about 7 mm long. Ripe fruits stalked; stalk covered with dense brown hairs; epicarp smooth, mesocarp thick, fibrous; seed with endocarp (stone) ovoid to obovoid; endosperm homogeneous.

Distribution: India (West Coast of India (between 18-23°L such as coastal area opposite Nagaon, Shergaon, Daman and Diu).

Flowering: March. **Fruiting:** July.

Conservation Status: Vulnerble

Specimens examined:

Dwaraka, 14.10.1961, fl., Rao 407 (CAL); Victor Albert Port, 9.10.1964,Rao 2196 (CAL); Nagoa Diu, 29.9.1964, fr., Seshagiri Rao Rolla 102635 (CAL).

Uses: The fleshy fibrous mesocarp of fruits is sweet and is eaten by the local people. The pulp is considered astringent and anthelmentic. Unripe kernal is edible. Leaves are used as thatch and trunck wood is useful as posts and roof beams, wood is also used as fuel. Due to large scale of felling of this wild palm this species has become scarce in its natural habitats (Rao 1964).

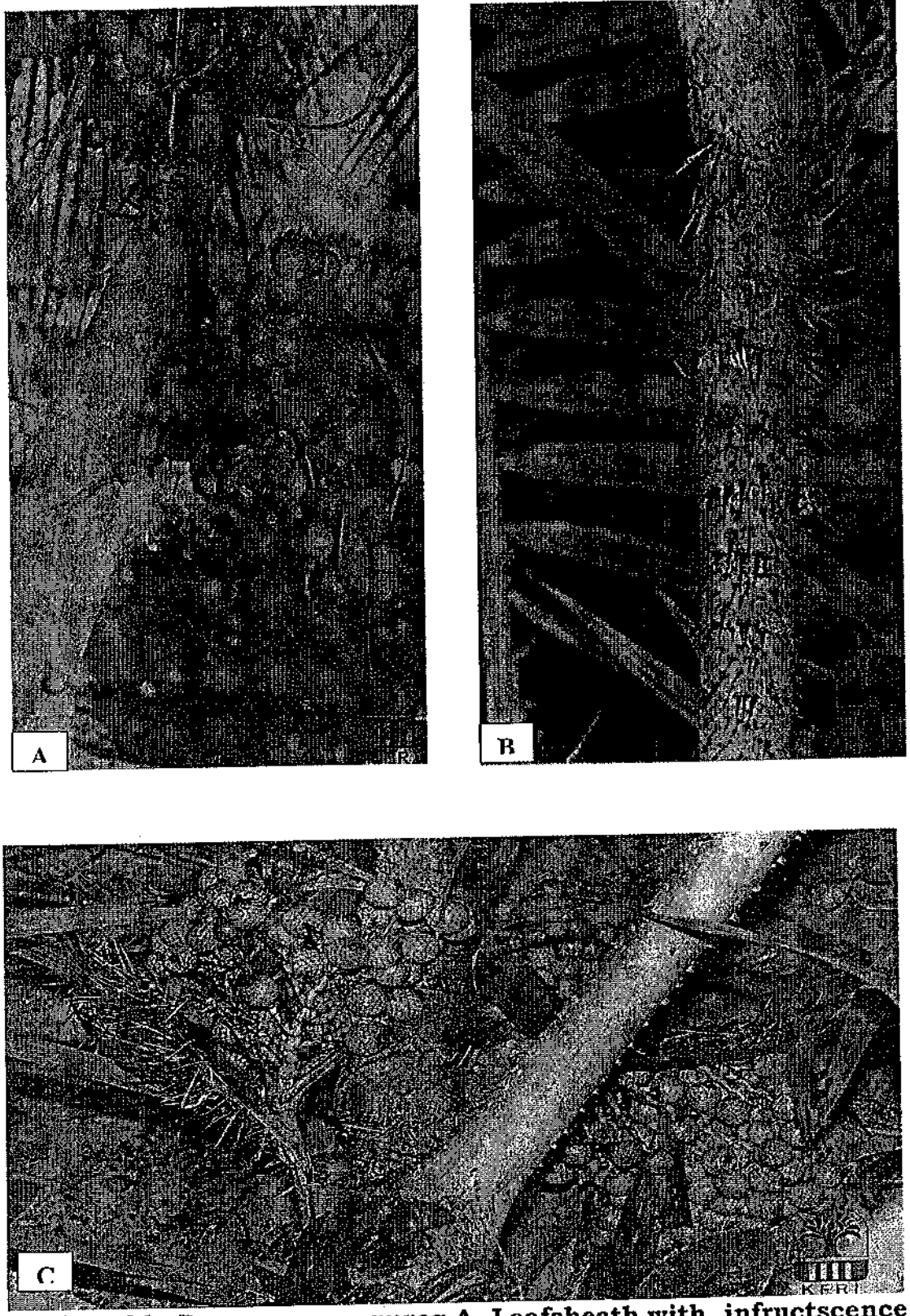


Plate 21. ***Daemonorops aurea*** **A. Leafsheath with infructscence** ***D. jenkinsiana*** **B. Leafsheath** ***D. kurzianus*** **C. Leafsheath with infructscence**

Korthalsia Bl. in Rumphia 2: 166 (1843); Mart., Hist. Nat. Palm. 3 (2nd Edit.): 210, 343 (1845); Miq., Fl. Ind. Bat. 3: 74 (1855), Prod. Fl. Sum. 255 (1861) and De Palm. Arc. Ind. 15 (1868); Kurz in J. As. Soc. Bengal 43: 206 (1874); Benth. & Hook., Gen. Pl. 3: 932 (1883); Becc., Malesia 2: 62 (1884) and in Hook. f., Fl. Br. Ind. 6: 474 (1893); Ridley, Mat. Fl. Mal. Pen. 2: 214 (1907); Becc. in Ann. Roy. Bot. Gard. Calcutta 12(2): 104 (1918); Merr., Bibl. Enum. Bornean Pl. 71 (1921) and Enum. Philip. Fl. Plants 1:146 (1922); Ridley, Fl. Mal. Pen. 5: 67 (1925); Furtado in Gdns' Bull., Singapore 13: 300 (1951); Moore in Gentes Herb. 9: 265 (1963); Backer & Bakh., Fl. Java 3: 180 (1968); Whitmore, Palms Mal. 65 (1973); Moore in Gentes Herb. 11: 130 (1973); Dransfield, Man. Rattans Mal. Pen. 37 (1979); B.K. Sinha., Fl. Great Nicobar Isl.: 463 (1999);

Calamosagus Griff. in Calcutta J. Nat. Hist. 5: 6 (1844) and Palms Br. India 26 (1850).

Slender to robust hapaxanthic spiny climbing palms suckering basally and frequently branching aerially in the forest canopy. Stems with uneven reddish surface, frequently marred by the adherent inner epidermis of the leaf sheaths; nodes frequently uneven with elongate shallow hollow above the node. Leaf sheaths without knee, variously armed in the exposed distal portion with spines, spicules and tomentum; ocrea very conspicuous, truncate or not, entire or disintegrating into fibrous network, closely sheathing or inflated, forming a hollow chamber inhabited by ants, or diverging from the stem, with inrolled margins forming an ant chamber, very rarely loosely funnel-shaped. Leaf ending in a well-developed cirrus on mature stems; petiole absent to well-developed; rachis usually rather sparsely armed with reflexed spines, the spines grouped into grapnels in the distal portion and on the cirrus; leaflets relatively few usually rhomboid, rarely lanceolate, plicate and pluricostulate, the distal

margins praemorse, the base frequently developed as a flattened versatile stalk ('ansa'); abaxial leaflet surface frequently indumentose, the leaflets thence strongly discolorous. Inflorescences produced in the axils of the most distal few leaves, the subtending leaves frequently much reduced, the apex of the flowering stem dying after flowering and fruiting; primary axis of inflorescence adnate to the internode above the subtending node, frequently bursting through the sheath of the subtending leaf, and branching to two orders, rarely unbranched, branches subtended by tubular bracts; ultimate flower-bearing axes (rachillae) usually cylindrical, catkin-like, bearing a tight spiral of usually imbricate bracts, adnate laterally to each other, or more rarely free and looser; bracts subtending floral pits or shallow hollows, usually densely filled with woolly hairs, and including a membranous prophyll and a minute bracteole. Flower hermaphrodite; calyx tubular in proximal portion, distally with three short triangular lobes; corolla tubular proximally with 3 free valvate lobes; stamens 6-9, epipetalous, with fleshy filaments and elongate anthers; ovary rounded, covered in vertical rows of imbricate scales, and tipped with conical stigmas; locules 3 each with a single anatropous ovule. Corolla circumscissile at the level of the ovary equator, carried up on the tip of the developing fruit, disintegrating though sometimes persisting to mature fruiting. Mature fruit covered in vertical rows of imbricate scales; mesocarp thinly fleshy. Seed with a non-fleshy testa; embryo lateral; endosperm with a conspicuous chalazal pit and ruminate or homogeneous endosperm. Eophyll simply flabellate or forked, with praemorse distal margins.

Distribution:- The genus *Korthalsia*, contains 27 species, widely distributed from Andaman and Nicobar Islands to New Guinea. In, India the genus is absent in the mainland; restricted to Andaman and Nicobar Islands with two species.

Key to the species of Korthalsia in India

1a. Stem robust, leaflets 22 x 12 cm..... *laciniosa*

1b. Stem slender, leaflets 13 x 6.5 cm..... *rogersii*

Korthalsia laciniosa (Griff.) Mart., Hist. Nat. Palm 3 (2nd Edit.): 211 (1845), 343 (1850); Miq., Fl. Ind. Bat. 3: 77 (1855) (as "*K. laciniata*"); Kurz in J. As. Soc. Bengal 43: 207 (1874) (excl. synon. *K. flagellaris* Miq.) & For. Fl. Br. Burma 2: 513 (1877); Becc. in Malesia 2: 74 (1884) & in Hook. f. Fl. Br. India 6: 479 (1893); Gamble, Man. Ind. Timbers (2nd Edit.): 737 (1902); Brandis, Ind. Trees: 654, 719 (1906) (excl. synon.); Becc. in Bull. Mus. Hist. Nat. Paris 17: 158 (1911), in Ann. Roy. Bot. Gard. Calcutta 12(2): 133 (1918) & in Philip. J. Sci. 14(3): 343 (1919); Merr., Enum. Philip. Fl. P1. 1: 146 (1922); C. E. Parkinson, Forest Fl. Andaman Isl.: 267 (1923); Basu, Rattans in India Monogr. Rev. 24. (1992); Renuka, Man. rattans of Andaman and Nicobar Isl. 66. (1995); B.K. Sinha., Fl. Great Nicobar Isl.: 463 (1999);

Calamosagus laciniosus Griff. in Calcutta J. Nat. Hist. 5: 23 (1844) and Palms Br. India: 27 (1850). Type: Burma, Mergui, Griffith March 1835 (holotype BR; isotypes FI, K).

Calamosagus wallichiaefolius Griff. in Calcutta J. Nat. Hist. 5: 24 (1844) and Palms Br. India: 29 (1850). Type: Malay Peninsula, Malacca, Kussan, Griffith (holotype BR).

Korthalsia wallichiaefolia (Griff.) H. Wendl. in Kerchove Palms: 248 (1878); Becc. in Malesia 2: 75 (1884) & in Hook. f. Fl. Br. India 6: 475 (1893); Ridley, Mat. Fl. Malay Pen. 2: 217 (1907); Becc. in Ann. Roy. Bot. Gard. Calcutta 12(2): 141 (1918); Ridley, Fl. Malay Pen. 5: 69 (1925).

Calamosagus harinaefolius Griff., Palms Br. India: 29 (1850). Type: as for *C. wallichiaefolius* (the two names used +_ indiscriminately;

McClelland in editing Palms Br. India illegitimately selected *C. harinaefolius*).

Korthalsia robusta Bl. in Rumphia 2: 170 (1843) as to Javanese plant. *Korthalsia teysmanni* Miq. in J. Bot. Neerl. 1: 16 (1861), Prod. Fl. Sum. 255, 591 (1861) & De Palm Arc. Ind.: 17, 26 (1868); Becc. in Malesia 2: 76 (1884) & Ann. Roy. Bot. Gard. Calcutta 12(2): 136 (1918); Backer & Bakh., Fl. Java 3: 180 (1968). Type: Sumatra, Muara Dua, *Teysmann* s .n. (holotype BO; isotype Fl).

Korthalsia scaphigera sensu Kurz non Griff. ex Mart. in J. As. Soc. Bengal 43: 207 (1874) & For. Fl. Burma 2: 513 (1877) (following Becc.).

Korthalsia andamanensis Becc. in Malesia 2: 76 (1884) (based on *K. scaphigera* sensu Kurz non Griff. ex Mart.).

Korthalsia grandis Ridley, Mat. Fl. Malay Pen. 2: 217 (1907) & Fl. Malay Pen. 5: 69 (1925); Furtado in Gard. Bull. Singapore 13: 311 (1951); Dransfield, Man. Rattans Mal. Pen.: 40 (1979). Type: Singapore, Selitar Ridley in 1894 (lectotype SING).

Vernacular Names: Lalbeth.

Clustering, medium diameter rattan. Stem branching, 25 m or more, with sheaths 2.1 cm in diameter, without sheaths 1.7 cm. Leaf 1.2 m long, cirrate; sheaths brown or red with very few spines to 0.6 cm long; disintegrating into embracing fibres; knee absent; ocrea very prominent, elongate, originally dry and membraneous but very soon disintegrate into filaments; petiole very short; adaxial side of the rachis with two rows of spines; spines 0.7 cm long; laeflets 22 x 12 cm, equidistant, cuneate-rhomboid, irregularly toothed, dark green above, pale below, narrowed to a short petiole. Inflcrescence large,

twice or thrice branched; primary and secondary sheaths not tightly sheathing, distal end papery; rachilla densely tomentose; flowers arranged in longitudinal rows. Fruits widely depressed ovate, 2 x 1.5 cm; scales in 13 vertical rows, orange red; endosperm ruminate.

Distribution: India (Andaman and Nicobar Islands), Burma, Indochina, Malaya, Indonesia and Philippines.

Flowering: October-November. **Fruiting:** April-May.

Conservation Status: Endangered.

Specimens examined: Mannarghat, South Andamans, 3.4.92, fr., Vijayakumaran 6625 (KFRI); 4th Km., Little Andamans, 13.4.92, fr., Vijayakumaran 6634 (KFRI); Great Nicobar, 10. 4. 93, fr., Renuka and Vijayakumaran 7041 (KFRI); S. Nicobar, 26.7.1976, fl., Balakrishnan 4035 (CAL); Lawn, W. Botanic Garden, 14.02.1936, Furtado 30664 (CAL).

Uses: The red cane is used for making walking sticks. Leaves are used as.

Korthalsia rogersii Becc. Ann. Roy. Bot. Gard. (Calcutta) 12(2): 131. 1918; Parkinson, Forest flora of the Andaman Isl. 263. 1923. Basu, Rattans in India Monogr. Rev. 26. 1992; Renuka, Manual of the rattans of Andaman and Nicobar Isl. 69. 1995.

Type: Andaman Islands, C. G. Rogers 143 (holotype FI: isotype K).

Clustering, very small diameter rattan. Stem 20 m long or more, with sheaths 0.7 cm in diameter, without sheaths 0.4 cm. Leaf upto 1 m long, cirrate; sheath light green, sparingly armed with spines; spines 1 cm long; knee absent; ocrea prominent, fibrous; petioles 15 cm long, margins armed below with 2 rows of recurved spines to 0.3 cm long; leaflets 13 x 6.5cm, equidistant, cuneate-rhomboid, irregularly toothed, dark green above and pale below; narrowed to a short petiole. Inflorescence 15 cm long; primary sheath tubular, unarmed;

secondary sheaths obliquely truncate; rachillae 3-5 cm long. Fruits obovoid, turbinate 1.8 x 1.5 cm; scales light yellow with reddish brown margin, chanelled in the middle.

Distribution: India (Andaman Islands). Endemic. Distributed in Radhanagar and Diglipur in North Andamans and Havlock Island in South Andamans.

Flowering and fruiting: Not known.

Conservation Status: Critically Endangered .

Specimens examined: South Andamans, 5.4.01, Sreekumar 22619 (KFRI).

Licuala Thunberg, Kongliga Vetenskaps Acadamiens Nya Handlingar 3: 286. 1782.

Pericycla Blume, Rumphia 2: 47. 1838 (" 1836").
Dammera Lauterbach, Die Flora der Deutschen Schiitzgebiete in de Siidsee 201. 1900 ("1900").

Very small to moderate, solitary or clustered, acaulescent to shrubby, rarely treelike, armed or unarmed, pleonanthic, hermaphroditic (very rarely dioecious) palms. Stem vey short and subteranean, creeping or erect, ringed with close leaf scars, partly obscured by remains of leaf sheaths, sometimes bearing short bulbillike shoots at the nodes. Leaves palmate, marcescent; leaf sheath disintegrating into a weft of fibers, the margin sometimes remaining as a broad, ligulelike ribbon or tongue; petiole adaxially channeled near the base, rounded or channeled distally, abaxialy rounded or angled, armed along margins with close sharp teeth or triangular spines, or unarmed, caducous indumentum often abundant; adaxial hastula well developed, usually triangular, abaxial hastula absent; blade entire or split variously along the abaxial ribs to he very base to produce single to multiple-fold, wedge-shaped reduplicate segments, these in turn with very short splits along the abaxial folds and slightly longer splits along adaxial folds, the central segment usually entire, sometimes bifid, sometimes borne on a stalk like extension, the ribs often with caducous indumentum, transverse veinlets usually conspicuous .Inflorescences interfoliar, much shorter to much longer than the leaves, very varied in spect and degree of banching, from spicate to branched to 3 orders; peduncle short o very long, bearing a basal, 2 keeled tubular prophyll, and 0-5 or more, similar, tubular, closely sheathing or inflated, glabrous or tomentose, peduncular bracts; rachis bracts subtending usually distant, first-order branches adnate to the inflorescence axis above the bract mouth; subsequent orders of bracts minute ; first order branches spicate or branched further; rachillar few to ca.30 or

more, crowded or spreading, glabrous to variously scaly or hairy, bearing spirally arranged, distant or very crowded flowers. Flowers solitary or in groups of 2-3, sessile or borne on short to long spurs, each subtended by a minute triangular bract; calyx sometimes stalk like at the base, tubular, truncate, irreguolarly splitting, or with 3 neat triangular lobes, glabrous or variously hairy; corolla usually marked near he tip on the adaxial face with the impresiions of the anthers; stamens 6, epipetalous, the filaments distinct, somewhat flattened , or united into a conspicuous tube tipped with 6 equal, short to moderate teeth bearing erect or pendulous anthers, or androecial ring 3-lobed, 3 anthers borne on short distinct filaments, 3 borne at the sinuses between the lobes, anthers rounded or ob long, very small to moderate, latrorse; gynoecium tricarpellate, glabrous or variously hairy, carpels wedge-shaped, distinct in the ovarian region, united distally in a long, slender columnar style tipped with a minute dot like stigma, ovules basally attached, anatropous. Fruit globose, ovoid, narrow, straight, spindle shaped or curved, perianth whorls usually persistent, 1-3 discrete carpels developing, abortive carpels frequently carried with the stigmatic remains at the tip of the fertile carpel, otherwise remaining at the base; epicarp frequently brightly colored, dull or shining, rarely corky-warted, mesocarp fleshy, somewhat fibrous, thin to thick, endocarp thin, crustaceous. Seed basally attached, endosperm homogeneous penetrated by a smooth or greatly lobed intrusion running the length of the seed in the middle ; embryo lateral.

Notes: the genus can be easily identified by the wedge-shaped marginally reduplicate segments of the leaves of most species. Morphologically closely related to *Hohannesteijsmannia* and *Livistona* and differs mainly in leaf form as noted.

Key to the species

1a. Stem solitary..... *peltata*
1b. Stem cluster forming.....2

2a. Stem slender 5 - 10 cm in diameter, densely tufted, leaf segments 12-19 number.....*spinosa*
2b. Stem 7.5 - 22 cm in diameter, not much tufted, leaf segments 8 – 10 number.....*paludosa*

Licuala peltata Roxb. ex Buch.-Ham. Roxb. ex Buch.-Ham., Mem. Wern. Nat. Hist. Soc. 5: 313 (1826). Griff., Calcutta. J. Nat. Hist. 5: 325. 1845; Palms Brit. E. Ind. 120, Pl. 222. 1850; Mart., Hist. Nat. Palm. 3: 234, Pl. 162. 1823–1853; Becc. & Hook. f. in Hook. f., Fl. Brit. India 6: 430. 1892; C. E. Parkinson, Forest Fl. Andaman Isl.: 269 (1923); Blatt., Palms Brit. Ind. 88. 1926; Plate 22.

Vernacular Names: Salai pathy (Andamans).

Solitary, pleonanthic palm. Stem, slender, 2-3 m long, to 15 cm in diameter near base; leafbases persistent on upper part of the stem, often covered by old, black spinelike leaf bases; leaf palmate, leafblade orbicular, 12-30 partite, to 1.5 m in diameter; segments variously connate, many toothed at margins; leaf sheath 50 - 60 cm long, with scattered ferruginous ramenta on lower side; petiole to 1.2 m long or more, green, almost glabrous, 0.6 - 1.2 cm in diameter. below insertion of blade, armed in entire length with flattened, recurved elongate spines, black at the apices, basally more or less evenly sized and evenly spaced, up to 1.5 cm long, further up highly irregular in both position and size. Lamina thick chartaceous, maximum span about 1.5 m, transverse veinlets obscure, scattered, translucent specks visible with backlighting at 10 x, midrib of adaxial folds extended into a thread, lamina undivided in var. *sumawongii,* otherwise divided in 7 to 21(-30) segments, segments in divided leaves from 50-90 cm long, narrow wedge-shaped to triangular; indentations leading to the adaxial ribs 3 - 15 mm long. Inflorescence with long

stout peduncle, up to 3.5 m long, erect with about 7 spicate, pendent, flattened at base; primary axis cane-like, covered with series of 15-30 cm long, leathery bracts, scurfy outside; prophyll 35 - 40 cm long, chartaceous, keels from low to 1 cm high, rounded, or sharp, covered with scattered ferruginous ramenta; rachis 1.5 - 2.3 m long, similar to the peduncle in colour and hair covering; peduncular bract 1, tubular, 33 - 36 cm long, green, covered with scattered minute ramenta, dry and woody distally and splitting irregularly, often with narrow rim of fibrous mesh; rachis bracts similar to the peduncular bract, the apical one being empty and 7 - 9 cm long; basal partial inflorescence with an up to 15 cm long bare basal portion, densely ferruginously ramentose basally to light brown tomentose distally and a 30 - 50 cm long flower bearing portion, covered with light brown tomentum. Flowering sequence basipetal; flowers up to 200 on longest rachilla, solitary; floral subtending bract about 3 mm, hairy, bracteole minute; calyx, truncate with irregular indentations, campanulate 6 - 7 mm, not fused with receptacle, sericeous; corolla three lobed, 10 mm long fused basally, sericeous, reflexed at anthesis, white basally to green apically on the inside; androecium 9 mm long, united with corolla in basal c. 5 mm, the remaining part of the filament free, about 2 mm wide at base, oblong with acuminate apex, white basally to yellow apically, anthers elongate 3 mm long; ovary 2 - 3 mm long at anthesis, barrel-shaped, truncate, glabrous, style slender 8 mm long. Ripe fruit ellipsoid, 1-seeded, deep orange in colour, perianth persistent.

Distribution: India (Assam, Bihar, Manipur, Tripura & Andaman and Nicobar islands), Bangladesh, Myanmar.

Flowering: September-November. **Fruiting:** April-May.

Conservation Status: Critically Endangered.

Specimens examined: Chittagong, march 1880, fl., Coll. No.7889, Acc. 52699 (MH); Diglipur, North Andamans, 16.10.2008, Linto & Manohara 25015 (KFRI); Baratang Islands, 7.4.2001, Sreekumar & James 22619 (KFRI); Baratang Island, 19.9.2008, fl., Linto &

Manohara 25007 (KFRI); North Andamans, 7.4.2001, fr., Sreekumar & James 22619 (KFRI)

Uses: In Andaman Islands, leaves are extensively used for thatching. In Chittagong hill tracts of Bangladesh the local people use the large leaves as rain hats. Split lamina is used for making baskets, mats etc. It is also reported that elephants feed on the lower part of the stem.

Licuala spinosa Wurmb, Verh. Batav. Genootsch. Kunsten 2: 474. 1780; C. E. Parkinson, Forest Fl. Andaman Isl.: 269(1923); Plate 22.

Corypha pilearia Lour., Fl. Cochinch.: 213. 1790.

Licuala ramosa Blume in J.J.Roemer & J.A.Schultes, Syst. Veg. 7: 1303. 1830.

Licuala horrida Blume, Rumphia 2: 39. 1838.

Licuala pilearia (Lour.) Blume, Rumphia 2: 42. 1838.

Licuala spinosa var. brevidens Becc., Malesia 3: 74. 1886.

Licuala spinosa var. cochinchinensis Becc., Malesia 3: 74. 1886.

Licuala acutifida var. peninsularis Becc., Webbia 5: 44. 1921.

A clusterforming, pleonanthic palm. Stem slender, 2-3 m long, 6-9 cm in diameter, forming large clumps, internodes up to 5 cm long at the base; leafscars prominent on the stem. Leaves orbicular to reniform, with petiole about 1.5 m long; leafsheath triangular, to 40 cm long, strongly fibrous at margins, in younger leaves with dense cover of closely adpressed, shrivelled ramenta; petiole up to 2-2.5 m long, about 1.5 - 2 cm wide at the base, greenish basally, caducous, slender, obtusely trigonous in cross-section; armed throughout at margins with angular spines; Lamina with adaxial side slightly darker green and shiny, thick chartaceous, maximum span 100 - 150 cm, transverse veinlets inconspicuous, lateral segments obliquely praemorsed; 4 lobed; median segments 10 lobed. Inflorescence interfoliar, 1 - 2.5 m long, extended above the crown, with 5 – 9 partial inflorescences; peduncle 20 - 50 cm long, 9 - 12 mm diam., greenish

beige, arching out, longer than leaves, to 3.5 m long, primary flower branches 6-10 in number, alternate, adnate to primary axis at base; lower branches divided into 3-5 ultimate flower branches; prophyll 20 - 30 cm long, 2.5 cm wide, with up to 5 mm high keels; peduncular bracts absent or present; rachis 1 - 2 m long; rachis bracts dark green to yellowish beige to distally brown, tubular, inconspicuously bicarinate, gradually decreasing in length; partial inflorescence inserted 2 - 6 cm above mouth of subtending bract, branched, bare basal portion lacking or up to 10 cm long, covered with dense tomentum; branching portion 1 - 4 cm long; rachillae 2 - 7, rigid, curving downward, longest rachilla 20 - 40 cm long, 2 mm in diam. Flowers solitary or in 2 or 3, sessile, irregular or in cluster of 2-3 flowers, acropetal; floral subtending bract to 0.5 mm long; calyx cupular, cylindrical to cyathiform, about 3 mm long covered with simple golden, 2 mm long, 3 toothed, ciliate outside; corolla little longer than calyx, 3-lobed; lobes lanceolate, acuminate, light beige to white on the inside, 3.5 - 4 mm long, densely hairy; androecium, 2.5 - 3 mm long, fused to corolla for 1.5 mm, staminal ring white, stamens with filaments short, setaceous; anthers oblong-ovate; ovary turbinate about 1 mm long, glabrous, locules basally in each carpel, bearing filiform style. Fruits obovoid, 5-7 mm long, pedicellate, deep red in colour.

Distribution: India (Andaman Islands), Southeast Asia. In Andaman Islands it usually grows in mangrove areas in small patches; found associated with mangroves where it forms tussocks.

Flowering: September-December. **Fruiting:** May-June.

Conservation Status: Critically Endangered.

Specimens examined: Baratpur forest, Andaman, 20.1.1959, Thothathri 9106 (MH); Austin I, North Andamans, 23.10.1964, fr., Ellis & Ramamurthy 18909 (MH); Shoal Bay, South Andamans, 11.09.2008, fl., Linto & Manohara (KFRI).

Uses: Leaves are sometimes used as thatch.

Plate 22. ***Licuala peltata*** **A. Habit B. Male inflorescence**
Licuala spinosa **C. Habit D. Male inflorescence**

Livistona R. Br., Prodr.: 267. 1810; Becc. & Hook. f. in Hook. f., Fl. Brit. Ind. 6:434. 1894; Kurz. For. Fl. Brit. Burma 2: 525. 1877; Becc. in Ann. Roy. Bot. Gard. Calc. 13:43-108. 1933; Benthall, Trees Calc. 439. 1946; Bailey, St. Cyc. Hort. 2:1894. 1950; Bailey, Man. Cult. Pl. (reprint ed.) 168. 1966; Whitmore, Palms Mal. 70. 1973; N. W. Uhl & J. Dransf., Genera Palmarum 190. 1987; Blatt., Palms Brit. Ind.: 100. 1926; S. Pie et al., Fl. China 147: 2010; Dowe, Aust. Palms 83. 2010.

Saribus Blume, Rumphia 2: 48. 1838 ("1836"). Type: *Saribus rotundifolius* (Lam.) Blume (*Corypha rotundifolia* Lam.) = *Livistona rotundifolia* (Lam.) Martius (See H.E. Moore 1963c)

Wissmannia Burret, Botanische Jahrbucher fur Systematik 73:184. 1943.

Solitary, short to tall, erect, armed or unarmed, pleonanthic, hermaphroditic, dioecious or functionally unisexual or polygamomonoecious, shrub or tree palms. Stems slender to robust, annulate, stout, unarmed, frequently swollen at base, sometimes uniformly thickened, ringed, cylindrical, obscured at first by persistent sheaths, later becoming bare or covered with persistent petiole bases, conspicuously or obscurely ringed with leaf scars. Leaves induplicate, palmate or costapalmate; sheath large, tough, disintegrating into a conspicuous interwoven, often clothlike, reddish brown mass of broad and fine fibers; petioles long, well developed, grooved or flattened adaxially, rounded or angled abaxially, sparsely covered with indumentums or not, expanded and sometimes bulbous at the occasionally persistent base, the margins unarmed or armed with inconspicuous to robust horizontal spines or teeth; adaxial hastula well developed, abaxial hastula poorly developed or absent; blade divided along adaxial ribs to varying depths to form single or, very rarely, multiple-fold segments, these further divided for a short to long distance along abaxial folds near the tip, rarely the adaxial splits

almost reaching the hastula and the costa, the segments then all single fold and very fine; segments stiff or pendulous, interfold filaments sometimes present, scattered caduceus indumentums present along ribs, wax sometimes present on the abaxial surface, more rarely waxy on both surfaces, midribs conspicuous, transverse veinlets obscure or conspicuous. Inflorescences interfoliar, solitary, branched to 5 orders; peduncle elongate; prophyll 3-keeled, tubular, closely sheathing, variously covered with indumentum or not, frequently tattering at the tip; peduncular bracts 1-few , tubular, like the prophyll; rachis usually longer than the peduncle; rachis bracts variously covered with indumentum, each subtending a first-order branch; bracts of subsequent orders generally inconspicuous; rachillae erect, pendulous or divaricate, glabrous or hairy, usually numerous, bearing spirally arranged flowers, singly or in stalks, each group subtended by aminute rachilla bract and each flower bearing a minute bracteole. Flowers small to very small, usually cream coloured; calyx with receptacle often producing a short, broad stalk, tubular above, tipped with 3 triangular lobes, these sometimes imbricate at the very base, apically with 3 triangular, valvate lobes; stamens 6, epipetalous, the filaments connate to form a fleshy ring, tipped with short, slender distinct filaments, anthers medifixed, rounded or oblong, latrorse; gynoecium tricarpellate, the carpels wedge shaped , distinct in the ovarian region, connate distally to form a common, slender style, with an apical, dotlike or minutely 3 lobed stigma, ovule basally attached, anatropous; where dioecious, anthers or ovules not developing but otherwise as in the hermaphroditic. Fruit globose to ovoid, or ellipsoidal, 1 seeded, small to medium-sized, variously coloured, green, scarlet, blue green, white black, black or dark brown, stigmatic remains apical or subapical, sterile carpel remains basal; epicarp smooth, dull or shinging, often with a wax boom, mesocarp thin or thick, fleshy or dry, somewhat fibrous, usually easily separated from the bony or woody endocarp. Seed ellipsoidal or globose basally attached, endosperm homogeneous, intruded by the

testa from one side with spongy-crystalline tissue to displace part or most of the endosperm; hilum broad, circular to elongate; raphe branches few or lacking; embryo small, supra- to sublateral.

Distribution:- The genus contain approximately 36 species, widespread but scattered from the Horn of Africa and India to Australia, New Guinea, the Solomon Islands, north to the Philippines, China, Japan, and the Bonin Islands. Greatest diversity is represented in Australia with half of the total species. India is represented with only one species *Livistona jenkinsiana* found in North East India.

Notes: - This genus is named after a Scottish horticulturist, Patrick murray, Baron Livingstone (died 1671). This is a large and variable genus distinguished by flower structure, in particular by the gynoecium of three carpels connate only by their styles, by united sepals, by petals with internal grooves, by the usually small fruits with apical stigmatic remains and basal sperm, and a large intrusion of seed coat.

Livistona jenkinsiana Griff., Griff., Calcutta. J. Nat. Hist. 5: 334. 1845; Palms Brit. E. Ind. 128, Pl. 226 A & B. 1850; Becc. & Hook. f. in Hook. f., Fl. Brit. India 6: 435. 1892; Blatt., Palms Brit . Ind. 101. 1926; S. Pie et al., Fl. China 23:147: 2010; Plate 23.

Saribus jenkensii (Griff.) Kuntze, Revis. Gen. Pl. 2: 736. 1891.

Livistona jenkinsii Griff. ex Mart.; Hist. Nat. Palm. 3(ed. 2): 242. 1849, orth. var.

Livistona speciosa Kurz, J. Asiat. Soc. Bengal, Pt. 2, Nat. Hist. 43(2): 204. 1874.

Saribus speciosus (Kurz) Kuntze, Revis. Gen. Pl. 2: 736. 1891.

Vernacular names : Toko tree (Aruncachal Pradesh)

Solitary, pleonanthic palm. Stem erect, rough, brownish grey, without persistent leafsheaths, 10 – 30 m long at maturity, 30 – 40 cm in diameter near base, surface rough, dull grey in colour; crown globose,

large with evenly spreading leaves. Leaves 2.5 m long, 1.5 cm diameter, palmately dissected partially, reniform or oval, plicate; leafblade costapalmate, shining green upper, dull bluish below; leaf segments 70 – 80 in number, to 1.5 m long; upper free part of segments bilobed; lateral segments deeply bifid at apices; petiole chanelled above, strongly dentate at margins; hastula cordate.

Inflorescence axillary, interfoliar, to 1.2 m long; peduncle strong, flattened, 4 – 6 cm long; prophyll reddish brown, boat shaped, hard, bicarinate, peduncular and rachis bracts leathery; basal flower branches twice or thrice branched to form alternate, bright yellow coloured rachillae. Flowers bisexual, sessile, about 3 mm long, borne on short tubercle, solitary or paired on distal part of rachilla; calyx cupular, 2 mm long, 3-lobed; corolla twice longer than calyx, 3-lobed, lobes triangular; stamens with short filaments; anthers oblong; ovary obconical, yellow with a depressed red spot; carpels coherent; style filiform. Fruit drupe, globose to reniform, 1.9- 2.8 cm long, 2-3 cm wide, leaden blue to dark bluish – purple in colour, with sub apical stigmatic remains, Seed globose, shining brown with broad raphae like line; endosperm horny, whitish.

Distribution: India (Sikkim, Arunachal Pradesh, Assam, Meghalaya). Seen in the moist deciduous Forests; found up to an elevation of 1100m.

Flowering : February – March

Fruiting : September-December.

Conservation Status: Near threatened

Specimens examined: Rikshabari block, Kurzeong, West Bengal, 1.12.1993,fr., Vijayakumarn T.T., 7052 (KFRI); Maklay, Rani, Guwahati Assam, 7. 12. 93, fr., Vijayakumaran T. T., 7060 (KFRI); Lower toridu range, Lataguri, North Bengal, 3. 12. 93, vijayakumaran T.T., 7055 (KFRI); Taliamara Division, Ambassa, Tripura, 19. 4. 94, fr.,

Renuka, Vijayakumaran and Mohandas 7065 (KFRI); Lailad umling range, Meghalaya, 25. 4. 94, Renuka and Vijayakumaran 7072 (KFRI); Lakhimpur, Assam, 11.3.1942, Dc 20932 (BSI Shillong); Siang, Arunachal Pradesh, 20.11.1958, Rao, 17912 (BSI Shillong).

Uses: Fresh nuts are used by the Mikir tribals as masticatory. Leaves are in universal use throughout Assam for covering the top of huts and roof of boats and also for making rain hats (Jhapi). In Arunachal Pradesh Toko leaves and stems are largely used by the tribals for making huts.

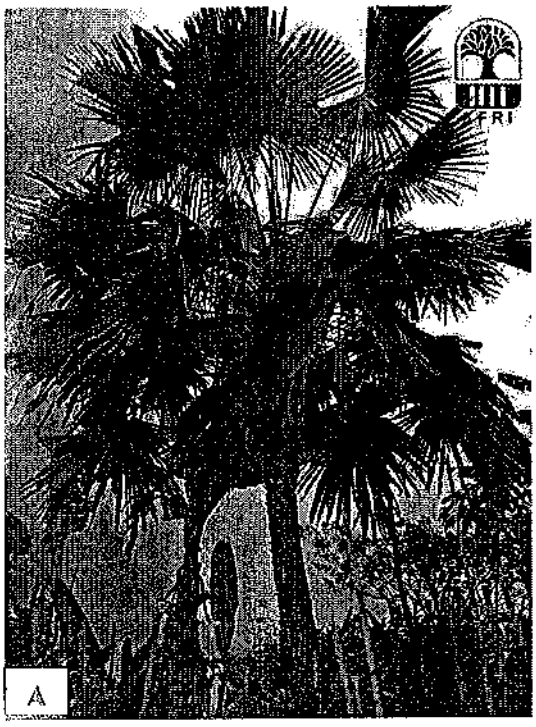


Plate 23. ***Livistona jenkinsiana*** **A. Habit B. Female inflorescence**
Nypa fruticans **C. Habit**

Nypa Steck, Sagu:15.1757; P. B. Tomlinson, Bot. mangroves 295. 1986; Blatt., Palms Brit. Ind.: 553. 1926; N. W. Uhl & J. Dransf., Genera Palmarum 285. 1987; B.K. Sinha., Fl. Great Nicobar Isl.: 463. 1999; S. Pie et al., Fl. China 23:143. 2010; Dowe, Aust. Palms 83. 2010.

Nipa Thunberg, Kongliga Vetenskaps Acadamiens Nya Handlingar 3: 234. 1782.

Prostrate, colonial, unarmed, pleonanthic, monoecious palms. Stem stout, prostrate or subterranean, dorsally flattened, dichotomously branched, leafscars curved, internodes compressed. Leaves, few, very large, erect, paripinnate; sheath soon splitting, glabrous; petiole long, stout, wide basally, elongate, channelled on the adaxial surface, rounded on the abaxial surface, distally terete; rachis basally terete, distally angled, pruinose to glabrous; leaflets numerous, single-fold, reduplicate, subopposite to opposite, acute, coriaceous, midrib prominent bearing distinctive, shining, chestnut-coloured, membranous ramenta abaxially, transverse veinlets not evident. Inflorescences interfoliar, solitary, erect, branched 5–6 orders, protogynous; prophyll tubular, 2-keeled; peduncular bract tubular, inflated, beaked, splitting lengthwise; rachis bracts tubular, inflated, subtending 7–9 first-order branches; peduncle erect, terete in cross-section; rachis shorter than peduncle, distally with an aggregated head of pistillate flowers; first-order branches proximal to the head of pistillate flowers, erect, terminating in catkin-like rachillae of staminate flowers overhanging the pistillate head. Staminate flowers solitary, sessile; sepals 3, distinct, narrow, oblanceolate; petals 3, distinct, slightly imbricate, similar to the sepals but slightly larger, both loosely closed over the stamens in bud; stamens 3, filaments and connectives connate in a solid stalk, anthers elongate, extrorse; pistillode lacking; pistillate flowers in an aggregated head; 3 oblanceolate irregular sepals; 3 similar petals; staminodes lacking;

carpels 3–4, obovoid, asymmetrical, angled by mutual pressure, acute distally; stigmatic opening funnel-shaped; ovule anatropous, dorsally attached. Fruit borne in an aggregated globose head, fertile and partially developed fruits intermixed; fruit developing from 1 carpel, compressed and irregularly angled, stigmatic remains terminal, pyramidal; epicarp smooth, mesocarp fibrous, endocarp thick with interwoven fibres; perianth not persistent. Seed broadly ovoid, grooved adaxially, hilum basal, raphe branches ascending from the base, endosperm homogeneous or rarely ruminate, with a central hollow; embryo basal.

The genus contains only one species; *N. fruticans* distributed from Sri Lanka through SE Asia to Japan (Ryukyu Islands), the Pacific islands (Solomon Islands), and just reaching Australia.

Nypa fruticans Wurmb, Wurmb, Verh. Batav. Genootsch. Kunsten 1: 349. 1779; *Nipa fruticans* (Wurmb) Thunb., Kongl. Vetensk. Acad. Nya Handl. 3: 231. 1782, *orth. var.*; K.L. von Blume, illustration in Rumphia 2: pls 164, 165.1847; *fide* H.Tralau, Kongl. Svenska Vetenskapsakad. Handl. ser. 4, 10: 8. 1964; Mart., Hist. Nat. Palm. 3: 305, Pl. 208.1850; Becc. & Hook. f. in Hook. f., Fl. Brit. India 6: 424. 1892. C. E. Parkinson, Forest Fl. Andaman Isl.: 263. 1923; Palms Brit. Ind.: 554. 1926; B.K. Sinha., Fl. Great Nicobar Isl.: 464.1999; S. Pie et al., Fl. China 23:143. 2010; Dowe, Aust. Palms 84. 2010; Plate 23 & 24.

Cocos nypa Lour.; Fl. Cochinch.: 567. 1790. Type: not designated.
Nipa litoralis Blanco, Fl. Filip.: 662. 1837. Type: not designated.
Nipa arborescens Wurmb ex H.Wendl. in O.C.E.de Kerchove de Denterghem, Palmiers: 252. 1878.

Nypa fruticans var. *neameana* F.M.Bailey, Proc. Roy. Soc. Queensland 5: 147. 1888. Type: Australia. Queensland. Herbert R., 1880, *A.neame*; holotype BRI.

[*Nipa fruticans* Wurmb (*sub* Pandanaceae), *in* F.Mueller, Fragm. 11: 128. 1881].

[*Nipa fruticans* Wurmb (*sub* Nipaceae), in F.Mueller, Second Syst. Cens. Aust. Pl.: 202.1889].

Vernacular names: Neetipana (Mal.), Gubna (Hind.)

Stem to 30 cm wide, to 15 cm thick, mostly subterrenian, submerged in mud or on the surface, roots on the lower surface. Leaves pinnate, 6-7 m long, erect to arcuate, uppermost part arching, leaf base to 2m long; petiole terete, smooth with long sheathing leaf base; rachis to 2.5-5 m long; leaflets linear, alternate, reduplicate, to 0.6 – 1.3 m long, 5–8 cm wide, rigid, narrowly lanceolate, acuminate, coriaceous, acute to attenuate at tips; midnerve prominent on lower side with paired scales at intervals; upper surface of leaflets glossy green, lower surface pale green. Inflorescence interfoliar, bisexual, 70-80 cm long; primary axis covered under sheathing bracts; prophyll 40–50 cm long, 20–25 cm wide, obtuse, yellow-orange-light brown; peduncular to 50 cm long, to 20 cm wide, acute, orangish; rachis bracts bracts to 50 cm long, to 20 cm wide, acute, orangish; first-order branches 10 cm long; staminate rachillae 6-8 cm long, glabrous, yellow-orange; pistillate head light brown. Staminate flowers densely crowded, subtended by subulate bracts, sepals 3–4 mm long, to 0.8–1 mm wide, yellowish; petals 3.5–4 mm long, 1.8–2 mm wide, yellowish; stamens to c. 5 mm long, fused into a column; anthers c. 2 mm long, yellow, anthers basifixed; pistillode absent; Pistillate flowers 10–15 mm long, terminal; perianth 6, sepals 4–5 mm long, 1.5–2 mm wide, cream-green; petals 4–5 mm long, 1–2 mm wide, cream-green; stigmatic opening funnel shaped, staminodes absent; carpels 3, greatly enlarged; each carpel has a terminal small slit; ovule solitary, erect; style large, slightly angular. Fruits crowded in a globose mass, 8-10

cm long 20 cm in diameter, 2-4 angled, obovoid to wedge-shaped; epicarp smooth, 1mm thick, dark brown, mesocarp spongy and fibrous, endocarp to 2 mm thick, hard; seed broadly ovoid, 0.5 –0.7 cm long, 0.5 cm wide.

Distribution: Indo Malaysia, Philippines, N.E. Australia, India (West Bengal, Andaman & Nicobar Islands), Bengladesh.

Flowering: September-November. **Fruiting:** May-June.

Conservation Status: Least Concern

Specimens examined: Campel bay, Great Nicobar, 9.3.1966, female fl., Thothathri & Banerjee 11421 (CAL); Car Nicobar, 7.4.93, Renuka and Vijayakumaran 7038 (KFRI); Homfray gunj, South Andamans, 14.4.1964, fl., Ellis and Ramamurthy 18795 (MH).

Uses: Leaves are used as thatch. A well developed inflorescence yields huge quantity of sugary sap from the peduncle for a period of about 10 days.

Notes: Fossil pollen grains of the palm genus *Nypa* were described under *Spinizonocolpites* from the west coast of India in the Tertiary sediments of the Warkalli and Quilon formations in Kerala (Rao, and Ramanujam, 1975) and in the sediments of the Ratnagiri Beds in Maharashtra (Kulkarni and Phadtare, 1983). This palm is also mentioned in Rheede's Hortus Malabaricus from Thekkenkoor areas in South Kottayam (Manilal, 2014).

Plate 24. ***Nypa fruticans*** **A. Infrutescence ;** ***Phoenix andamanensis*** **B. Habit C. Infrutescence**

***Phoenix* L.,** Sp. Pl.: 1188 (1753); Cav., Icon. 2: 12 - 15 (1793); Willd., Linn. Sp. Pl. (ed. 4), 4(2): 730 - 731 (1806); Buch.-Ham., Trans. Linn. Soc. London 15: 82 - 89 (1827); Roxb., Fl. Ind. ed. 2: 783 - 790 (1832); Kunth, Enum Pl. 3: 254 - 258 (1841); Griff., Calcutta J. Nat. Hist. 5: 344 - 355 (1845); Mart., Hist. Nat. Palm. 3: 257 - 276 (1849); Griff., Palms Brit. E. Ind.: 136 - 147, pl. 228, A - 229, A, B (1850); Brandis, Forest Fl. N.W. India: 552 - 556 (1874); Becc., Malesia 3: 345 - 416, pl. 43, f. 1 - 3, 44, f. 1 - 6 (1890); Becc. & Hook. f., Fl. Brit. India 6: 424 - 428 (1892); Gamble, Man. Ind. Timb. (ed. 2): 730 - 732 (1902); Brandis, Indian Trees: 644 - 646 (1906); Becc., Webbia 3: 238 - 240 (1910); Becc., Bull. Mus. Hist. Nat. (Paris) 17: 148 - 160 (1911); L. H. Bailey, Stand. Cycl. Hort.: 2593 - 2594 (1916); Blatt., Palms Brit. Ind.: 1 - 43, pl. 2 - 9, f. 1 - 5 (1926); Magalon, Contr. Etud. Palmiers Indoch.: 20 - 30 (1930); Gagnep. & Conrard in Lecomte, Fl. Indo-Chine 6: 974 - 978 (1937); Vasc. & Franco, Portugaliae Acta Biol., Ser. B, Sist. 2: 307 - 318 (1948); Mahab. & Parthasarathy, J. Bombay Nat. Hist. Soc. 60 (2): 371 - 387 (1963); N. W. Uhl & J. Dransf., Genera Palmarum: 214 - 217 (1987).

Type species: *P dactylifera* L. Lectotype: *Palma hortensis mas et foemina* Kaempf., Amoen. Exot. Fasc. 668, 686, t. 1, 2 (1712) (see Moore & Dransfield 1979).

Vaga L., Fl. Zeyl.: 187 (1747).

Elate L., Sp. Pl.: 1189 (1753). Type species: *E. sylvestris* L. = *Phoenix sylvestris* (L.) Roxb. Lectotype: *Katou-indel* Rheede, Hort. Malab. 3: 15 - 16, pl. 22 - 25 (1678 - 1703); Mart., Hist. Nat. Palm. 3: 270, 273 (1845).

Palma (L.) Mill., Gard. Dict. Abr. ed. 4, nom. illegit. (1754). Lectotype: *P. dactylifera* (L.) Mill., Gard. Dict. ed. 8 (1768). See Moore (1963b).

Dachel Adans., Fam. Pl. 2: 25, 548 (1763). No type designated.

Phoniphora Neck., Elem. Bot. 3: 302 (1790). No type designated.

Zelonops Raf., Fl. Tellur. 2: 102 (1837). Type: *Z. pusilla* (Gaertn.) Raf. (*Phoenix pusilla* Gaertn.). *Zelonops* was described as a small palm of India and Vietnam (probably *P. loureiri* Kunth) by Rafinesque (1837) who misunderstood the floral characteristics of *R dactylifera,* and did not consider it to belong in *Phoenix.*

Palaeophoenix Saporta, Ann. Soc. Agric. Puy 33: 25 (1878). Type: *P aymardi* Saporta, ibid., pl.1. Eocene: near Puy-en-Velay, France.

Dwarf or creeping to large, solitary or clustered, armed, ploeonanthic, dioecious palms. Stem to 25 - 30 m tall or less than 10 cm high and bulbiferous, often clothed with spirally arranged leaf bases. Leaves induplicate, pinnate, usually marcescent; sheath forming a fibrous network; petiole very short to well developed, adaxially channelled to flattened or ridged, abaxially rounded; rachis elongate, tapering, adaxially rounded or flat to angled, abaxially rounded to flat, usually terminating in a leaflet; leaflets regularly arranged or variously fascicled, in one to four planes or of orientation, single-fold, acute to acuminate, flaccid or stiff, sometimes decurrent along rachis; lamina with no true midrib but midvein often prominent abaxially, adaxial surface glabrous, abaxial surface glabrous or with discontinuous scurfy, white ramenta or with veins darkened with tannin-filled cells. Inflorescences interfoliar, branching to 1 order, the staminate and pistillate superficially similar; staminate inflorescences not extending far beyond prophyll; prophyll coriaceous or papery, splitting one to two times between margins; peduncle flattened; rachillae crowded along rachis, flexuose. Staminate flowers along full length of rachillae, yellow-white, sweet to musty smelling; with 3 sepals connate in low cupule; lobes variously distinct; petals 3 (rarely 4), valvate, acute or

rounded, much exceeding the calyx; stamens usually 6 (rarely 7 or 9), filaments minute, erect, the anthers linear, latrorse; Pistillate inflorescences interfoliar, erect, arching or becoming pendulous at fruit maturity; prophyll bivalved, 2-keeled, coriaceous or papery, glabrous or floccose with reddish-brown tomentum; other bracts inconspicuous; peduncle flattened, yellow-green to orange, variously elongated; rachillae unbranched, numerous, irregularly arranged or in loose spirals along rachis; Pistillate flowers globose; yellow-white to pale green, each subtended by a non-persistent papery bract; sepals connate in a 3 lobed cupule; petals imbricate strongly-nerved, about twice as long as the calyx or more; staminodes usually 6, scale like or connate in low cupule; carpels 3, distinct, follicular, ovoid, narrowed into a short, recurved, exserted stigma, ovule attached adaxially at the base, anatropous. Fruit usually developing from 1 carpel, ovoid to oblong with apical stigmatic remains; epicarp smooth, mesocarp fleshy, endocarp membranous. Seed elongate, terete or plano-convex, and deeply grooved with intruded seed coat below the elongate raphe, hilum basal, rounded, endosperm homogeneous; embryo lateral or subbasal.

Distribution :- An Old world genus, consists of about 17 species ranging from ranges from the Canary Islands through subtropical and tropical Africa, the Mediterranean, the Arabian Peninsular, the Indian Subcontinent and Indochina to Hong Kong. Widely cultivated as ornamentals, one species, *P. dactylifera*, the date palm, is a major economic plant for its edible fruits, now wide spread in semi-arid areas. In India, the genus is represented with

Notes: Easily distinguished from all other palms by the induplicate pinnate leaf with the lower leaflets modified as spines. The distinct carpels and relatively unspecialized perianth and stamens suggest close affinity with the apocarpous genera of the Corypheae. A modern developmental study of the unique leaf is greatly needed.

Key to the species in India

1a.Stem solitary 3

1b.Stem clump forming 2

2a.Leaflets 2-farious ensiform with filiform tips, abaxial lamina surface greyish, veins darkened with tannin, embryo basal..... *paludosa.*

2b.Leaflets 4- farious with very sharp needle like apices, lamina glossy green, veins not darkened with tannin, embryo lateral opposite raphae.....*pussilla.*

3a.Stem bulbous, to 10 cm high or absent ..... *acualis.*

3b.Stem not bulbous, to 2-6 m high 4

4a. Leaves 4- fariously fascicled; with spirally arranged persistent leaf sheath on the stem 5

4b.Leaves 2-farious, partially or completely ringed by oblique, narrow leaf base scars. 6

5a. Stem dwarf, leaf short, stiff; fruits cherry red in colour, 1.5 cm long ..... *loureirii.*

5b. Stem tall, slender to robust, orange yellow to light brown-black in colour, above 3 cm long.....6.

6a.Endosperm homogeneous .....*rupicola.*

6b.Endosperm ruminate. .....*andamanensis.*

Phoenix acaulis Roxb., Hort. Bengal.: 73 (1814), Pl. Coromandel 3: 70, t. 273 (1820), Fl. Ind. ed. 2, 3: 783 (1832); Buch.-Ham., Trans. Linn. Soc. London 15: 87 (1826); Royle, Ill. Bot. Himal. Mts.: 397, nomen (1840); Kunth, Enum. Pl. 3: 257 (1841); Griff., CalcuttaJ. Nat. Hist. 5: 344 (1845); Mart., Hist. Nat. Palm. 3: 274 (1849); Griff., Palms Brit. E. Ind.: 137, t. 228 (1850); Brandis, Forest Fl. N.W. India: 555 (1874); Kurz, Forest Fl. Burma 2: 535 (1877); Mason, Burmah 2: 142 (1883); Becc., Malesia 3: 397, t. 44, 4. f. 51 - 57 (1890); Becc. & Hook. f., Fl. Brit. India 6: 426 (1892); Brandis, Indian Trees: 645 (1906); T. Cooke, Fl. Bombay 2: 802 (1907); L. H. Bailey, Stand. Cycl. Hort.:

2595 (1916); Blatt., Palms Brit. Ind.: 15 (1926); Osmaston, Forest Fl. Kumaon: 545 (1927); P. C. Kanjilal, Forest Fl. Pilighit, Oudh, Gorakhapur & Bundelkhand: 382 (1933); H. E. Moore, Principes 7 (4): 157 (1963); B. D. Naithani, Fl. Chamoli 2: 667 (1985); P. C. Pant, Flora of Corbett National Park: 158 (1986); Noltie, Fl. Bhutan 3 (1): 235 (1994).

P acaulis var. *melanocarpa* Griff., Calcutta J. Nat. Hist. 5: 346 (1845) and Palms Brit. E. Ind.: 138, t. 227 (1850).

Acaulous palm. Stem bulbous, to 10 cm high, densely covered with persistent leaf bases. Leaves 0.6-1.8 m long; leaf sheath reddish-brown, fibrous; rachis 0.3-1.5 m long x 1.5-2 cm in diam at base; basal leaflets closely arranged in more than one plane, to 9 cm long; leaflets arranged in sub- opposite groups of 4-5 in more than one plane of orientation, 16-24 on each side of rachis, linear, 8-36 x 0.5-1.4 cm, flaccid, with strong marginal nerves; lamina concolorous, pale green. Inflorescences held at ground level; staminate inflorescences not extending beyond prophyll; prophyll papery and splitting in many places, 13 x 2 cm; peduncle 7 x 0.6 cm; rachillae arranged in one whorl, 10-15 in number, 8 cm long; pistillate inflorescences not extending beyond prophyll; prophyll papery, 25 x 4-6 cm; peduncle 9-12 x1.4 cm, not extending on fruit maturity; rachillae arranged in one compact whorl, 15-20 in number, 4-14 cm, drying striate, with differential maturation of fruit along rachillae; pistillate flowers 5-20 per rachilla, congested in arrangement, each subtended by a distinct rachillae swelling (bractiform notch), 3-10 mm long; calyx united; petals 5-6 x 4 mm. Fruit obovoid, 12-18 x 8 mm, ripening from green with scarlet apices to blue-black, with mesocarp scarcely fleshy and stigmatic remains prominently pointed (1-2 mm long). Seed elongate in shape, 10 x 5 mm, with rounded apices; embryo lateral, opposite raphae; endosperm homogenous.

Distribution: Sub-Himalayan belt of Northern India, Nepal and Myanmar.

Flowering: January. **Fruiting:** May-June.

Conservation Status: Near Threatened

Specimens examined: MEGHAYALA: Barapani, BSI, Shillong, 27.4.2009, fr., MADHYA PRADESH: Manohara 25029 (KFRI); Korba, Bilaspur, 18.4.1965, fl., ORISSA: Panigrahi & Arora 8729 (CAL); Gharhaon, 28.6.1957, Panigrahi 8397 (CAL); Nigirda, Orissa, 18.2.1958, WEST BENGAL: Panigrahi 12569 (CAL); Ilam bazaar, 24.4.1966, fr., Basak 231 (CAL); Durgapur belt, Allahabad, 25.7.1973, fr., Mukerjee 18789 (CAL); Baidayanathpur, 29.7.1966, male fl., Basāk 523 (CAL); CHATTISGARH: Bastar, 22.5.1983, fr., Roy & Dixit 31980 (CAL).

Uses: Fleshy sweet pulp of the fruit is eaten by the tribals of Northeastern India. Rope is made in certain localities from the beaten leaves. Leaves are also used as thatch. In Chotonagpur a sort of sago is made from the pith, but unlike common date palms its stem or peduncle is not used for tapping sugery sap.

Phoenix andamanensis *S. Barrow* Kew Bull : 53 1998.

Phoenix sp., Kurz, Rep. Veg. Andaman Isl.: 7, 50 (1870); Brandis, Indian Trees: 646 (1906); C. E. Parkinson, A Forest Flora of the Andaman Isl.: 263 (1923); Plate 24.

Solitary tree palm. Stem 2 - 5 m, without leaf sheaths c. 15 cm diam. Leaves to c. 2.4 m long; acanthophylls sparsely arranged in one plane, to c. 4 cm long; leaflets closely and regularly inserted in one plane, 14 - 45 x 0.4 - 2.5 cm; lamina concolorous with discontinuous white, scurfy ramenta in midrib region on the abaxial surface. Staminate inflorescence with prophyll to c. 30 x 5 cm, coriaceous; rachillae to c. 10 cm long. Staminate flowers not seen. Pistillate inflorescence with prophyll splitting twice between margins, to 60 x 4 cm; peduncle to

100 x 1.2 cm; rachillae to c. 23 cm long. Pistillate flowers spirally arranged in distal half of rachilla, c. 20 in number; calyx cupule 1.5 mm high; petals 3 - 4 x 6 mm. Fruit oblong, to 19 x 10 mm, colour at maturity not known. Seed elongate, to 14 x 7 mm; embryo lateral opposite raphe, slightly supra-equatorial; endosperm ruminate.

Distribution: Endemic to Andaman Islands. Presently reported from North Andaman and Little Andaman, and from Cinque and Rutland Islands.

Flowering: January-February. **Fruiting:** June.

Conservation Status: Endangered

Specimens examined: ANDAMAN IS. NORTH ANDAMAN: Saddle Hill, 450 m alt., 28 Sept. 1905 (stam., pist.), Osmaston (CAL!); Saddle Hill, 500 m alt., 1 Dec. 1976 (pist.), Balakrishnan & Nair 4771 (CAL!); RUTLAND ISLAND: Andamans, 11.10.2008, Manohara 24245 (KFRI); Saddle peak, North Andaman Island, Manohara 24247 (KFRI); CINQUE ISLAND: precise locality unknown, 7 April 1911 (stam., pist.), Rogers s.n. (CAL!);

Phoenix loureiroi* var. *pedunculata (Griff.) Govaerts (Griff.) Govaerts in R.H.A.Govaerts & J.Dransfield, World Checklist Palms: 171. 2005; Plate 25.

Phoenix pedunculata Griff., Palms Brit. E. Ind.: 139. 1850.

Phoenix humilis var. *pedunculata* (Griff.) Becc., Malesia 3: 384. 1890.

Phoenix ouseleyana Griff., Calcutta J. Nat. Hist. 5: 347. 1845.

Phoenix humilis var. *robusta* Becc., Malesia 3: 384. 1890.

Phoenix humilis var. *typica* Becc., Malesia 3: 380. 1890., nom. inval.

Phoenix robusta (Becc.) Hook.f., Fl. Brit. India 6: 427. 1892.

Phoenix loureiroi var. *humilis* S.Barrow, Kew Bull. 53: 563. 1998.

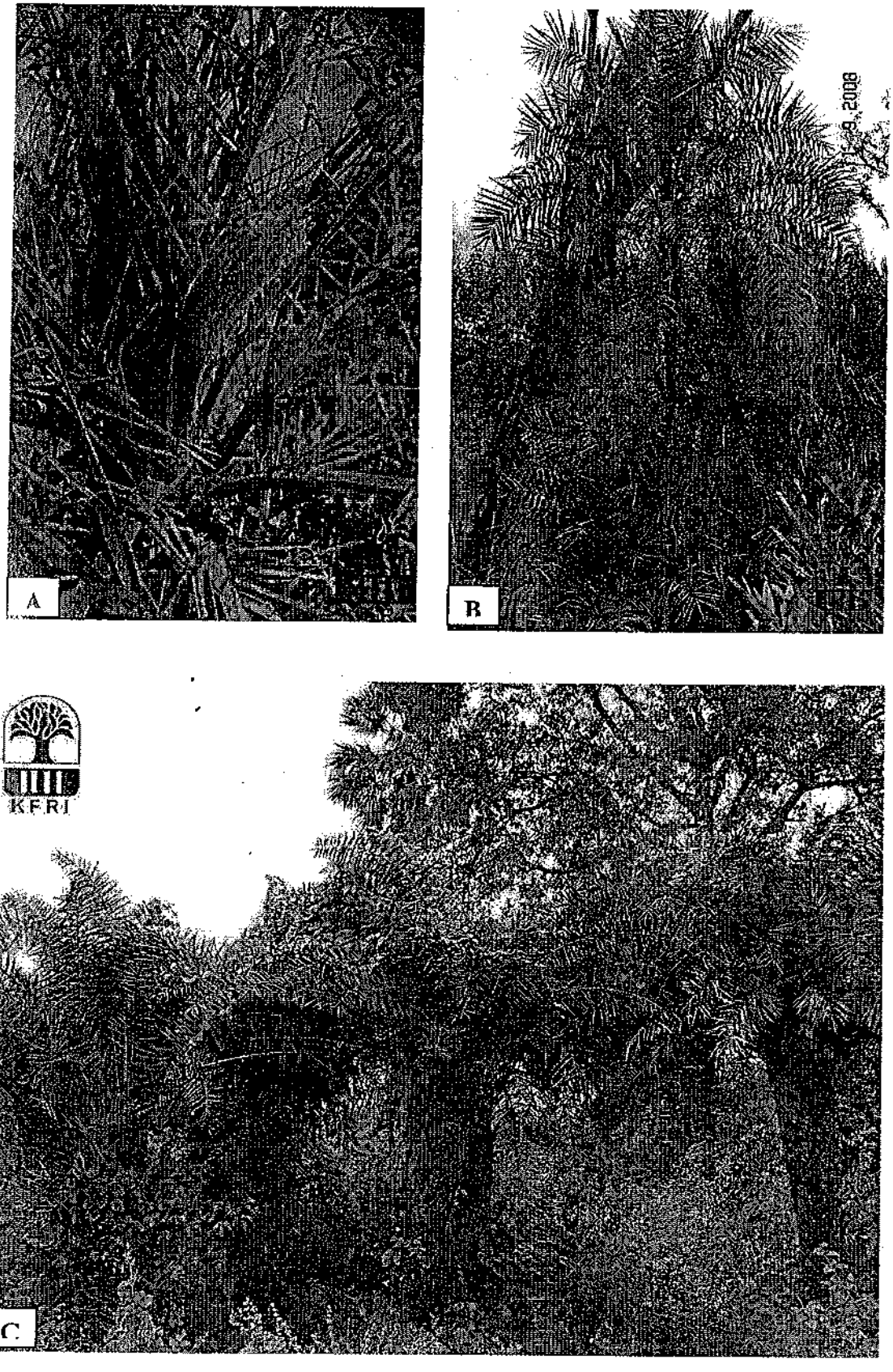


Plate 25. ***Phoenix loureiroi*** **var.** ***pedunculata*** **A. Inflorescence;** ***P. paludosa*** **B. Habit;** ***P. pusilla*** **C. Habit**

Solitary or clustering, dioecious, pleonanthic palm. Stem dwarf, 2-3 m high, to 23 cm in diameter, closely packed with persistent leaf bases, more or less spirally arranged. Root suckers develop frequently when the primary stem is burnt or injured. Leaves 1-2 m long; leaflets pliable, 25-50 x 0.5-1 cm; fasicled, more or less quadrifarious, the uppermost sometimes confluent, pale green to bluish green, often bearing scales; emergent leaves frequently brown indumentum. Inflorescence interfoliar, peduncle to 80 cm long, rachis flattened, rachillae unbranched, numerous, in groups in a spiral along the rachis; staminate flowers with sepals connate in a low cupule; petals valvate, rounded, much extending the sepals; stamens 6, filaments short, erect, the anthers linear, latrorse, pistillode absent; pistillate flowers globose, sepals connate in a 3 lobed cupule; petals imbricate, strongly nerved, about twice as long as the sepals; staminodes 6, connate in a low cupule; carpels 3, distinct, ovule attached adaxially at the base, anatropus, stigma short. Fruit orange red to black, usually developing from 1 carpel, ovoid to oblong with apical stigmatic regions, 1 x 0.5 cm, seed elongate and deeply grooved, endosperm homogenous, embryo lateral.

Distribution: India (Assam, Nagaland, Bihar, Himachal Pradesh, W. Ghats, Orissa, Andhra Pradesh).

Flowering: January-March. **Fruiting:** October-December.

Conservation Status: Least concern

Specimens examined: Nelliampathy, Palakkad, 9.3.09, Manohara 25064 (KFRI); Brandhipara, Periar East, 6.3.09, fr., Manohara 25063 (KFRI); Silent Valley, 14.1.2009, fl., Manohara 25062 (KFRI); Himavath gopalaswami hills, Karnataka, 20.7.2009, fl., Manohara 25057 (KFRI); Amaikulam, Nadukani, 21.7.2009, Manohara 25059 (KFRI); Puliancholai, 22.3.1959, fr., Sebastine 7942 (MH); Gudalur, Nilagiri, Tamil Nadu, 11.3. 1969,fr., Deb 31658 (MH); Attaishola, Nilagiri, Tamil Nadu, 19.6.70, fl.& fr., Shetty 34322 (MH); Madanad R.F., Nilagiri, Tamil Nadu, 20.7.1970, fr., Vajravelu 34942 (MH); Madanad R.F., Nilagiri, Tamil Nadu, 2.5.1971, fr., Vajravelu 38192

(MH); Devala-Nadugani forest, Nilagiri, Tamil Nadu, 19.11.1972, fr., Vajravelu 42855 (MH); Near Gudalur, Nadugani, 24.5.1971, fr., Ellis 38522 (MH); Near Bimaka Peak, 28.11.1970., fl., Subba Rao 37389 (MH); Singara R. F., 24.4.1971, fl., Radhakrishnan 38047 (MH); Cumbummedu Ramanad, 14.3.1970, fl., Vajravelu 33757 (MH); Ettapur, Selam Dist., 23.7.1977, fl., Ansari 49982 (MH); Karianshola, Anamudi, Coimbatore, 17.3.1931, Narayanaswami, 5421 (MH); Cheedipalam, East Godavari, Andra Pradesh, 27.5.1966, Subba Rao 27428 (MH); Devikulam Idukki, 27.1.1964, Sebastine 18477(MH); Brahmagiri, Cannanore, 4.3.1979, fl., Ramachandran 62062. (MH); Kuttikkanam, Peermedu, 21.1.1965, fl., Vivekanandan 22910 (MH); Siruvani Dam site, Palghat, 19.1.1980, fr., Bargavan 65582 (MH); Pamba Dam, Quilon, 29.3.1978, fl., Mohanan 54374 (MH).

Phoenix paludosa Roxb., Hort. Bengal.: 73 (non vidi) (1814), Fl. Ind. 3: 789, pl. 1193 (1832); Royle, Ill. Bot. Himal. Mts.: 397, nomen (1840); Kunth, Enum. Pl. 3: 256 (1841); Mart., Hist. Nat. Palm. 3: 272, t. 136 (1849); Griff., CalcuttaJ. Nat. Hist. 5: 353 (1845) and Palms Brit. E. Ind.: 144, t. 229B (1850); Hook. f., Himal. J. 2: 355 (1854); Kurz, Rep. Veg. Andaman Isl.: 50 (1870), J. Asiat. Soc. Bengal, Pt. 2, Nat. Hist. 43 (2): 202 (1874) & Forest Fl. Burma 2: 536 (1877); Brandis, Forest Fl. N.W. India: 556 (1874); Gamble, Man. Ind. Timb.: 419 (1881); Becc., Malesia 3: 410, fig. 6, f. 58 - 61 (1890); Becc. & Hook. f., Fl. Brit. India 6: 427 (1892); Brandis, Indian Trees: 646 (1906); Becc., Webbia 3: 239 (1910); C. E. Parkinson, Forest Fl. Andaman Isl.: 263 (1923); Blatt., Palms Brit. Ind.: 21, pl. 7, f. 3 (1926); Magalon, Contr. Etud. Palmiers Indoch.: 20 (1930); H. E. Moore, Principes 7(4): 157 (1963); Mahab. & Parthasarathy, J. Bombay Nat. Hist. Soc. 60(2): 371 - 387 (1963); Whitmore, Palms of Malaya: 86 - 87 (1973); Kiew, Malayan Nat. J. 42 (1): 16 (1988); S. M. Mathew & S. Abraham, Principes 38 (2): 100 - 104 (1994); Plate 25.

Roxburgh (1832), Fl. Ind. 3: 789, pl. 1193 (K). *P siamensis* Miq., Palm. Archip. Ind.: 14 (1868).

Phoenix siamensis Miq., Verh. Kon. Akad. Wetensch., Afd. Natuurk. 11(5): 14.1868.

Clustering, pleonanthic, dioecious palm. Stem slender, annulate, to 6 m long, 15-16 cm in circumference near base. Leaves arching, pinnate, to 120 cm long or more; leafsheath fibrous, reddish in colour; petiole reddish brown, scurfy outside; basal leaflets arranged individually or paired, green-brown, flattened, stiff, sharp with bulbous base, rachis with green-brown indumentum; leaflets linear, induplicate, about 60 in number per leaf, grouped in more than one plane of orientation. Inflorescence interfoliar, erect from the leaf axil; prophyll compressed, reddish brown, spatuliform; staminate flowers bright yellow at anthesis; pistillate flowers accrescent. Ripe fruits yellowish to purple and turning black, about 2 cm long; endosperm homogenous.

Distribution: Coastal regions of India to Malay Peninsula and northern Sumatra. A component of estuarine mangrove swamps.
Flowering: January-February. **Fruiting:** June.
Conservation Status: Least concern
Specimens examined: Orissa, 2.5.2002, fr., Sreekumar & Dinesh 22677 (KFRI); Baratang Island, S. Andamans, 9.4.2001, Sreekumar & James 22622 (KFRI); North Andamans, 10.4.2001, Sreekumar 22623 (KFRI).
Uses: Its leaves are used in Sunderbans for making ropes for tying boat and logs and also for thatching. Crushed leaves are used for making brooms. The stem of the smaller trees are used as walking sticks and longer ones serve for rafters. The local people believe that the snake gets out of the way of any person having such a stick.

Phoenix pusilla Gaertn., Gaertn., Fruct. Sem. Pl. 1: 24. 1788; Barrow, Kew Bull. 53: 555. 1998; Plate 25.

Elate sylvestris L., Sp. Pl.: 1188 (1753), Sri Lankan plant only (referred to as Hinindi).

P farinifera Roxb., Pl. Coromandel 1: 74, t. 74 (1796) & Fl. Ind. 2: 785 (1832). Willd., Linn. Sp. Pl. (ed. 4), 4 (2): 731 (1806); Griff., CalcuttaJ. Nat. Hist. 5: 348 (1845); Becc., Malesia 3: 402, t. 44, fig. 3 (1890); T. A. Davis, & A. F. Joel, Palms & Cycads 23: 2 - 10 (1989).

P zeylanica Trimen, J. Bot. 23: 267 (1885); Becc. & Hook. f., Fl. Brit. Ind. 6: 425 (1892); Trimen, Handb. Fl. Ceylon 4: 326, pl. 95 (1898); Blatter, Palm. Brit. Ind. 11: 14 (1926); Mahabale & Parthasarathy, J. Bombay Nat. Hist. Soc. 60: 375 (1963)

Solitary or clustering, dioecious, pleonanthic palm. Stem to 6 m high and 30 cm in diam. Leaves to 3 m long; pseudo petiolate to 70 cm long x 1.5-3 cm wide at base, rounded abaxially; leaf sheath fibrous, reddish-brown; leaf base persistent, vertically oriented on trunk, 8 cm wide at base; basal leaflets spiny, individually arranged in one or more planes of orientation, 7-18 on each side of rachis, yellow-green, very sharp, to 11 cm long; leaflets more or less irregularly arranged, quadrifarious proximally, 30 – 100 on each side of rachis, elongate-spathulate in shape with very sharp, needle like apices, 10-45 x 0.5-3 cm in length; leaflet join with rachis marked by yellow-orange pulvinus; lamina concolorous, dark, glossy green, and pliable in texture. Staminate inflorescences erect; prophyll coriaceous, 12-30 x 4-8 cm; peduncle 5-25 cm long; rachillae arranged at wide angle to the rachis, 50-70 in number, to 21 cm long; staminate flowers ovoid, yellow-white; calyx 1-1.5 mm high; petals 4-5 x 2-3 mm ovate, with rounded apices. Pistillate inflorescences erect, arching at fruit

maturity; prophyll coriaceous, splitting twice, 17-41 x 2.5-5.5 cm; peduncle to 25-75 cm; rachillae 20-120 in number, orange green, 5-30 cm long; pistillate flowers mostly in the distal half of rachilla; calyx to 1.2 mm high; petals 2 x 3-4 mm. Fruit ovoid, 11–15 x 5-8 mm, ripening from green to red to purple black, moderately fleshy, sweet; seed ovoid with rounded apices, pinkish-brown when fresh, drying glossy chestnut-brown, 8-12 x 6 mm, with intrusion of testa in region of raphae often Y-shaped in transverse section; embryo lateral, opposite raphae; endosperm homogenous.

Distribution: India (Eastern Ghats of Tamil Nadu and southern region of Kerala), Sri Lanka.

Flowering: January. **Fruiting:** April-May.

Conservation Status: Least concern

Specimens examined: Thovalai, Tamilnadu, 24.1.1978, fr., Henry 53270 (MH); Meelakadu R F, Sivaganga, 22.12.65, Ramamurthy 22825 (MH); Kongampallam, Yercaud, 15.2.69, fl., Deb 31430 (MH); Janjore, 28.7.1932, fr., Jacob 80417 (MH); Kodiakadu, 21.1.1961, fl., Ellis 11820 (MH); Kodaikadu , 21.1.1961, fl., Ellis 11821 (MH); Pattukottai, Tamil Nadu, 1.2.1978, fl., Ramamurthy 53719 (MH); Kalakadu, 7.3.1963, fl., Joseph 15868 (MH); Veli, Thiruvananthapuram, 4.8.1978, fl., Mohanan 58538 (MH); Auroville, 21.11.1988, fr., Rajan 89832 (MH); Guindy Park R F, 6.2.1976, fl., A. N. Henry 47181(MH); Kollegal, Coimbatore Dist, 18.2.1930, fr., V. Narayanaswamy 20073 (MH); Noyi River side, Coimbatore, fr., 16.11.67, M. Chandrabose 29034 (MH); Maruthamalai, fl., 15.4.1970, Acc. 96618 (MH); KFRI Palmetum, Peechi, 14.08.2009, fr., Manohara 25060 (KFRI).

Uses: Leaflets are used for making mats, fruits are edible.

Phoenix rupicola T.Anderson, T.Anderson, J. Linn. Soc., Bot. 11: 13. 1869; Becc., Malesia. 3: 395. 1890. Becc. & Hook. f. in Hook. f., Fl.

Brit. India 6: 425. 1892; Blatt., Palms Brit. Ind. 14. 1926; H. E. Moore, Principes 7 (4): 157 (1963); Noltie, Fl. Bhutan 3 (1): 415 (1994); Barrow, Kew Bull. 53: 537. 1998; Plate 26.

Solitary, pleonanthic, dioecious palm. 4-6 m long, 20 cm in diameter, without persistant leaf bases, deep grey in colour. Leaves 3 m long, gracefully arching; leaf sheath reddish brown, fibrous; leaflets arranged in one plane of orientation, basal leaflets green and soft, lamina abaxial surface with persistent, discontinuous white ramente in midrib region. Male inflorescence erect; rachillae to 22 cm long. Pistillate inflorescence erect, becoming pendulous on maturity; rachillae arranged in horizontal fascicles, flowers arranged in upper half of rachilla, calyx joined to form a cupule; corolla 3 x 6 mm. Fruit obovoid, seed obovoid with squared apices, 12-15 x 5-7 mm; endosperm homogeneous.

Distribution: India (Sikkim, Assam), Bhutan.

Flowering: March to May

Conservation Status: Near threatened

Specimens examined:

INDIA. ASSAM. Shillong, Kimin to Khunipahad, 25 Sept. 1959 (pist.), Panigrahi 19485 (CAL!). SIKKIM. 24June 1876 (ster.), King s.n. (BM!, CAL!); 19Jan. 1877 (ster.), Davis & Gamble 2387a (CAL!). WEST BENGAL. Sivoka, Teesta valley, 23 Feb. 1867 (pist.), *Herb. Sikkimensis* Anderson s.n. (type CAL!).SILLIM: Rainmatong, 26.3.1945, Mukerjee 1396 (CAL); Numbong, Sikkim, 3.6.1909,male fl., Lepeha Collection 2100 (CAL); CULCUTTA: BSI Botanic garden, Howrah, 24.05.2009, fl., Manohara 25054 (KFRI); BSI Botanic garden, Howrah, 24.05.2009, ARUNACHAL PRADESH: Manohara 25055 (KFRI); Kimin, 14.05.2009, fl., Manohara 25051 (KFRI); Kimin, Arunachal Pradesh, 14.05.2009, Manohara 25052 (KFRI)

Uses: The core of the stem contains starchy materials and during food shortage the trees are felled by the Lepchas for extracting the core.

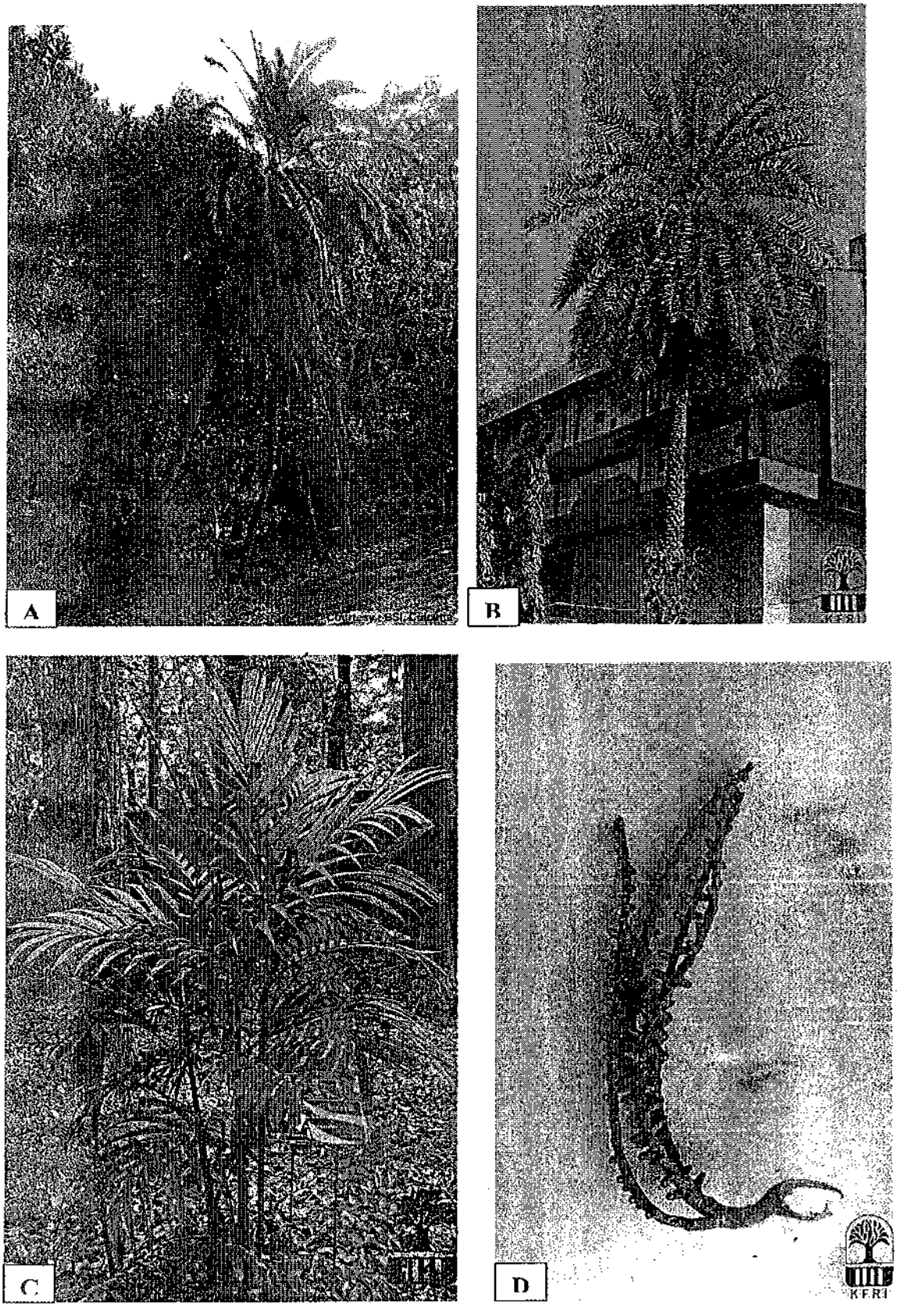


Plate 26. ***Phoenix rupicola*** **A. Habit;** ***P. sylvestris*** **B. Habit;**
C. Pinanga dicksonii (KFRI palmetum) **D. Inflorescence**

Phoenix sylvestris (L.) Roxb., Hort. Bengal.: 73 (1814) and Fl. Ind. ed. 2: 787 (1832); Royle, Ill. Bot. Himal. Mts.: 397, nom. (1840); Griff., CalcuttaJ. Nat. Hist. 5: 350 (1845); Mart., Hist. Nat. Palm. 3: 270, t. 136 (1849); Griff., Palms Brit. E. Ind.: 141, t. 228 (1850); Aitch., Cat. Pl. Punjab Sindh: 143 (1869); Brandis, Forest Fl. N.W. India: 554 (1874); Becc., Malesia 3: 364, t. 43, 3, f. 25 - 36 (1890); Becc. & Hook. f., Fl. Brit. India 6: 425 (1892); Gamble, Man. Ind. Timb.: 731 (1902); Brandis, Indian Trees: 645 (1906); L. H. Bailey, Stand. Cycl. Hort.: 2594 (1916); Blatt., Palms Brit. Ind.: 3, pl. 2, 3, (1926); Osmaston, Forest Fl. Kumaon: 544 (1927); C. Fischer, Fl. Madras 3: 1559 (1931); Kashyap, Lahore Fl.: 250 (1936); H. E. Moore, Principes 7 (4): 157 (1963); Mahab. & Parthasarathy, J. Bombay Nat. Hist. Soc. 60 (2): 374 (1963); H. G. Champion & S. K. Seth, A Revised Survey of Forest Types of India (1968); H. E. Moore &J. Dransf., Taxon 28 (1, 2/3): 67 (1979); K. M. Matthew, Mat. Fl. Tamilnadu Carnatic: 367 (1981) and Fl. Tamilnadu Carnatic 3: 1674 (1983); Malik in Nasir & Ali (eds.), Fl. W. Pakistan 153: 24 (1984); Noltie, Fl. Bhutan 3 (1): 416 (1990). Lectotype: Katou-Indel Rheede, Hort. Malab. 3: 15 - 16, pl. 22- 25 (1682) vide Mart., Hist. Nat. Palm. 3: 270- 273, t. 136 (1849). See Moore & Dransfield (1979); Plate 26.

Dalzell & Gibson, Bombay Fl. 278 :1861

Elate sylvestris L., Musa Cliff.: 11 (1736) and Sp. Pl.: 1189 (1753). Typified as for *P sylvestris* above.

Katou Indel Rheede ex Buch.-Ham., Trans. Linn. Soc. London 15: 82 - 87 (1826).

Solitary, dioecious, pleonanthic palm. Stem to 10 m tall, without leaf sheaths 20-30 cm diameter, with persistent, diamond-shaped leaf bases; stem base with mass of roots; crown hemispherical, with more

than 50 leaves. Leaves 1.5 x 4m long; leaf sheath reddish-brown, fibrous; pseudopetiole 30-40 cm long x 3-5 cm wide at base; (basal leaflets turned into spines) closely inserted, arranged in several planes, 13-18 on each side of rachis, conduplicate, yellow-green, very sharp, 30-33 cm long; leaflets irregularly fascicled, arranged in several planes, 80-90 on each side of rachis, concolorous, greyish-green, often waxy, very sharp, 18-35x1.2-2.4cm; Staminate inflorescences 25 per plant, erect, not extending far beyond prophyll; prophyll coriaceous, bright orange internally when young, splitting first adaxially (side adjacent to trunk), 25-40 x 6-15 cm; peduncle 20-30 x 1.2-2.2 cm; rachis 13- 18 cm long with numerous, congustedly arranged rachillae, each 4-16 cm long; staminate flowers white or yellow, musty-scented; calyx a deep cupule with 3 poorly defined lobes; petals 3 (rarely 4), apices obtuse, slightly hooded; anthers 3-4 mm long; pistillate inflorescences erect, arching on fruit maturation; prophyll papery, short, splitting twice between margins; rachillae arranged in irregular horizontal whorls, 50-60 in number, yellow green in colour, 8-34 cm long; pistillate flowers creamy white, 40-50 mostly restricted to distal half of rachilla; calyx united; petals 3-4 x 4-5 mm. Fruit obovoid, 15-25 x 12 mm, ripening from green to orange-yellow, with mesocarp moderately fleshy and astringent. Seed obovoid with rounded apices, 15-20 x 7-10 mm; embryo lateral opposite raphae; endosperm homogeneous.

Distribution: India (Through out the hotter parts), Pakistan.

Flowering: January - April. **Fruiting:** October - December.

Conservation Status: Least Concern

Specimens examined: Subansiri F. D., Kimin to Khunipahad, Arunachal Pradesh, 25.9.1959, Panigrahi 19485 (CAL); Burla, 26.8.1986, Sauris Pandae & Das 207 (CAL); Balugan, Orissa, 7. 5. 02, fr., Sreekumar and Dinesh, 22676 (KFRI); Lalacheruvu, Andra Pradesh, 28.5.02, fr., Sreekumar and Dinesh, 22695 (KFRI); Jagathalpur, Chathisgarh, 21.5.02, fr., Sreekumar, 22687 (KFRI); Manjeri, Andaman, 8. 4. 01, Sreekumar and James 22621 (KFRI); S. K.

University campus, Anantapur, 24.5.1982, leaf, Yesoda 516 (MH); W.Godavari, 31.1.1934, fl., Jacob 457 (MH); Bunds of Vedanthangal; W. B., Chigleput, 25.1.1976, Henry 47014 (MH); Sindhuvalli, Mysore, 21.7.2009, fl., Manohara 25058 (KFRI).

Uses: One of the most useful palms in India. Freshly obtained sap of the wild date palm is clear as water having 12–15% sugar and is a delicious drink rich in vitamin. Application of the lime in the receiving pot delay the fermentation of the juice. When the sweeet juice is boiled a thick syrup is obtained which is consumed in various ways. After sufficient boiling sweet juice condenses into palm jaggery (Gur) which is moulded in suitable blocks. It is often more expensive than the crystal sugar made from sugar cane. On an average a date palm in one season yields about 40 kg of jaggery. Leaves are crushed and the beaten leaflets are made into brooms, baskets or woven into mats locally known as chattai. Old unproductive palms are cut and pieces of stems are used as fuel for burning tiles etc.

Phoenix dactylifera L., Sp. Pl.: 1188 (1753) & Hort. Cliff.: 482 (1738); Willd., Linn. Sp. Pl. (ed. 4), 4 (2): 730 (1806); Roxb., Fl. Ind. ed. 2: 786 (1832); Kunth, Enum. Pl. 3: 255 (1841); Mart., Hist. Nat. Palm. 3: 257, t. 120, X. f. 1, t. 1., f. 1 (1849); Aitch., Cat. Pl. Punjab Sindh: 143 (1869); Boiss., Fl. Orient. 5: 47 (1882); Becc., Malesia 3: 355, tab. 43, f. 1 - 14 (1890); Hand.-Mazz., Ann. K. K. Naturhist. Hofmus. 28: 36 (1914); Brandis, Forest Fl. N.W. India: 552 (1874); L. H. Bailey, Stand. Cycl. Hort.: 2594 (1916); V. H. W. Dowson, Dep. Ar. Iraq Mem. 3 (3): 1 (1920), (2): 1 (1921), (3): 1 (1923) and Trop. Agric. 6, 6: 172 (1929); Blatt., Palms Brit. Ind.: 24, pl. 8, f. 3 (1926); Magalon, Contr. Etud. Palmiers Indoch.: 20 (1930); Vasc. & Franco, Portugaliae Acta Biol., Ser. B, Sist. 2: 312, figs. 3, 19-1 (1948); Blatt., J. Indian Bot. Soc. 11 (1): 42 (1932); Tickh. & Drah, Fl. Egypt: 165 - 273 (1950); H. E. Moore, Principes 7 (4): 157 (1963); P. Munier, Tech. Agric. Produc. Tropic. 14: 1 - 221 (1973); H. E. Moore, Fl. Iranica 146: 4 (1980); Malik, Fl. Pakistan 153: 23 (1984); J. Dransf., Fl. Iraq 8: 263

(1985). Lectotype: *Palma hortensis mas et foemina* Kaempf., Amoen. Exot. Fasc. 668, 686, t. 1, 2 (1712), vide Moore & Dransfield, Taxon 28: 64 (1979). Palma dactylifera (L.) Mill., Gard. Dict. ed. 8, nom. illegit. (1768). See Moore (1963b). Typified as for P dactylifera above.

Phoenix excelsior Cav., Icon. 2: 13, t. 125 (1793). No type designated.

P dactylifera var. *cylindrocarpa* Mart., Hist. Nat. Palm. 3: 258 (1849). No type designated.

P dactylifera var. *gonocarpa* Mart., Hist. Nat. Palm. 3: 258 (1849). No type designated.

P dactylifera var. *oocarpa* Mart., Hist. Nat. Palm. 3: 258 (1849). No type designated.

P. dactylifera var. *oxysperma* Mart., Hist. Nat. Palm. 3: 258 (1849); Becc., Malesia 3: 357 (1890). No type designated.

P dactylifera var. *sphaerocarpa* Mart., Hist. Nat. Palm. 3: 258 (1849). No type designated.

P dactylifera var. *sphaerosperma* Mart., Hist. Nat. Palm. 3: 258 (1849). No type designated.

P dactylifera var. *sylvestris* Mart., Hist. Nat. Palm. 3: 258 (1849). No type designated.

P. dactylifera var. *adunca* D. H. Christ ex Becc., Malesia 3: 357, pl. 43, f.12 (1890). Type: No type has been designated, but a specimen of three seeds (FI-B!) collected by Christ in 1888 has been annotated by Beccari with this name.

P dactylifera var. *costata* Becc., Malesia 3: 357, pl. 43, f. 11 (1890). No type designated.

P atlantica A. Chev. var. *maroccana* A. Chev. in Compt. Rend. Hebd. Seances Acad. Sci. t. 234, 2: 172 (1952) and Rev. Bot. Appliq. Agric. Trop. 32, no. 2311: 82 (1952). Type: No type was cited but Chevalier annotated a specimen of *P dactylifera* in the Paris herbarium with this name (Morocco, between Tiznit and Agadir, 18 Dec. 1951 (pist.), Chevalier s.n.).

Solitary, or sparsely clustering palm, with several suckering offshoots at base. Stem to 30 m tall, without leaf sheaths to c. 40 - 50 cm diam.; trunk dull brown, marked with diamond-shaped leaf base scars c. 10 x 25 - 30 cm. Leaves straight, obliquely vertical in orientation, to 3 - 4 (5) m long; leaf base 15 - 20 cm wide; pseudopetiole 50 - 100 cm long; leaf sheath reddish-brown, to c. 45 cm long, fibrous; acanthophylls sparsely arranged, pointing in several directions, to 20 cm long; leaflets variously arranged in 1 - 3 planes of orientation, c. 50 - 130 on each side of rachis, stiff, c. 40 x 2 cm in length; lamina concolorous, glaucous, drying pale green. Staminate inflorescences erect; prophyll splitting 1 - 2 times between margins, yellow- green with reddish-brown tomentum when young, becoming brown and coriaceous, to 45 x 12 cm; peduncle to c. 50 cm long; rachillae to 30 cm long. Staminate flowers crowded along full length of rachillae; calyx a 3-lobed cupule with uneven margin, loosely surrounding the corolla; petals, 3 (rarely 4), creamy yellow-white, fleshy, each 7- 10 x 3 - 5 mm with apex rounded and minutely serrate; stamen c. 5 mm. Pistillate inflorescences initially erect, becoming pendulous with maturity; prophyll splitting between margins, yellow-green, c. 100 cm long; peduncle yellow-green, 60 - 150 cm; rachillae c. 150 in number, yellow, to c. 40 cm long, elongating with fruit maturation. Pistillate flowers mostly in distal half of rachillae, yellow-white, with faintly

sweet scent; calyx cupule c. 2 - 3 mm high; petals, 3 (rarely 4), c. 4 - 5 x 4 mm. Fruit very variable in shape and size, 4 - 7 x 2 - 3 cm, ripening a range of colours from yellow and green to orange, red, purplish- brown to black; mesocarp sweet, thick and fleshy or dry and thin. Seed variable in size and shape but generally elongate, 20 - 30 x 5 - 8 mm, with apices rounded or pointed; embryo lateral opposite raphe; endosperm homogeneous.

Distribution: The natural distribution is not known. The long history of date palm cultivation in the Middle East and North Africa has extended the distribution of the species far beyond its presumed original range, such that its area of origin remains a mystery.

Pinanga Blume, Rumphia 2: 76 (1839); Bull. Phys.Nat.Neerl. 1 : 65 (1838) ; B.K. Sinha., Fl. Great Nicobar Isl.: 464 (1999). Lectotype: *P.coronata* (Blume *ex* Mart.) Blume = *Areca coronata* Blume ex mart.

Cladosperma Griff., Nat. Plan. Aisat. 3 : 165 (1851); Ophiria Becc., Ann. Jard. Bot. Buitenz. 2: 128 (1885) Type: *Areca paradoxa* Griff. = *Pinanga paradoxa* (Griff.) Scheff.
Pseudopinanga Burr., Notizbl. Bot Gart. Mus. Berl. Dahl 13: 188 (1936) Type: *P. insignis* (Becc.) Burr. = *Pinanga insignis* Becc.

Very small to robust, solitary or clustered, acaulescent or erect, unarmed, pleonanthic, monoecious palms. Stem very slender to moderate, with elongate or short internodes and conspicuous leaf scars, occasionally stilt-rooted. Leaves undivided and pinnately ribbed, with or without an apical notch, or pinnate; sheaths tubular, forming a well-defined crownshaft, with leaves neatly abscising, very rarely leaves marcescent and crownshaft not well developed; petiole present or absent, adaxially rounded or channelled, abaxially rounded, glabrous or variously indumentose; leaflets 1 to several-fold, regularly to irregularly arranged, acute, acuminate, or lobed, the lobes corresponding to the folds, the apical leaflets almost always lobed, blade occasionally mottled, sometimes paler beneath, often with a wide variety of scales and hairs, transverse veinlets usually obscure. Inflorescence mostly infrafoliar, rarely interfoliar in acaulescent species with marcescent leaves, very rarely bursting through marcescent leaf sheaths, usually rapidly becoming pendulous, occasionally erect, protogynous, unbranched or branching to 1 order only; peduncle usually short, dorsiventrally flattened, glabrous or tomentose; prophyll thin, membranous, 2-keeled, enclosing the inflorescence in bud, quickly splitting to expose the flowers except in some species where persistent and enclosing inflorescence up to almost mature fruiting; peduncular bracts absent; rachis usually longer than the peduncle; rachis bracts triangular, usually very

inconspicuous; rachillae bearing spiral or distichous triads throughout, or triads in 4 or 6 vertical rows, or, more rarely, spiral proximally and distichous distally; triads sometimes partially sunken in the axis of the rachilla, but well-defined pits not present; floral bracteoles minute. Staminate flowers asymmetrical, sessile, rarely stalked at the base, very rarely the stalk of one flower much longer than the other; calyx cupular with 3 triangular, frequently unequal lobes; petals 3, triangular, frequently unequal, joined briefly basally, valvate in bud, much exceeding the calyx lobes, usually very fleshy; stamens rarely 6, usually 12–68, filaments short, anthers linear, latrorse; pistillode absent. Pistillate flowers usually globose, symmetrical, much smaller than the staminate; sepals 3, membranous, striate, imbricate, distinct, or connate proximally with 3 broad, sometimes imbricate lobes distally; petals 3, distinct, imbricate, membranous; staminodes absent; gynoecium unilocular, uniovulate, globose, stigma usually convolute, sessile or on a short style, ovule basally attached, anatropous. Fruiting rachillae usually brightly coloured, to reddish or orange. Fruit globose, or ellipsoidal to spindle-shaped, sometimes narrow spindle-shaped and curved, bright crimson, scarlet, orange or black, very rarely dull brown or green, frequently passing through pink to crimson to black at maturity, stigmatic remains apical; epicarp usually smooth, shiny, with a silky sheen, or dull, mesocarp usually thin, fleshy, sweet, rarely greatly expanding, endocarp of longitudinal fibres, usually adhering to the seed, becoming free at the basal end only, fruit without a solid beak. Seed conforming to the fruit shape, but usually slightly hollowed at the base, with conspicuous basal hilum and anastomosing raphe branches; endosperm deeply ruminate or, very rarely, subruminate or homogeneous; embryo basal.

Key to the species

1a. Stem cluster forming.....2
1b. Stem solitary.....*manii*
2a. Stem delicate up to 1 cm in diameter.....*gracilis*
2b. Stem not delicate; more than 2 cm in diameter.....3
3a. Stem more than 3 meter long..... *dicksonii*
3b. Stem up to 2 m long.....4
4a. Internodes green with dark brown spots.....*griffithii*
4b. Young internodes scurfy with dark brown spots.....*sylvestris*

Pinanga manii Becc., in Males. 3: 178. 1889; Beccari & Hook .f. in Hook. f., Fl. Brit. India 6: 409. 1892; Brandis, Indian Trees 647. 1906; B.K. Sinha., Fl. Great Nicobar Isl.: 464 (1999); Plate 27.

Areca costata Kurz in J.Asiat. Soc. Beng. 43(2) 200: 1874.

Pinanga andamanensis Becc., Atti Soc. Tosc. Sci. Nat. Pisa, Mem. 44: 121. 1934.

Cluster forming, pleonanthic, monoecious palm. Stem slender, not delicate, 3-8 m long, to 10 cm in diameter near base. Leaves pinnate, to 2 m long; petiole minutely scurfy outside; leaflets many, falcate, linear to linear-lanceolate, finely acuminate, prominently 3 nerved on upper side, middle leaflets to 60 cm long; upper leaflets jointed. Inflorscence simple branched; peduncle robust, reddish in colour; rachillae to 30 cm long. Fruits broadly ellipsoid, shortly beaked, dark purple in colour, 13-15 mm long, 9 mm broad at middle; seed ellipsoid, 9 mm long, 7 mm wide, adherent to pericarp.

Distribution. India (Andaman Islands). Endemic. Component of the moist hill forest, grows on soft loam near the stream. Found in the Saddle Peak Range of North Andamans.

Flowering: March to May

Conservation Status: Critically Endangered

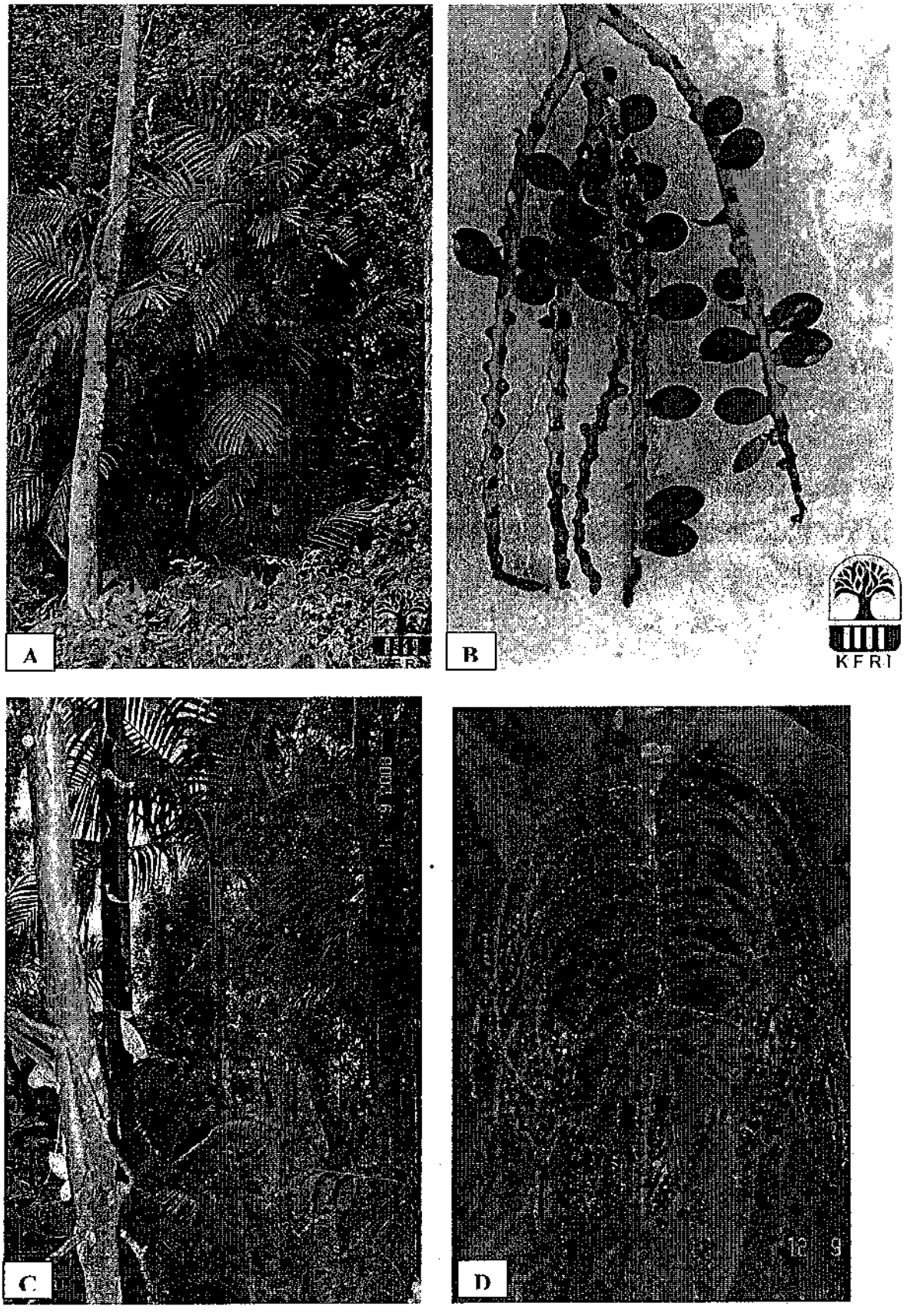


Plate 27. ***Pinanga sylvestris*** **A. Habit;** ***P. gracilus*** **B. Fruits;** ***P.manii*** **C. Habit D. Infructscence**

Pinanga dicksonii (Roxb.) Blume (Roxb.) Blume, Rumphia 2: 77. 1839; Becc. & Hook f. in Hook. f., Fl. Brit. India. 6: 409. 1892. Fischer in Gamble, Fl. Pres. Madras.1556. 1931; Plate 26.

Areca dicksonii Roxb., Fl. Ind. 3: 616. 1832.

Areca dicksonii Roxb., Fl. Ind. ed. 1832, 3: 616. 1832.

Seaforthia dicksonii (Roxb.) Mart., Hist. Nat. Palm. 3: 184. 1838.

Ptychosperma dicksonii (Roxb.) Miq., Fl. Ned. Ind. 3: 23. 1855.

Vernacular Names: Kantha kamuku.

A slender, stoloniferous, pleonanthic, monoecious palm. Stem solitary, erect, to 6 m long, 3-12 cm in diameter, soboliferous with well developed crown shaft. Leaf pinnate, forked, about 1.7 m long, 2.5-7 cm broad; leaflets sessile, light green, with numerous parallel veins, broadly linear to falcate, cuminate or praemorsed, uppermost leaflets confluent. Inflorescence infrafoliar, peduncle about 4-10 cm long; flower branches 4-5, simple, rigid, compressed, densely covered with flower clusters; flowers in triads of two males and central female, male flowers pinkish, sepals subulate; nearly as long as the petals; petals ovate, cordate, tapering; stamens 20-30, filaments very short, anthers linear; female flowers sepals and petals 3 each; staminode 6, clavate, penicillate; style short; stigma 3 lobed. Fruits oblong, dry, fibrous, 1.5-2 x 1 cm, endosperm ruminate.

Distribution: India (W.Ghats). Endemic.

Flowering: August-September. **Fruiting:** February-March.

Conservation Status: Least concern

Specimens examined: Forest down to Kundipuzha dam, Palakkad, 10.3.1975, fr., Vajravelu 46300 (MH); Way to Valiyaparathodu S.V.R.F., Palakkad, 7.10.1979, fr., Nair 64386 (MH); Chandanakavu, Quilon, Kerala, 20.2.1979, fr., Mohanan 61155 (MH); Durbakulam, Thiruvananthapuram, Kerala, 15.9.1977, Infl., Nair 51092 (MH); Forest near Bonacaud Estate, Thiruvanathapuram, Kerala, 2.10.1973, fr., Joseph 44495 (MH); Kovilthérimalai, Thiruvananthapuram,

9.3.1979, fr., Mohanan 61758 (MH); Way to Injikuzhi, 29.8.1963, fr.& fl., Henry17366 (MH); Way to Nagapathigai, Thirunelveli, 2.4.1991, fr., Gopalan 96212 (MH); Cannonore, Kerala, 6.9.1928, Fischer 73128 (MH); Panoth, 2.5.1979, Ramachandran 61700 (MH); Chandanathodu, Cannanore, 24.6.1965, fr., Ellis 25136 (MH).

Uses: Stem althoughslender is used for making fences. Leaves are used as thatches.

Pinanga gracilis Blume Blume, Rumphia 2: 77. 1839; Plate 27.

Areca gracilis Roxb., Fl. Ind. ed. 1832, 3: 619. 1832., nom. illeg.

Seaforthia gracilis (Blume) Mart., Hist. Nat. Palm. 3: 185. 1838.

Nenga gracilis (Blume) Becc., Malesia 1: 25. 1877.

Areca gracilis Buch.-Ham., Mem. Wern. Nat. Hist. Soc. 5(2): 310. 1826.

Cluster forming, pleonanthic monoecious palm. Stem slender, reddish, to 4 m long, about 1 cm in diameter near middle. Leaves about 1.5 m long, sparingly pinnate; petiole and leafsheath scurfy outside; leaflets broad at base, acuminate, prominently 3 nerved, about 30 cm long; upper leaflets broader than middle, about 15 cm long, 5-7 nerved, praemorsed at apices. Inflorescence simple, reflexed; flower branches scarlet, 4-20 cm long; peduncle pubescent; male flowers in 3 rows, broad and flat; calyx minute; petals 3, cuspidately acuminate, each 6 mm x 4 mm, female flowers much smaller than males, spirally disposed; sepals and petals 3 each, almost same size and length; fruiting branches pendulous; fruits ellipsoid to fusiform, scarlet or light orange in colour, 10 mm long, about 6 mm broad at middle, tapering at stigmatic end.

Distribution: India (West Bengal, Assam, Meghalaya, Arunachal Pradesh, Manipur, Nagaland). Grows in the moist lower hill forests.

Flowering: June-September. *Fruiting:* January.

Conservation Status: Endangered

Specimens examined: Darjeeling, November 1879, fr., Gamble 7463 (MH).

Uses: Nuts are brownish white when dried. The Mikir tribes of Arunachal Pradesh and Assam consume both fresh and dried nuts as substitute of Arecanut.

Pinanga griffithii Becc., Becc., Malesia 3: 117. 1886; Becc. & Hook. f., in Hook. f., Fl. Brit. India 6 : 407. 1892. Brandis Ind Trees 647. 1906.

Areca sp. Griff., Calc. Journ. Nat. Hist. 5. 461. 1845. (under A. gracilis, fruit only).

Cluster forming, pleonanthic, monoecious palm. Stem distinctly annulate, about 2 m long, 2.5 cm in diameter; internodes to 7 cm long, green in colour with dark brown spots. Leaves pinnate, about 1 m long; lower leaflets irregularly disposed, broad based, falcate, acuminate, 3-6 nerved, about 60 cm long; middle leaflets alternate, subfalcate, prominently nerved on upper side, about 40 cm long, 5 cm broad at middle; upper leaflets opposite to subopposite, broad based, subfalcate, about 30 cm long, 3-5 nerved; tip of the upper leaflets with 3-5 bidentate lobes; terminal leaflets bilobed, 7-8 nerved, crenulate at apices. Inflorescence infrafoliar, about 35 cm long; peduncle about 5 cm long, reflexed, subdigitately branched; rachillae 3-5 in number; each about 30 cm long; flower clusters spirally disposed; male flowers calyx shorter than corolla. Ripe fruits reddish, disposed in 4 vertical rows, broadly ellipsoid, tapering at base, mammillate, 1.2 cm long, about 8 mm broad; endosperm deeply ruminate.

Distribution: India (West Bengal, Assam, Meghalaya, Arunachal Pradesh, Manipur, Nagaland), Bangladesh. Occur in the moist forests of lower hill valleys and ravines, along watercourses.

Flowering: March to May

Conservation Status: Vulnerable

Pinanga sylvestris (Loureiro) Hodel, Palm J. 139: 55. 1998; Plate 27.

Areca sylvestris Loureiro, Fl. Cochinch. 2: 568. 1790;

Stems clustered, to 6 m tall, 1.5-3.5 cm in diam., reddish brown. Leaves pinnate; sheaths closed and forming crownshafts, 17-45 cm, green or yellowish with reddish scales; petioles 10-25 cm; rachis 1-1.3 m; pinnae 10-28 per side of rachis, green abaxially, linear, distantly spaced, regularly arranged; middle pinnae 39-60 × 2-5 cm. Inflorescences branched, pendulous, occasionally erect; peduncles 2.5-6 × ca. 0.7 cm; rachis 0.5-2.5 cm; rachillae 3-8, 9-26 cm, zigzag, triangular in cross section, glabrous; triads distichously arranged, superficial on rachillae; male flowers not seen; female flowers to 3 mm; sepals to 3 mm, rounded at apex, ciliate; petals to 3 mm, ciliate. Fruits red in colour, ellipsoid, 1.4-1.8 × 0.5-0.7 cm.

Distribution: Lowland and montane rain forests; 100-1700 m.
Cambodia, Laos, Myanmar, Thailand and India (Arunachal Pradesh)
Flowering: February -March. **Fruiting:** July-September.
Conservation Status: Near threatened
Uses: Leaves are used as thatch, stems as posts.

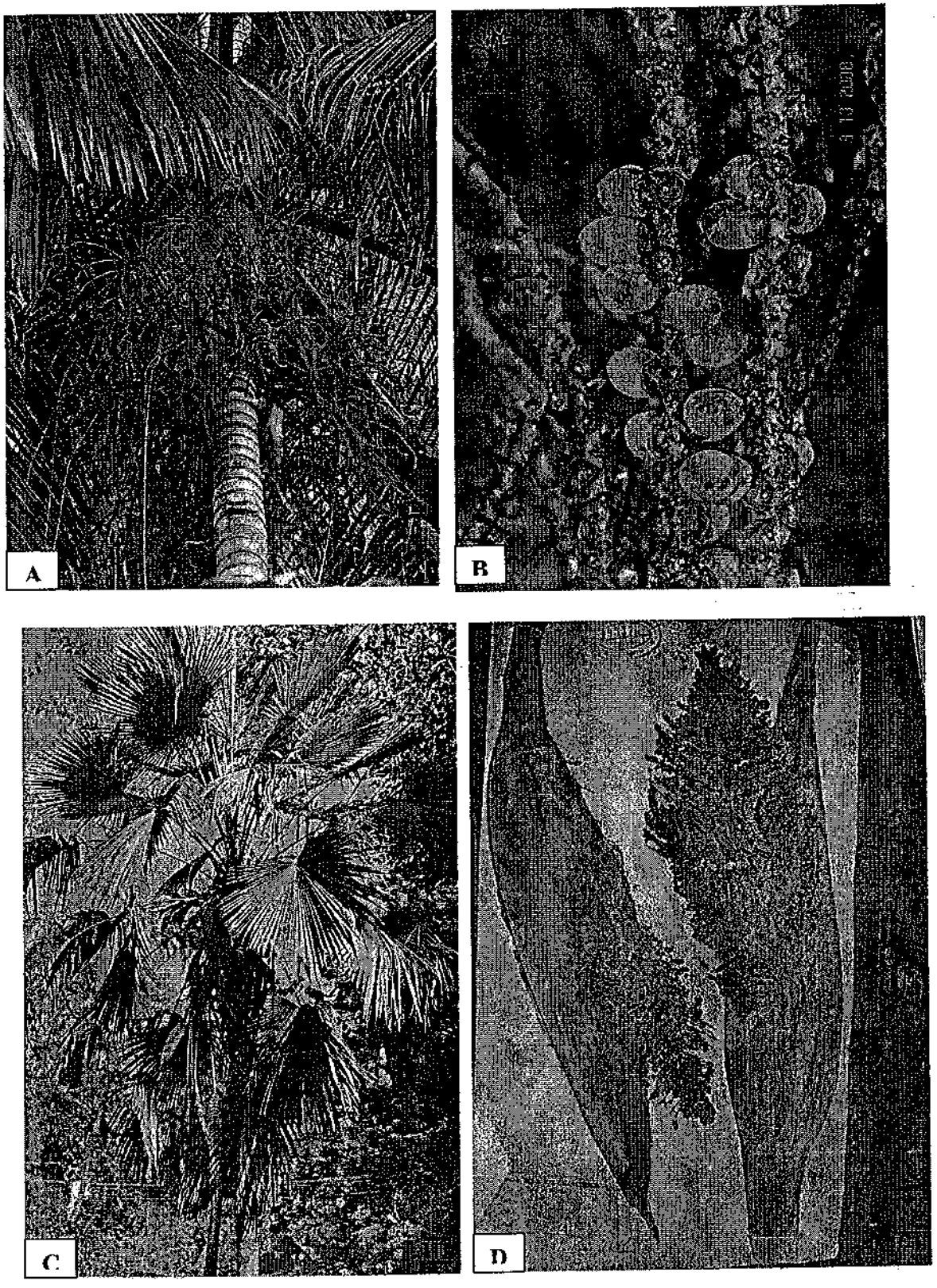


Plate 28. ***Rhopaloblaste augusta*** **A. Habit; B. Fruits;**
Trachycarpus martianus **C. Habit D. Inflorescence**

Plectocomia Mart. & Bl. J.J. Roemer & J. A. Schiltes Syst. Veg. 7 (2): 1333.1830; Hook.f., in Benth. & Hook.f. Gen.Pl. 3: 934; 1883; Becc. in Ann. Roy. Bot. Gard. Calcutta 12 (2): 26. 1918. Dransfield Man. Rat. Mal. Pen.55. 1979, Madulid in Kalikasan 10: 1. 1981.

High-climbing rattan, solitary or clustered, spiny, hapaxanthic, dioecious; leaves cirrate; leafsheath without knee or flagellum; leaflets numerous, single-fold, entire, usually lanceolate, regularly arranged or grouped and fanned within the groups, adaxial surface often with scattered bands of caducous indumentum, the abaxial often bearing white tomentum, midribs and submarginal ribs slightly larger than other veins, transverse veinlets not evident. Inflorescences in the axils of the uppermost reduced leaves; primary axis of inflorescence subtends pendulous flower branches; each flower branch covered by a series of non tubular, boat shaped, overlapping, coriaceous bracts, each enclosing a small branch system, that bears flowers. Staminate flower sessile or with a stalklike base; calyx tubular, much shorter than the corolla, with 3 short lobes; corolla tube, anthers usually elongate, latrorse or introrse; pistillode minute or absent. Pistillate flowers much longer than males; calyx cupular, deeply 3 - lobed, not thickened at base; corolla much longer calyx, divided into 3 accuminate petals; staminodal ring with 6 radiating teeth; gynoecium rounded, scaly, stigmas 3, usually very long, flexuous, sometimes with a well developed style, locules 3, incomplete, ovules 3, basally attached, anatropous. Fruit globose, 1-(rarely 2-3-) seeded, with apical stigmatic remains; epicarp covered in numerous vertical rows of reflexed scales, the scale tipes frequently fringed and upward pointing, mesocarp thin, fibrous, endocarp not differentiated. Seed globose, 1-3 seeded, attached near the base, sarcotesta thick but not juicy, endosperm homogeneous; embryo basal.

Distribution: - About 16 species distributed from India, Thailand, Indochina, South China, Burma, Malaysia, Indonesia and Philippines. India is represented with two species.

Key to the species in India

1a. Leaflets green above, mealy white below, acute or acuminate, not filamentous at apex, bracts densely tomentose outside.....*assamica*

1b. Leaves green on both sides, apiculate, bracts finely tomentose outside.....*himalayana*

Plectocomia himalayana Griff., Griff., Calcutta J. Nat. Hist. 5: 100. 1845; Palms Brit. E Ind. 108, t.219. 1850; Mart., Hist. Nat. Palm. 3, 199. 1823–1853; Becc. & Hook. f. in Hook. f., Fl. Brit. India 6: 478. 1893.

Plectocomia montana Griff. ex T.Anderson, J. Linn. Soc., Bot. 11: 12. 1869.

Plectocomia montana Hook.f. & Thomson, Fl. Brit. India 6: 478. 1893., nom. inval.

Cluster forming, medium diameter rattan. Stem with sheaths 2.5 cm in diameter. Leaves cirrate, 1.8 - 2 m long, including the cirrus; leaflets 30 - 40 cm long, 2.5 - 3.75 cm broad, alternate, linear-lanceolate, very acuminate, narrowed into filiform tips, margins with spinescent teeth; petiole unarmed or margins spiny; rachis scurfy, hooked. Inflorescences erect, branches 60-900 cm, drooping, covered with rust coloured tomentum; spathes conduplicate, scurfy; rachilla with 3 - 7 flowers, scurfy, tomentose; male flowers, calyx cupular, with three short rounded teeth ending in bristles; petals 6mm long, ovate-lanceolate; stamens 6; filaments stout, subulate; anthers large, linear-oblong. Fruit 13 mm in diameter, dipressed-globose; scales very small, fimbriate.

Distribution: Sub-Himalayan ranges.

Flowering: March to May **Fruiting:** Not known

Conservation Status: Endangered

Specimens examined: Loobah lake, 10.11.1914, fl., Upendranath Kanjilal 4699 (CAL); Dargeeling, Acc. 52763, Gamble 3312 B (MH).

Uses: It produces soft canes of little use except occasionally for tying fences and for rough basket work (Gample).

Plectocomia assamica Griff., Calcutta. J. Nat. Hist. 5: 97. 1845 and Palms Brit. E. Ind. 107, Pl. 218 a. 1850; Mart., Hist. Nat. Palm. 3, 199, Pl. 176 f. 11 1853; Becc. & Hook. f. in Hook. f., Fl. Brit. India 6: 479. 1893. Becc., Ann. Roy. Bot. Gard. (Calcutta) 12 (2): 38. 1918. Basu, Rattans in India Monogr. Rev. 32. 1992.

Plectocomia bractealis Becc. Becc., Ann. Roy. Bot. Gard. (Calcutta) 12(2):40.1918.

Plectocomia khasyana Griff., Calcutta J. Nat. Hist. 5: 98 1845.

A clustering, medium diameter rattan. Stem with leaf sheath about 3 cm in diameter. Leaves cirrate; leaflets up to 60 cm long, 6-6.5 cm broad at middle, whitish and scurfy below, non filamentous at apices; petiole with stout marginal spines and smaller seriate spines on the dorsal side. Male inflorescence not seen; flower branches in female inflorescence about 1 m long, thickly covered with rust-coloured tomentum; bracts on the flower branches distichous, cuneate, oblong with triangular tips, 6-7 x 2.5-3 cm; female flowers 3-7 in number in each bract, shortly pedicellate, bracteolate; bracteoles 4-5 mm long. Fruits globose, slightly conically beaked, densely villous outside, about 2.5 cm in diameter; seed globose, 1.8 cm in diameter; fruiting perianth flat, not chanelled at middle.

Distribution: India (Assam, Arunachal Pradesh). Endemic.

Flowering: March to May

Conservation Status: Vulnerable

Specimens examined: Mamit, Mizoram, Sreekumar 24206 (KFRI); S. Coll. M.H.Acc. No. 72650, March 1891 (MH).

Uses: The tribals use the long canes for making hanging bridges over mountain streams

Rhopaloblaste Scheff, Ann. Jard. Bot. Buitenzorg 1: 137 1876 ; B.K. Sinha., Fl. Great Nicobar Isl.: 465 (1999); Banka & W.J. Baker, in Kew. Bull 59: 51 2004.

Ptychoraphis Becc., Ann. Jard. Bot. Buitenzorg 2: 90 (1885). Type: *P singaporensis* (Becc.) Becc. (*Ptychosperma singaporensis* Becc. = *Rhopaloblaste singaporensis* (Becc.) Hook. f.)

Small to large, solitary or clustered, unarmed, pleonanthic, monoecious palms. Stem short or tall, often enlarged at the base but uniform and moderate to slender above, clearly ringed with leaf scars, brown or gray. Leaves pinnate; sheaths tubular, forming a crownshaft, or crown shaft not defined, more or less densely covered with deciduous tomentum; petiole short to elongate; channelled adaxially, rounded abaxially; rachis rounded abaxially, angled above towards the apex, the sheath, lower surface of petiole and rachis usually densely covered with peltate scales with tattered interlocking margins, the upper surface of petiole and rachis usually with basifixed, twisted, entire or tattered, membranous scales persisting about the bases of the leaflets; leaflets spreading or pendulous, acutely to acuminate and obliquely bifid apically, the midrib and one or more secondary rings on each side prominent abaxially, minutely brown-dotted and at least the midrib with prominent dull brown, basifixed or medifixed, twisted, membranous scales basally or throughout, transverse veinlets not evident. Inflorescences infrafoliar, branched to 3 orders basally, fewer orders distally, peduncle short; the prophyll 2-keeled, tubular, enclosing the similar peduncle short; the prophyll 2-keeled , tubular , enclosing the similar peduncular bract, both usually tomentose at least when young, and caducous; rachis short to prominent but as long as or longer thean the peduncle; basal branches usually abruptly divaricate; bracts subtending the branches often prominent, pointed, rachilla bracts prominent or not, subtending triads nearly throughout; bracteoles surrounding the pistillate flower subequal or unequal.

Staminate flowers symmetrical or nearly so at anthesis but in bud the outer sepal prominent and largely enfolding the remainder of the perianth; sepals 3, distinct, broadly imbricate at anthesis, rounded, gibbous and keeled dorsally; petals 3, distinct, valvate; stamens 6-9, the filaments very briefly connate basally or distinct, the filaments very briefly connate basally or distinct, strap-shaped, narrowed and prominently inflexed at the apex in bud, the anthers narrowly elliptic in outline, medifixed, emarginate apically and basally, the connective prominent the entire length of the anther, latrorse; pollen elliptic or circular, monosulcate, finely reticulate, tectate exine; pistillode conical to columnar, the apex briefly 3-lobed and sometimes somewhat expanded. Pistillate flowers broader than high in bud and with the outer sepal usually enfolding the remainder of the perianth as in the staminate; sepals 3, distinct, broadly imbricate basally, the short valvate apices erect; staminodes mostly 6, obtuse, deltoid, membranous, often united in pairs or irregularly united or united in a membranous, lobed ring; gynoecium irregularly ovoid, unilocular, uniovulate, stigmas erect to recurved between the valvate apices of the petals at anthesis the ovule hemianatropous, broader laterally, attached adaxially (in the ventral angle) and pendulous from the top of the locule. Fruit ovoid or ellipsoidal to subglobose, orange-yellow to red at maturity, with apical or stigmatic remains; epicarp smooth, mesocarp lacking fiber sclereids or tannin cells, with flattened longitudinal fibers in one or usually more than one layer against the yellowish, fragile endocarp, this impressed over the hilum and with a round basal operculum. Seed brown, with a lightly to deeply impressed hilum along the adaxial side; endosperm deeply ruminate; embryo basal, large.

Distribution: The genus represented with six species distributed in the Nicobar Islands, Peninsular Malaysia, and Singapore, the

Moluccas, New Guinea, and Solomon Islands. In India only One species, *R. agusta* is found in Nicobar group of Islands.

Rhopaloblaste augusta (Kurz) H. E. Moore, Principes 14: 79. 1970. B.K. Sinha., Fl. Great Nicobar Isl.: 465 (1999); Banka & W.J. Baker, in Kew. Bull. 59: 51 2004; Plate 29.

Areca augusta Kurz, J. Bot. 13: 331 (1875).

Ptychoraphis augusta (Kurz) Becc., Ann. Jard. Bot. Buitenzorg 2: 90 (1885).

Type: India, Nicobar Islands, Camorta [Kamorta], Feb. 1875, Kurz s.n. (holotype CAL; isotype K!).

Vernacular Names: Komba.

Solitary, monoecious, pleonanthic palm. Stem erect, annulate, about 20 m long, about 30 cm diameter near base, dull grey in colour, surface more or less smooth. Leaves about 4 m long, deep green in colour; upper leaves ascending by their midrib with conspicuously drooping leaflets; leaflets linear, alternate to sub opposite in one plane on the rachis; each to 1 m long, 3-4 cm broad, pointed at their apices; petiole short, more or less rounded; petiole and rachis distinctly scurfy outside. Inflorescence infra foliar, about 1 m long; prophyll and peduncular bract very large, flattened, leathery, grayish green in colour; flower branches much ramified, deep green in colour, each thickened at base; flower clusters spirally disposed; each cluster subtended by more or less reflexed lip-like bracts; male flowers oblong in bud, about 2mm long; female flowers smaller than males; sepals and petals 3 each, more or less equal in size; staminodes united into a membranous 6 lobed ring; Fruits ovoid, 2.5 cm x 1.4 cm; stigmatic region slightly mamillate; mesocarp pulpy, fibrous, mostly 1-2 seeded, rarely 3-4 seeded; 2 seeded fruits have distinct longitudinal septum at middle; seed ovoid, endocarp shell like; endosperm deeply ruminate.

Distribution: India (Nicobar Islands); grows in the moist hill valleys and slopes of high rainfall areas.

Flowering: June-August; **Fruiting:** January-March.

Conservation Status: Near Threatened

Specimens examined: Galathea, Great Nicobar, 22.4.01 Sreekumar and James 22632 (KFRI).

Salacca Reinwardt in Hornschuch, Syll. Pl. Nov. 2: 3. 1825.

Stems clustered, short and subterranean, mostly obscured by persistent leaf bases. Leaves 6–20 per stem, pinnate, sometimes undivided, spiny; leaf sheaths open, not forming crownshafts, sheaths and petioles elongate, covered with flattened spines often in short rows or sometimes arranged in whorls completely encircling sheaths and petioles; pinnae sometimes silvery gray on abaxial surfaces, usually sigmoid, less often linear, regularly arranged and spreading in same plane or, more often, irregularly arranged and spreading in different planes, pinnae at apex usually joined in compound terminal pinna, sometimes this absent. Plants dioecious, most iteroparous, some semelparous. Inflorescences borne simultaneously in axils of reduced leaves on a short stem, this dying after flowering, in iteroparous plants inflorescences borne sequentially, emerging from a groove on outside of subtending leaf sheaths, inflorescences branched to 2 orders or sometimes spicate, covered with many persistent, sheathing bracts very short and spicate, short and branched, or very long, branched, and rooting at apex and forming new plants; in male inflorescences flowers borne in densely arranged pairs on short, thick rachillae; in female inflorescences flowers either solitary or borne in pairs with a sterile male flower, also densely arranged on rachillae. Fruits reddish brown, ovoid, obovoid, or pear-shaped, usually 3-seeded, covered with many overlapping scales, tips of scales turned up and giving fruit a spiny appearance; endosperm homogeneous.

Distribution: The genus is represented with Twenty-one species distributed in Borneo, China, NE India, Indonesia (Java, Sumatra), Malaysia (Peninsular), Myanmar, Philippines, Thailand; one species, *S. secunda* in India.

Salacca secunda Griff., Griff., Calcutta J. Nat. Hist. 5: 12. 1845. Palms Brit. E. Ind. 14, t.117.1850.

Acaulescent palm. Leaves 10 m long, pinnate; petiole covered with rusty idumentum. Leaflets straight, coriaceous, arranged in groups of 2 - 3 on each side of the rachis on its lower part; upper part of the rachis trigonous, unarmed, regularly alternate from the middle to upper, acuminate, filamentous at tip; green and shining on the upper surface, distinctly three nerved, bristly spinulous on upper nerves from middle to upper, nerves smooth below, margins spinulous from middle upwards; middle leaflets 95 x 7 cm, lower most leaflets shorter and narrower; upper leaflets gradually smaller and less acuminate; upper most leaflets sometimes united at their base. Male inflorescence with a robust axis; prophyll and axis covered with a rusty indumentum, lanceolate acuminate; primary branches long, each bearing rachillae; rachillae 6 - 7 cm long, 14 – 15 mm broad, supported by a slender pedicellar part; male flowers 8 mm long, clavate, exserted from the bracts, calyx deeply 3 lobed; corolla little longer than calyx, divided into three oblong segments; stamens 6; anthers linear oblong. Fruit ovoid, usually 4 cm in diameter; pericarp thin, brittle, clothed with recurved, dark brown scales; embryo above the base dorsal or sub lateral.

Distribution: Upper Assam to China.

Flowering: March-April. **Fruiting:** August-September.

Conservation Status: Not evaluated

Specimen examined:

Uses: Fruit is edible, it is reported that the fruits are consumed as substitute for tamarind as a cooking ingredient.

Trachycarpus H. Wendland, Bull. Soc. Bot. France 8: 429. 1862

Dwarf or moderate, solitary or clustering, acaulescent or erect, unarmed or lightly armed, pleonanthic, dioecious or polygamous palms. Stem decumbent or erect, becoming bare and marked with conspicuous, oblique leaf scars, or clothed with persistent petiole bases and fibrous sheaths. Leaves induplicate, palmate, marcescent; sheath disintegrating into a mass of fine and coarse fibers, the upper margin ribbon like, becoming twisted; petiole elongate, narrow adaxially flattened or slightly flattened or slightly rounded, abaxially rounded or angled, bearing scattered, deciduous indumentum, armed along the margins with very fine teeth or unarmed; adaxial hastula well developed, rounded or triangular, abaxial hastula absent; blade fan- shaped to almost circular, equally or unequally divided along adaxial ribs into single-old segments, shallowly bifid at the tips, longitudinally striate or not, the abaxial surface sometimes glaucous, sometimes dotted with minute brown scales, midrib. Inflorescences solitary, interfoliar, stout, branched, branching to 4 orders; peduncle oval in cross-section, bearing sparse indumentum; prophyll complete, conspicuous, with a tubular base, and inflated distally, 2 kneeled laterally, splitting apically and along one side, covered with deciduous indumentum; peduncular bracts 1-3, as the prophyll but single–keeled, rachis shorter or longer then the peduncle, bracts, but each subtending a first-order branch; bracts of subsequent orders inconspicuous, triangular, not sheathing; rachillae slender, short, very crowded, bright yellow to greenish, glabrous or sparsely hairy, bearing spirally arranged flowers, solitary or in clusters or 2-3, sessile or borne on low tubercles, each flower bearing a minute, apiculate, membranous bracteole. Flowers similar in both sexes; sepals 3, united at the base, triangular, short or long, glabrous; petals usually considerably exceeding the sepals, 3, distinct, imbricate, ovate, triangular-tipped or rounded, glabrous; stamens 6, filaments distinct, fleshy, anthers short, oblong, sometimes slightly pointed, latrorse;

pollen elliptic, monosulcate, with finely reticulate, tectate exine; staminodes when present, similar to fertile stamens but with flattened filaments and empty anthers, sometimes with filaments connate at the very base; carpels 3, distinct, follicular, hairy, ventral sutures partially open, stylar projections short, ovule basally attached, hemianatropous, surrounded dorsally and ventrally by a fleshy aril; pistillodes when present similar to, but much smaller than the fertile carpels. Drupes 1-3 kidney-shaped to oblong, purplish-black with a pale bloom, slightly grooved on the adaxial side with lateral or subapical stigmatic remains; epicarp thin, hairy in immature fruit, mesocarp thin with scattered layer of tannin cells, endocarp crustaceous; albumen equable; embryo lateral.

Distribution:- *Trachycarpus* consists of nine species, found in Nepal, Bhutan, north eastern parts of India and China extending southwards to northern Thailand and Vietnam; grows well in steep rocky areas at higher elevations. In, India there are 5 species mainly found in Sikkim, Meghalaya, Nagaland, Uttarakhand, Manipur and West Bengal.

Key to the species of Indian *Trachycarpus*

1a.Leaflets more than 65 per leaf; fruits oblong or ellipsoid.....2

1b.Leaflets fewer than 65 per leaf; fruits kidney shaped and wider than long.....3

2a.Petiole margins smooth, hastula small.....*latisectus*

2b. Petiole margins toothed, hastula prominent..... *martianus*

3a. Leafsheath fibres short, brittle, deciduous, not forming an ocrea; hastula conspicuous..... *ukhrulensis*

3b.Leafsheath fibres long, not brittle, persistent, forming an ocrea; hastula inconspicuous.....4

4a. Ocrea less than 20 cm long.....*takil*

4b. Ocrea more than 20 cm long.....*fortunei*

Trachycarpus fortunei (Hooker) H. Wendland, Bull. Soc. Bot. France 8: 429. 1862; Plate 29

Chamaerops fortunei Hooker, Bot. Mag. 86: t. 5221. 1860

Solitary, erect, 15 m tall, and 15 cm diameter, thick covered with loosely arranged leafsheath fibres, hairy, persistent, forming an ocrea more than 25 cm long, Leaves spreading to all directions, petioles 35 cm long, 2 - 2.5 cm wide, flat above, convex below, the margins toothed finely, hastula short, blades to 1 cm wide, green on the lower surfaces, divided to about three – quarters their length into 40-50 leaflets, the transverse veinlets barely visible. Inflorescence 1 cm long, flowers mostly in clusters of four or less. Fruit Bean or kidney shaped 3 lobed, 1.5 cm long, 1.5 cm diameter and dark blue in colour with waxy bloom.

Uses: Ornamentally planted in gardens, fibers collected from leaf bases used for making brooms, brushes, doormats. Wax is obtained from fruits.

Notes

Extensively cultivated and natualised; not known in the wild.

Distribution and Habitat

India, Bhutan, China, Myanmar, Nepal and Vietnam; steep rocky areas at high altitudes.

Trachycarpus martianus (Wall. ex Mart.) H. Wendl., (Wall. ex Mart.) H.Wendl., Bull. Soc. Bot. France 8: 429. 1861; Becc. & Hook. f. in Hook. f., Fl. Brit. India 6: 436. 1892. Blatt., Palms Brit. Ind. 49. 1926; Plate 28.

Chamaerops martiana Wall. ex Mart. in N.Wallich, Pl. Asiat. Rar. 3: 5. 1831.

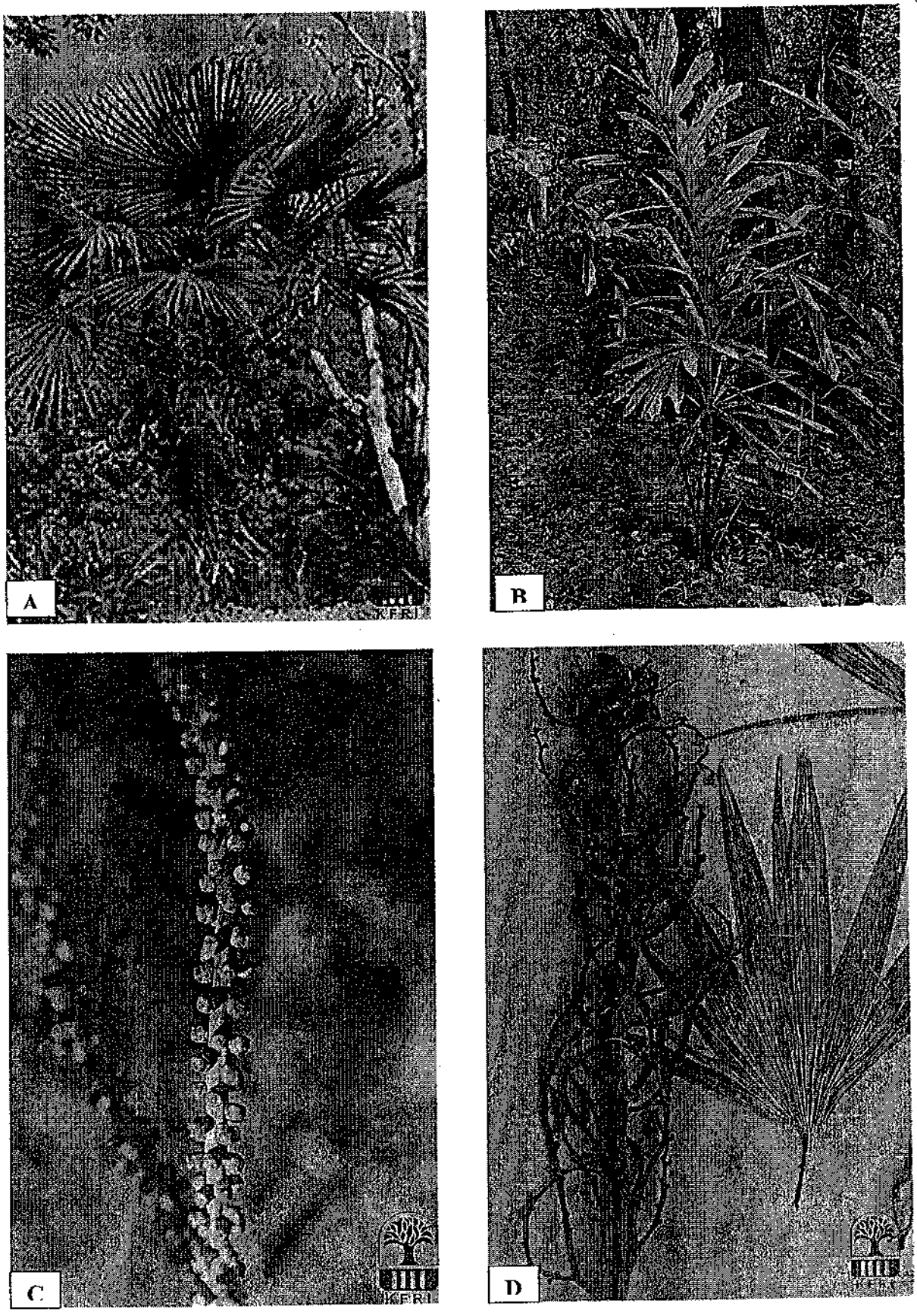


Plate 29. ***Trachycarpus fortuneii*** **A. Habit; Wallichia disticha B. Planted in KFRI palmetum ;** ***Wallichia carytoides*** **C. Inflorescence D.** ***Trachycarpus takil*** **Herbarium specimen.**

Chamaerops nepalensis Lodd. ex Schult. & Schult.f., Syst. Veg. 7: 1489. 1830, nom. nud.

Chamaerops khasyana Griff., Calcutta J. Nat. Hist. 5: 341. 1845.

Chamaerops tomentosa C.Morren, Ann. Soc. Roy. Agric. Gand 1: 488. 1845.

Trachycarpus khasyanus (Griff.) H.Wendl., Bull. Soc. Bot. France 8: 429. 1861.

Chamaerops griffithii Lodd. ex Verl., Rev. Hort. 42: t. 276. 1870.

Trachycarpus griffithii (Lodd. ex Verl.) auct., Rev. Hort. 51: 212. 1879.

Solitary, tall, pleonanthic, polygamo-monoecious palm. Stem, slender, marked with conspicuous, oblique leaf scars, retaining the leaf bases only on the upper part, otherwise naked. Leaf induplicate, palmate, reniform, 80-90 cm long from tip of the petiole to the margin; leaf segments divided half way from the margin, bluish green below; free segments obliquely bilobed at apices; lateral segments acuminate, narrowly bilobed at tips; petiole armed along with margins with fine teeth, slightly twisted, basal part covered with brown, tough fibres. Inflorescence interfoliar, shorter than leaves, to 1.5 m long; peduncle about 30 cm long; prophyll bicarinate, 30-40 cm long, semi-tufted at apex; rachillae 3-5 cm long. Flowers solitary, in pairs, minutely bracteate; calyx 3-lobed, ovate, subobtuse; petals 3 ovate-orbicular; stamens 6, as long as corolla; anthers linear-oblong; carpels 3, follicular, woolly outside; style short, stigma capitate; ovule basally attached, hemianatropous, surrounded by a fleshy aril. Ripe fruits oblong, glossy, blue, about 1 cm long, endosperm horny, horse shoe shaped in transverse section; embryo at the centre on dorsal face.

Distribution: Eastern Himalaya, North East.

Flowering: March-April. **Fruiting:** August-September.

Conservation status: Near threatened

Specimens examined: Way to Cherrapunjee, Meghalaya, 26.4.2009, Linto 25020 (KFRI).

Trachycarpus takil Becc. Becc. Webbia I, 52. 1905; Plate 29.

Solitary, pleonanthic palm. Stem erect, not tall, robust, covered with closely appressed stem fibres, covered with persistant leaf bases, leaves palmate, half orbicular to reniform, leaf blade divided rather unevenly to about middle, green, rather shining on the upper surface, lateral segments becoming narrower and shorter. Inflorescence interfoliar, subtended by leafy bract; male flowers yellow, 2-4 together; sepals suborbicular, obtuse and narrowed at apex, petals broadly ovate, twice as long as the sepals; stamens 6, larger than the petals; carpels 3, narrowly conical. Fruits reniform.

Flowering and fruiting: March-April.

Distribution: India (Kumaon).

Conservation status: Vulnerable

Uses: Leafsheath fibres are largely used by the localpeople for making ropes for which they cut the mature trees thus cause depletion of its population.

Trachycarpus latisectus Spanner, H.J.Noltie & M.Gibbons. Edinburgh J. Bot. 54: 257 (1997).

Vernacular names : *Kasru (Sik.)*

Stem 12 m tall, and 18 cm diameter, trunk slender, erect, bare, light grey, obscurely ringed, Leaves forming an erect, open crown, numerous, forming a small skirt below the crown; leafsheath 30cm long or more, fibres coarse, forming an ocrea, upper surface covered in pale tomentum, broadly triangular towards the apex; petioles 2.5 cm wide, the margins without teeth, hastules small, leaf-blade palmate, 65-85cm long from hastula, 110-135cm wide, leathery, dark green above, with thin whitish tomentum along the folds, slightly glaucous

beneath, divided to half their length in to 65-75 broad segments. Inflorescences 3-6, solitary, borne among the leaves, 1.5 cm long, branched to 3 orders; male inflorescence 0.6 – 1 m long, spreading; peduncle short; flowering branches short; flowers globose, yellowish; female inflorescence 1– 1.5 m long, stiff, spreading; flowers globose, yellowish, usually in pairs. Fruit oblong, to ellipsoid, shortly stalked, 1.7 cm long, 1.3 cm diameter, yellowish brown turning bluish-black.

Conservation status: Critically Endangered.

Uses: Planted in gardens as ornamental plants.

Notes

Rare in natural habitat, only known wild population is below Mirik Church about 25 km east of Kalimpong slope above the Relli river, Sikkim (Kholia, 2010).

Distribution and Habitat

India (Sikkim and West Bengal), grows in deep gorges or open rocky grassy slopes at an elevation of 2000 m.

Trachycarpus oreophilus M.Gibbons & Spanner Principes 41: 205 (1997)

Stem slender, erect, 8 m high and 30 cm diameter, obscurely ringed, usually naked to 1.5 m below crown. Leaves 6-23 per crown, asymmetrically triangular, very broad and rather short, trunk densly covered with leaf sheaths, fibres coarse, petioles 40 cm long, up to 5 cm wide at the base, lamina broadly fan shaped, 63 cm long, 98 cm wide, glaucous beneath and green above, slightly irregularly divided into 65-70 segments. Inflorescence borne among the leaves, 35-50 cm long, peduncle stout, spathes many, sheathing, coriaceous, green yellow, tomentose, branches spreading to a width of 28-35 cm; floral bracts minute, flowers 0.2 mm diameter, male flowers with 6 stamens, female flowers with 6 staminodes lacking anthers. Fruits

Kidney shaped, 0.9 - 1.0 cm long, 0.7 cm wide, bright yellow; changing to dark brown when mature.

Habitat : The population on Doi Chiang Dao was the only one known in Thailand and there is no evidence to suggest that it might occur in similar sites outside Thailand, in Burma for instance. This species is known from Maku, Ukhrul district of Manipur, India, grows on steep slopes on open grasslands at an altitude of 1600 -2100 m.

Conservation status: Endangered.

Uses: Used as ornamental palm.

Specimen examined: Thailand, Doi Chiang Dao, 5500-5900 ft (1680-1800 m) a.s.l., Jan. 25th 1913, A. F. G. Kerr 28724 (K); 1700-2100 m a.s.l., Jun. 4th 1921, A. F. C. Kerr 5600 (K); 1700-2100 m a.s.l., Jun. 4th 1921, A. F. G. Kerr 5600 (K);

Wallichia Roxb., Pl. Coromandel 3: 91. 1820; Kurz, Forest Fl. Burma 2: 531 1877; A.E. Osmasten, A For. Fl. Kumaon 543 1926; Blatt., Palms Brit. Ind.: 367 1926; A. J. Hend. Taiwania 52: 1. 2007; S. Pie et al., Fl. China 152: 2010.

Harina Buch.-Ham., Mem. Wern. Nat. Hist. Soc. 5: 317. 1826.
Wrightea Roxb., Fl. Ind. ed. 1832, 3: 621. 1832.
Asraoa J. Joseph, Bull. Bot. Surv. India 14: 144. 1975.

Dwarf to large, solitary or clustered, hapaxanthic, monoecious or dioecious, acaulescent, shrubby or tree palms. Stem clustered (rarely solitary) with congested or elongate internodes, usually obscured by persistent fibrous leaf bases and sheaths. Leaves spirally or distichously arranged, induplicate, imparipinate, marcescent; sheath covered in a great variety of tomentum, scales and hairs, often extended beyond the petiole to form a ligule, eventually disintegrating into a mass of black fibers; petiole well developed, slender to robut, rounded in cross-section or channeled adaxially, variously tomentose, leaflets single fold except for the terminal flabellum, regularly arranged or grouped and fanned with the groups, linear lanceolate, irregularly rhomboid or deeply lobed, sometimes auriculate at base, the distal margins praemorse, the veins parallel to the fold or radiating from the base, or pinnately arranged along the fold, adaxial blade surface glabrous, abaxial surface usually tomentose, transverse veinlets obscure. Inflorescences axillary, interfoliar, solitary, brusting through leaf sheaths, produced in a basipedtal sequence, branched to one order only, unisexual, usually dimorphic, the pistillate usually the most distal or "terminal", with inconspicuous bracts, the staminate proximal (lateral), often hidden by very conspicuous bracts; peduncle circular in cross section, usually densely covered with indumentum; prophyll small, 2-keeled, tubular only at the very

base; peduncular bracts several, spirally arranged, much larger than the prophyll, tubular at the very base, splitting, usually densely covered in brown scales and tomentum; rachis usually longer than the peduncle; rachis bracts minute; rachillae numerous, rather slender, spirally arranged, usually densely covered with indumentum, bearing spirally aranged, minute bracts, subtending flowers. Staminate flowers borne in spirally arranged pairs, the pairs either side of an aborted pistillate flower (or sometimes an intermediate flower with gynoecium and stamens), subtended by a very small bracteole; sepals cupular, lobed or not lobed, sometimes the lobes briefly imbricate; petals free, valvate; stamens 3-19, linear, basifixed; pistillode absent; Pistillate inflorescence terminal, usually erect, with fewer, more robust rachillae; pistillate flowers, solitary, spirally arranged, each subtended by a low bract and surrounded by 3 bracteoles; sepals 3, low, rounded, imbricate, joined briefly at base; petals 3 united basally to about middle, valvate distally; staminodes 0-3; gynoecium globose, 2-3 locular, 2-3 ovulate with a conical apical stigma, ovules inserted adaxially at the base, hemianatropous. Fruit ellipsoidal, small, reddish or purplish, ovoid to ellipsoidal, 1-2, rarely 3-seeded, stigmatic remains apical; epicarp smooth, mesocarp fleshy, filled with irritant needlelike crystals, endocarp not differentiated. Seeds basally attached ellipsoidal or hemispherical, endosperm homogeneous; embryo lateral.

Notes: - In floral characters, specifically in the connae sepals and elongate receptacles of the staminate flowers, *Wallichia* is the most specialized of the Caryoteae. The genus consists of 5 species in India mainly found in the north eastern parts.

Key to the species in India

1a. Stem solitary, arborescent; leaves arranged in one or few planes; leaflets elongated ..... *distichia*
1b. Stem cluster forming, leaves spirally arranged; leaflets mostly lobed 2
2a. Stem short subterranean, leaflets oblong to linear oblong; margins wavy..... *oblongifolia*
2b. Stem aerial, leaflets lanceolate or trapezoid, broadly cuneate at base 3
3a. Stem to 2 cm diameter, flowering branches 1- 4..... *nana*
3b. Stem to 10 cm diameter, flowering branches more than 10.....4
4a. Male flowers stamens 6 in number ..... *caryotoides*
4b. Male flowers stamens 3 in number ..... *triandra*

Wallichia caryotoides Roxb., Roxb., Pl. Coromandel 3: 91. 1820; Mart., Hist. Nat. Palm. 3, 180, Pl.136 1823–1853. Griff., Calcutta. J. Nat. Hist. 5, 485. 1845; Kurz, For. Fl. 2, 532. 1877; Becc. & Hook. f. in Hook. f., Fl. Brit. India 6: 419. 1892; Plate 29.

Harina caryotoides (Roxb.) Buch.-Ham., Mem. Wern. Nat. Hist. Soc. 5: 317. 1826.

Wrightea caryotoides (Roxb.) Roxb., Fl. Ind. ed. 1832, 3: 621. 1832.

Harina wallichia Steud. ex Saloman, Palmen: 127. 1877.

Wallichia siamensis Becc., Atti Soc. Tosc. Sci. Nat. Pisa Processi Verbali 44: 175. 1934.

Wallichia mooreana S. K. Basu, Taiwania 28: 146. 1983.

Suckering, bushy, hapaxanthic palm. Stem clustered, very slender, to 3 m tall, 3-10 cm diameter, covered with thick mat of leafsheath fibres; leaves 4-7 arranged spirally, almost radical, pinnate, to 2.5 m long; sheathing at base, sheaths disintegrating into black fibres, with a prominent ligule at apex; petiole slender, 1-1.5 m long; rachis 1-1.5 m long, dorsally bifaced, ventrally convex; leaflets or pinnae 7-12 per side of rachis, leaflets alternate, lobed,

praemorsed; regularly and alternately arranged except for clustered proximal 2-3 leaflets, spreading in the same plane, basal leaflets in groups, 3 on each side, wedge shaped, to 30 cm long, to 9 cm broad at middle; middle 25-45 cm long, 5-10 cm wide, lanceolate, with two pronounced lobes, terminal leaflets deeply 3 lobed. Inflorescences subtended by small bracts, unisexual, staminate and pistillate inflorescences about equal length; staminate inflorescence axillary, to 40 cm long, erect; prophyll 5-7 cm long, 2-3 cm diameter, glabrous with many large alternate, papery, peduncular bracts, 6-8, sheathing the peduncle; rachillae simple, numerous, filiform, 15-20 cm long; 12 – 20 cm long. 1.5 -3 mm long, staminate flowers single or paired, sessile, 6 mm x 2 mm, sepals 2 mm long, connate into a copular calyx, petals 5 mm, yellow; stamens 10 -15 in number; pistillate inflorescence terminal, erect, prophyll to 5-6 cm long, to 40 cm long with large peduncular bracts; rachillae caudiform, alternate, 12-14 in number, to 7 – 15. 10-20 cm long; female flowers 3-bracteate, to 2 - 2.5 cm long at anthesis; sepals 1 mm long, petals 2 mm long at anthesis; sepals 1 mm long, gynoecium 2 mm long, ovary 3 loculed. Fruit obpyriform or avoid to ellipsoid, 2 seeded, 1.5 cm long, 0.7 cm diameter, red coloured; seed planoconvex.

Distribution: Bangladesh, China (Yunnan), India (Arunachal Pradesh, Tripura), Myanmar (Kachin, Mon, Rakhine, Sagaing), and Thailand (North). A component of the tropical evergreen moist forest mostly grows as undergrowth; at 100-1800 m elevation.

Flowering and fruiting: The palm flowers once in its lifetime. Several inflorescences are produced in a basipetal order and the palm dies after the last inflorescence mature.

Conservation status: Near threatened

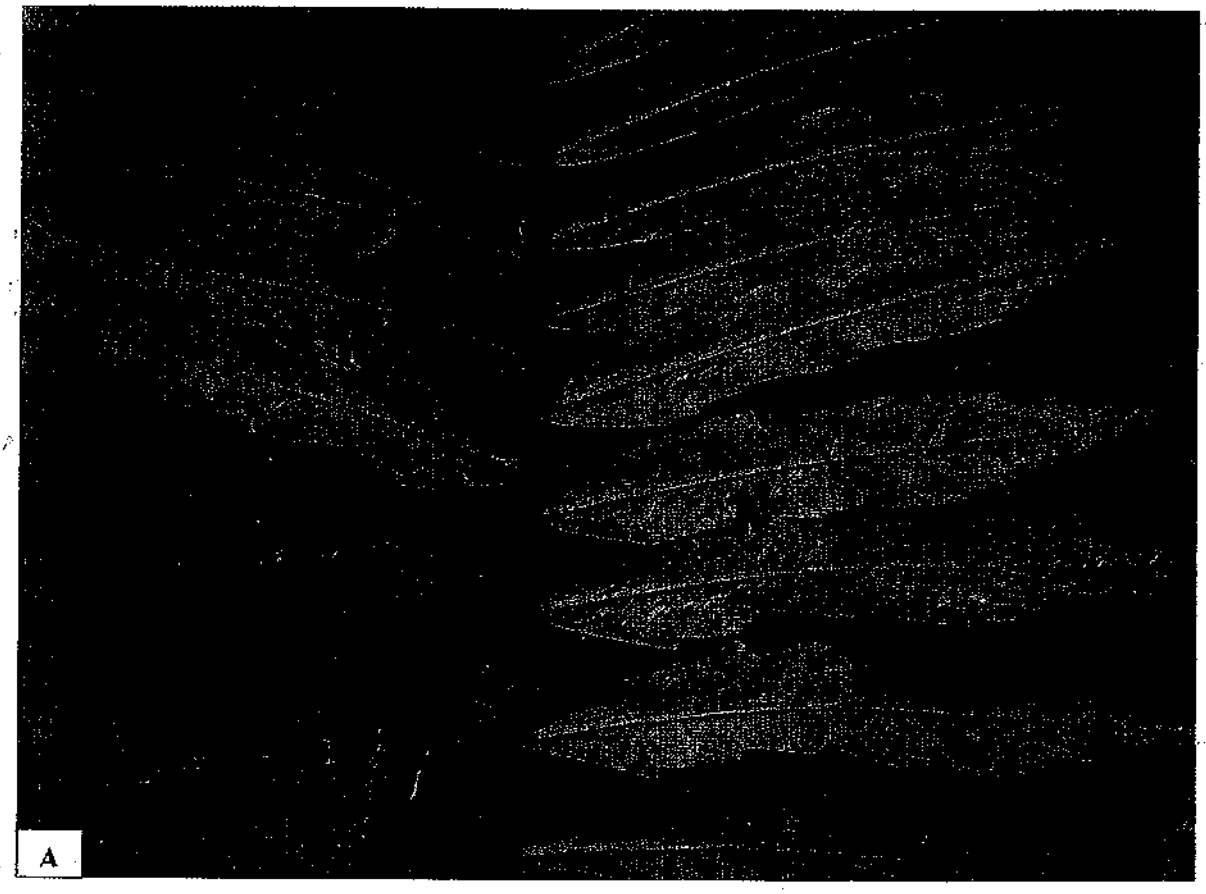
Specimens examined: Kheitum, Sushai Hills, Assam, 23.1.1963, Deb 31211 (BSI Shillong); Rheyanlie, Dibang valley, Arunachal Pradesh, 25.8.2000, fr., Bhaumik 3242 (BSI Shillong).

Wallichia oblongifolia Griff., Calcutta J. Nat. Hist. 5: 486. 1845; Plate 30

Harina oblongifolia (Griff.) Griff., Palms Brit. E. India 175. 1850.
Wallichia densiflora Mart., Hist. nat. palm. 3: 190. 1845.
Harina densiflora (Mart.) Walp., Ann. Bot. Syst. 3: 1032. 1853.

Vernacular names: *chilputtal, araru, lemi, ipathi.*

Stem, clustered, slender, short and subterranean or to 1 m long, to 40 cm diameter. Leaves to 7-10. spirally arranged, 3 m long, arching from base; sheaths and ligules disintegrating into black fibres; petioles to 2 cm long; rachis 2-2.5 cm long; leaflets 15 per sides of rachis, regularly arranged, spreading in the same direction, basal leaflets oblong, in groups of 2-3 leaflets on each side of rachis; each 10-20 cm long, 3-7 cm broad at middle; deep green upper, whitish below; middle leaflets linear-oblong, to 60 cm long, to 8 cm wide, widest near the apex, approximately oblong, with several lobes, terminal leaflets jointed, lobed at upper margin; midnerve on lower side light orange in colour. Inflorescences unisexual, staminate and pistillate inflorescences almost equal length, borne on separate plants; staminate inflorescences axillary, pendulous, to 50-100 cm long, with many densely imbricated papery peduncular bracts; rachillae numerous, to 10 cm long, 2 mm diameter, glabrous, filiform, staminate flowers 7 mm x 1.2 mm, yellow when fresh, sepals 5-7mm long, connate into a copular calyx; petals to 5 mm long, free except for basal 2 mm, forming a solid tube; stamens 6, anthers 3 mm long; pistillate inflorescence terminal, to 50-100 cm long, spreading horizontally, erect; prophyll and peduncular bract sometimes pinnately foliar;



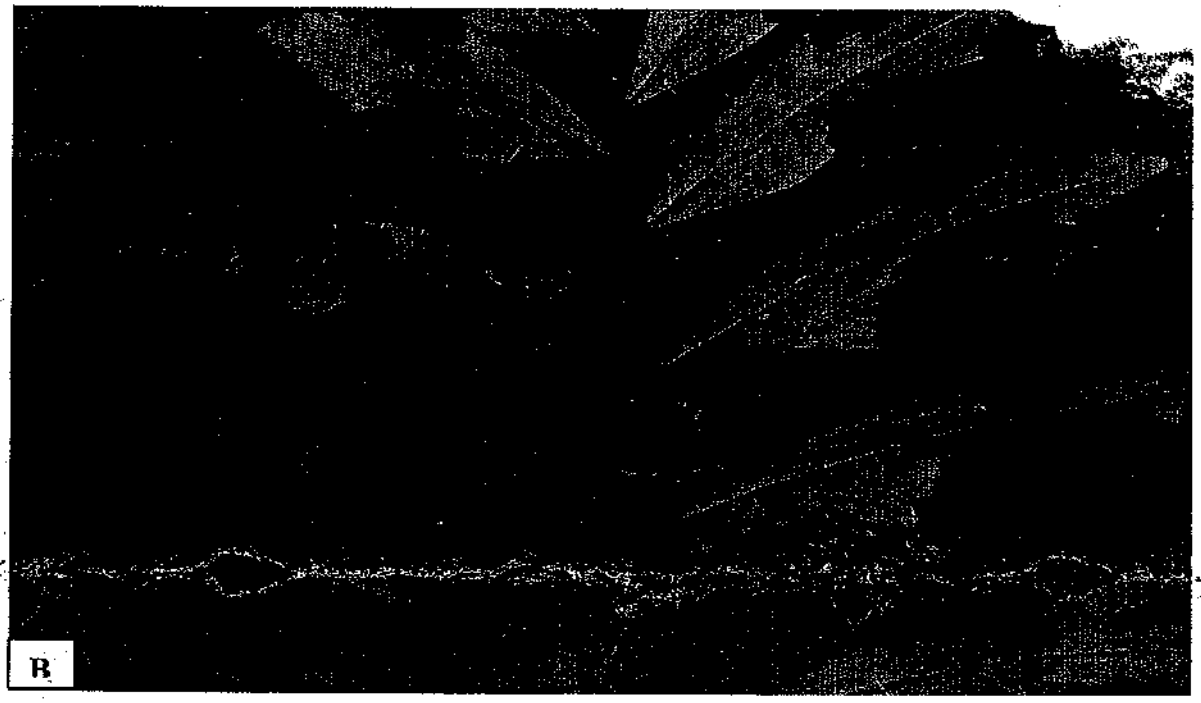


Plate 30. ***Wallichia oblongifolia*** **A. Leaf;** ***Wallichia triandra*** **B. Leaf**

rachillae 15-32. caudiform, to 40 cm long, 5-6 mm diameter, olive green in colour; pistillate flowers spirally disposed, 5 mm long, 3 mm diameter; calyx irregularly lobed, sepals 1 mm long; corolla shortly 3 lobed, petals 5 mm long; fruit ovoid to oblong, 2 seeded, 1.6 cm long, 0.8 cm diameter, greenish brown to reddish colour; seed plano-convex, 1.2 cm long and 0.4 cm diameter.

Distribution: India (Sikkim, West Bengal, Assam, Arunachal pradesh, Manipur, Tripura, Mizoram and Nagaland), Bangladesh, Nepal, Bhutan, Burma; lowland or montane evergreen forest, especially in rocky places on steep slopes; 200-1200 m elevation.

Flowering and fruiting: The palm flowers once in its lifetime. Several inflorescences are produced in a basipetal order and the palm dies after the last inflorescence mature.

Conservation status: Threatened

Specimens examined: Near Moosmai cave, Cherrapunjee, 28.04.2009, Linto 25032 (KFRI); Barapani, Shillong, 27.04.09, Linto 25031 (KFRI);Namdapha, 16.12.1981, Joseph, 79182 (BSI Shillong); Mikir Hills, Assam, 15.7.1957, fr., Panigrahi 9371 (BSI Shillong); Syndai, K & J Hills, Assam, 17.8.68, Balakrishnan 46186 (BSI Shillong); Dwaki, Near Chirapunjee, K & J Hills dist., Arunachal Pradesh, 25.11.1956, Pangrahi 4689 (BSI Shillong); Botanic Garden, Shillong, 25.7.1973, Deb 35744 (BSI Shillong); Khasia & Jaintea Hills, Assam, 19.11.1969, Balakrishnan 50019 (BSI Shillong); Balaiba tilla, Nangpoh, Assam, 31.7.1964, Joseph 37480 (BSI Shillong).

Uses: In Kumaon the leaves are used as thatch and are said to be imperishable. In Darjeeling the leaves are used as fodder for ponies.

Wallichia disticha T.Anderson, J. Linn. Soc., Bot. 11: 6. 1869; Becc. & Hook. f. in Hook. f., Fl. Brit. India 6: 419. 1892; Plate 29.

Didymosperma distichum (T.Anderson) Hook.f., Rep. Progr. Condition Roy. Bot. Gard. Kew 1882: 61. 1884.

Wallichia yomae Kurz, Forest Fl. Burma 2: 533. 1877.

Stem erect, solitary, to 5-8 m tall, 20-30 cm in diameter near base; leaves ascending from the stem, arranged in one or a few directions to 2.5 m long; leafsheath semiwoody, extremely fibrous at margins, with conspicuous black bristles on the inner side; petiole rounded, to 30 cm long, 2.5 cm in diameter, with conspicuous groove at middle on lower side; leaflets linear, notched at margins, bluish green in colour, 60-90 cm long, arranged in groups on rachis, each deflected to different plane; terminal leaflets broadly 3 lobed. Male inflorescence axillary, 1.5 m long with stout rounded peduncle; rachillae slender, to 30 cm long, male flowers mostly in pairs with a rudimentary female flower bud; stamens 6, 1.5 to 2 mm long, female inflorescence terminal, female flowers bracteolate; calyx obscurely 3 lobed; corolla 3 partite almost cover the pistil; stigma mamillate, 2 fid. Fruit oblong, reddish brown when ripe, 2-2.2 cm x 1.5 cm.

Distribution: India (Sikkim Himalaya), Bangladesh, Bhutan, Myanmar.

Flowering and fruiting: The palm flowers once in its lifetime. Several inflorescences are produced in a basipetal order and the palm dies after the last inflorescence mature.

Conservation status:

Specimens examined: Nusa to Wami, Tirap, Arunachal Pradesh, 2.9.1958, Panigrahi 15078 (BSI Shillong).

Uses: This species is very ornamental in appearance therefore can be introduced in the gardens for beautification of the landscape. It thrives best

in moist soil and not under direct sun wher day temperature is high. The core of the stem contains starch and consumed largely by the tribals of Arunachal Pradesh.

Wallichia triandra (J.Joseph) S.K.Basu, T.Anderson, J. Linn. Soc., Bot. 11: 6. 1869; Becc. & Hook. f. in Hook. f., Fl. Brit. India 6: 419. 1892; Plate 30.

Didymosperma distichum (T.Anderson) Hook.f., Rep. Progr. Condition Roy. Bot. Gard. Kew 1882: 61. 1884.

Wallichia yomae Kurz, Forest Fl. Burma 2: 533. 1877.

Asraoa triandra J.Joseph, Bull. Bot. Surv. India 14: 144 (1972 publ. 1975).

Suckering, bushy, hapaxanthic palm. Stem more or less uniformly thick, densely covered with dark brown leafsheath fibres; taller stems, to 3 m long, 3.5 cm in diameter. Leaves, to 2 m long; leafsheath with stiff bristle like out-growths from the margins; leaflets opposite to subopposite and alternate, 11-19 in number per leaf, each irregularly trapezoid, to 40 cm long, 10 cm broad at middle, obliquely toothed and wavy at margins. Male inflorescence axillary, curved, to 35 cm long; peduncle covered with large overlapping, ovate to narrowly lanceolate dull brown leathery bracts; rachillae numerous, to 16 cm long, filiform, male flowers narrowly cylindrical, to 9 mm long, deep purple at anthesis; calyx cylindrical, truncate or wavy at margins; corolla longer than calyx; petals fleshy, narrowly lanceolate, valvate, to 8 mm long; stamens 3; filaments subulate, connate to form a short column, female inflorescence terminal, peduncle stout; rachillae many, caudiform, to 30 cm long, female flowers subglobose, spirally disposed on rachillae; each 4 mm x 4 mm; calyx saucer shaped, obscurely 3-lobed; petal lobes ovate, obtuse, valvate; ovary functionally 1 loculed, 1 ovuled; Fruit oblong, ellipsoid, 13 mm x 9 mm, deep red to purple when ripe; seed single; endosperm homogenous.

Distribution: India (Arunachal Pradesh and Assam), Common in dense forests on humid soil.

Flowering and Fruiting: The palm flowers once in its lifetime. Several inflorescences are produced in a basipetal order and the palm dies after the last inflorescence mature.

Specimens examined: Hill behind Hayuliang I.B., Lohit District, 25.9.1969, Rao 48105 D (BSI Shillong); Rheyanlie,Dibang valley, Arunachal Pradesh, 26.8.2000, leaf, fr., Bhaumik 3279 (BSI Shillong); Hoonly, Lower Dibang valley District, Arunachal Pradesh, 10.05.2009, Linto 25037 (KFRI).

Wallichia nana Griff., Calcutta J. Nat. Hist. 5: 488. 1845.

Harina nana (Griff.) Griff., Palms Brit. E. India 176. 1850.
Didymosperma nanum (Griff.) H. Wendl. & Drude in O. C. E. de Kerchove de Denterghem, Palmiers 243. 1879.

Blancoa nana (Griff.) Kuntze, Revis. Gen. Pl. 2: 727. 1891.
Arenga nana (Griff.) H. E. Moore, Principes 4: 114. 1960.
Vernacular names: *ipathi* (India).

Clustered palm, to 0.6 -1 m tall, to 2 cm diameter. Leaves arranged spirally; sheaths to 20 cm long, fibrous, with a fibrous ligule to 8 cm long; petioles 0.1-0.28 m long; rachis 0.15-0.5 m long; pinnae 3 per side of rachis, regularly arranged, spreading in the same plane, pinnae from middle of leaf 9-20 cm long, 6.5-10 cm wide, lanceolate, with two lobes. Stems bearing staminate and pistillate inflorescences about equal in length. Inflorescences unisexual, subtended by smaller leaves, the pistillate terminal and the staminate lateral; staminate inflorescences to 30 cm long, erect; prophyll not seen; peduncle to 20 cm long; peduncular bracts several, sheathing the peduncle; rachillae 1-4,

to 13 cm long, 2 mm diameter, densely brown tomentose; connate into a cupular calyx, deeply lobed, the lobes not imbricate; petals 5 mm long, purple; stamens 9; pistillate inflorescences 20-30 cm long, erect; prophyll not seen; peduncle 11-15 cm long; peduncular bracts several, sheathing the peduncle; rachillae 1-3, often only one well-developed, 8-12 cm long, 3-4 mm diameter, densely brown tomentose; pistillate flowers 2-3.5 mm long; sepals 0.5 mm long; petals 2-3 mm long; gynoecium 2-3 mm long; fruits white. ellipsoid, to 1.2 cm long, to 1.0 cm diameter.

Distribution: India (Arunachal Pradesh, Assam, Meghalaya); lowland evergreen at low elevations

Flowering and Fruiting: The palm flowers once in its lifetime. Several inflorescences are produced in a basipetal order and the palm dies after the last inflorescence mature.

Specimens examined: INDIA. Assam: Duphla Hills, 12 Dec 1874, *Lister 59* (P); banks of the Duking and Dhumsiri rivers, Mar 1890, *Anon s. n.* (K) Meghalaya: Khasia, Nowgong, 22 Jul 1850, *J. Hooker & J. Thomson s. n.* (K, P).

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