

GERMPLASM ESTABLISHMENT OF RATTANS

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Project Proposal

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Abstract

Rattans, once abundant in the tropical forests, have become a scarce resource today due to loss of habitat, overexploitation, inadequate replenishment and unscientific management. There is an urgent need to ensure the future for rattans by intensifying the *ex situ* and *in situ* conservation methods. Recent studies have shown that genetic variations exist between populations of rattans. Genetic conservation or germplasm aims at maintaining the entire gene pool of species and populations for many generations.

In this *ex situ* conservation project, seeds and seedlings of different species of rattans from various populations were collected from the Western and Eastern Ghats, north eastern states and from the Andaman and Nicobar islands. Seeds of each population were kept separate and germinated. One – year - old seedlings were out planted in the selected areas. Linear plots were laid out with at least 25 plants from a population.

Two germplasm plots were established, at Nilambur in north Kerala , and at Achencoil in south Kerala. Two smaller live collection plots also were established, one at Vazhachal and the other at Peechi, both in central Kerala. There are 18 species at Achencoil, 22 at Nilambur, 29 at Peechi and 18 at Vazhachal. Exotic species collected were planted only in the KFRI campus at Peechi. There are six species collected from China, Lao PDR and Malaysia. For each species planted in the germplasm, the botanical name, local names, accession number, distribution, the provenance collected, the nature of the species, flowering and fruiting time, conservation status according to IUCN specifications and uses are given in this report.

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INTRODUCTION

In India about 61 species of rattans have been reported under four genera namely, *Calamus*, *Daemonorops*, *Korthalsia*, and *Plectocomia*, distributed in three major geographic regions: Peninsular India, north & north eastern India and the Andaman and Nicobar Islands (Renuka, 2002). One genus and 24 species have so far been reported from Peninsular India, three genera and 18 species from the Andaman and Nicobar islands and three genera and 20 species and two varieties from north eastern states. Each region has its own specific rattan flora and the species distribution does not overlap. Only one species, *Calamus viminalis* Wild. is reported from all the three regions.

Over 90 per cent of the world's rattan requirement is extracted from its natural population. There has been no regard for any scientific principles in the exploitation of canes from its natural environment. The cane workers occasionally dig out the rhizome resulting in heavy loss of natural regeneration. In majority of the cases, rattans are extracted before they start to flower or fruit. Rattans are dioecious, ie., the male and female plants are separate but the sex of the plant cannot be identified till they flower. Hence extraction before flowering may reduce the number of any one sex of the plant in the population. Seeds are viable only for a short period (Renuka, 1991,1992 a; Renuka *et al.*, 2002). Poor natural regeneration of certain species is one of the major threats to the existence of those species in their natural environment. In case of rattans with edible fruits, there is an additional threat of low per cent of seed germination in the natural forests.

The tropical forests, the natural habitat of rattans, are fast depleting due to various reasons. This, along with over exploitation of commercially important species and other problems affecting natural regeneration, is leading many of the species to the verge of extinction. Many species reported earlier as abundant in a locality have become very rare. As the demand for cane furniture is increasing, the pressure on existing population will only increase in future.

At present out of the species reported, six species are critically endangered, eight are endangered and 26 are vulnerable (Basu, 1991; Renuka, 2001). If this situation continues, several species may soon become rare and highly threatened and in extreme situations perhaps also extinct. For example, in the case of *Calamus dransfeildii* Renuka, a species reported from Dhoni forests of Kerala, only three or four plants are remaining in their original locality. Clearly, efforts are required to stem the decline of this resource, before they are irreversibly lost.

During previous studies it was noted that there are phenotypic and genotypic variations between different populations of the same species of rattans (Renuka *et al.*, 1998). Populations of *C. thwaitesii* from southern Western Ghats vary phenotypically from that of northern Western Ghats. They differ in stem diameter, colour and spine arrangement of the leaf sheath and in the appearance of leaflets. Different populations of *C. andamanicus* differ in stem diameter and in the length of inflorescence. Genetic diversity studies for these two species showed that provenances significantly differ with regard to seedling height and the heritability was also found to be very high.

The existing genetic variability between provenances, families and individuals within a species must be conserved, being a guarantee for stability, a source of wealth and a prerequisite to any future evaluation. Genetic variability also constitutes the raw material for further breeding programmes. The higher the variability inside a population the better the chances to select families and individuals with desirable characters.

In India, about eight regions (three in the Western Ghats, three in the north east and two in the Andaman and Nicobar islands) were identified as hotspots of rattan diversity . Together, these eight regions account for about 45 species of rattans in the entire country (Uma Saankar *et al.*, 2004).

An analysis of the conservation status of rattans in all the rattan producing countries shows that a systematic approach to genetic conservation is lacking in most of the rattan producing countries. In India too, even though a collection of many species exists in research institutes and universities, a true gemplasm collection is lacking.

Germplasm conservation may be in the form of seeds, live plants in the field or *in vitro* preservation. Preservation as live plants requires large forest areas which should be regularly maintained.

The present project was taken up with an aim to conserve the genetic variations among populations by building up a germplasm of rattans as live plants in different parts of Kerala.

REVIEW OF LITERATURE

The rattans are strictly old world palms belonging to the subfamily Calamoideae. They are distributed in equatorial Africa, India, Sri Lanka, southern China through the Malay Archipelago to Australia and the western Pacific as far as Fiji. Some rattans are widespread while some are very narrow endemics. Many countries have conducted extensive survey of their natural resources of rattan. An alarming result of the survey is that in almost all the countries the genetic resources of rattan are diminishing fast due to various reasons. Taking this into account many countries have started conservation of the resources.

In China, the work on conservation of rattan resources started in the mid 1970s. A live collection of rattans was established in the Research Institute of Tropical Forestry. Eight species of rattans have been successfully conserved *in vitro* (Xu *et al.*, 1999).

In the Philippines an *in situ* conservation area was established in 1984 which contains 13 species (Aida, 1998). An *ex situ* conservation plot of 5 ha also exists here which has 44 rattan taxa.

In Sri Lanka, forest department initiated cultivation of rattans in 1980s. De Zoysa and Vivekanandan (1994) report that many species are not protected under the existing conservation schemes.

In Thailand the first rattan plantation was established in 1968. Subsequently a survey of the genetic resources was conducted (Ramyangrangi *et al.*, 1999) and small scale plantations and seed stands were established.

An assessment on the conservation status of rattan has been carried out for Peninsular Malaysia (Kiew and Dransfield, 1989) and Sarawak (Pearce, 1989). Here *ex situ* conservation is confined to a few species planted by the forest department.

The forest department of Sabah started *ex situ* plantation in 1979 followed by several private agencies. But only two or three species are protected in this way.

In India the earliest domestication of rattans dates back to 1801, when offsets of *Calamus latifolius* were introduced into the East India Company's Botanic Garden at Calcutta (Now Indian Botanic Garden, Howrah). In early 1930s, realizing the superior quality of the elite Malayan canes, attempts were made to introduce them to India, but were unsuccessful. The Forest Research Institute at Dehra Dun introduced some seedlings of *Calamus caesioides* in 1955 and distributed them to various states. One individual still survives in Kerala being located at the Kodanad Forest Rest House campus in Malayattoor Forest Division.

From 1987 onwards basic studies necessary for the genetic conservation were going on continuously in India (Lakshmana, 1987, 1993; Renuka, 1987, 1991, 1992a, 1995a, 1996a, 1996b, 1999a, 1999b; Renuka and Anto, 1998; Renuka *et al.*, 1998, 2004). Seeds and seedlings of different species were procured and planted at KFRI. State Forest Research Institute, Arunachal Pradesh also started conservation efforts and established a germplasm collection at Chessa. Studies were conducted on the *ex situ* performance of different species of rattans (Renuka and Rugmini, 1996) and seed stands of some commercially important species also were established.

In 'A State of the Art Review on Genetic conservation of rattans' (Renuka and George, 2002), the resource diversity and the conservation measures underway in different countries are discussed. It also provides an annotated bibliography on resource diversity, conservation and related aspects.

MATERIALS AND METHODS

Selection of site

Survey was conducted in the Kerala part of Western Ghats to select suitable areas for establishing germplasm gardens. Two plots, 50 ha each, were selected, one at Kottavasal on the right side of the Achencoil – Shencottah Road in Achencoil range under Achencoil Forest Division and another at Ganapathykallu on the left side of the Nilambur – Gudallore State Highway at Nadukani in Vazhikadavu range under Nilambur North Forest Division. A small plot was selected near the Forest station at Vazhachal Forest division and an one hectare plot was selected in the KFRI campus.

Production of planting materials

Seeds of different species of rattans from various populations were collected from the Western and Eastern Ghats, North Eastern States and from the Andaman and Nicobar islands.

Seeds were put to germination in the nursery beds. Seeds of each population were kept separate. Germinated seeds from the seed beds were transplanted to polybags of 23 x 15 cm size, filled with forest topsoil and sand in a ratio 3:1. Immediately after transplanting, these polythene bags were shifted to the nursery under 50 per cent shade. Weeding was carried out at regular intervals till out planting.

Planting design

Linear plots were laid out with at least 25 plants from a population.

Planting method and after care

One - year - old seedlings were out planted in the plots with a spacing of 4 m. Weeding was done once in an year for the first three years.

RESULTS AND DISCUSSION

Two germplasm plots were established in Kerala, at Nilambur in the north, at Achencoil in the south. Two smaller live collection plots also were established, one at Vazhachal and the other at Peechi, both in the central Kerala.

The species represented in the germplasm at different locations are given in Table 1. Different populations of 22 species were established at Nilambur, 18 species at Achencoil, 29 species at Peechi and 18 species at Vazhachal.

Exotic species collected were planted only in the Peechi campus (Table 2). These species were collected from China, Lao PDR and Malaysia. Out of eight species collected, two Malaysian species, *Calamus manan* and *C. caesius* perished and only six species are remaining.

For each species planted in the germplasm, the botanical name, local names, accession number, distribution, the provenance collected, the nature of the species, flowering and fruiting time, conservation status according to IUCN specifications and uses are given in this report.

Table 1. Species represented in the germplasm

No.	Species planted	Achencoil	Nilambur	Peechi	Vazhachal.	Accession No.
1	<i>Calamus andamanicus</i> Kurz	+	+	+	+	101
2	<i>C. baratangensis</i> Renuka & Vijayakumaran	+	+	+	+	102
3	<i>C. brandisii</i> Becc. ex Becc. & Hook. f.			+		114
4	<i>C. delessertianus</i> Becc.		+	+		112
5	<i>C. dransfieldii</i> Renuka			+		117
6	<i>C. gambleii</i> Becc. ex Becc. & Hook. f.			+	+	121
7	<i>C. guruba</i> (Buch.-Ham.) Mart.		+	+		119
8	<i>C. hookerianus</i> Becc.	+	+	+	+	108
9	<i>C. huegelianus</i> Mart.		+	+		109
10	<i>C. karnatakensis</i> Renuka & Lakahmana	+	+	+	+	110
11	<i>C. lakshmana</i> Renuka	+	+	+		111
12	<i>C. longisetus</i> Griff.	+	+	+	+	115
13	<i>C. metzianus</i> Schltr.		+	+	+	124
14	<i>C. nagbettai</i> Fernandez & Dey	+	+	+	+	122
15	<i>C. neelagiricus</i> Renuka		+	+	+	107
16	<i>C. palustris</i> Griff.	+	+	+		116
17	<i>C. prasinus</i> Lakshmana & Renuka	+		+	+	128
18	<i>C. pseudotenuis</i> Becc. ex Becc. & Hook. f.	+	+	+	+	120
19	<i>C. rotang</i> L.	+	+	+	+	123
20	<i>C. stoloniferus</i> Renuka	+	+	+	+	127
21	<i>C. tenuis</i> Roxb.	+	+	+		118
22	<i>C. thwaitesii</i> Becc. & Hook.f.	+	+	+	+	125
23	<i>C. travancoricus</i> Bedd. ex Becc. & Hook.f.	+	+	+	+	113
24	<i>C. unifarius</i> Wendl.			+		103
25	<i>C. vattayila</i> Renuka	+	+	+	+	126
26	<i>C. viminalis</i> Wild.	+		+		107
27	<i>Daemonorops kurzianus</i> Becc.	+	+	+	+	104
28	<i>D. manii</i> Becc.			+		105
29	<i>Korthalsia laciniosa</i> (Griff.) Mart.		+	+	+	106

Table 2. Exotic species planted at Peechi

No	Name	Country of origin
1	<i>Calamus tetradactylus</i> Hance	China
2	<i>C. thysanolepis</i> Hance	„
3	<i>C. trachycoleus</i> Becc.	„
4	<i>C. perigrinus</i> Furtado	Malaysia
5	<i>Calamus</i> sp.	Lao PDR
6	<i>Daemonorops margaritae</i> (Hance) Becc.	China

1. Calamus andamanicus Kurz (Motta beth) Acc. No. 101

Distribution: *C. andamanicus* is a common species seen in almost all the islands of Andaman and Nicobar. Variations were reported between the populations of this species (Renuka *et al.*, 1998).

Provenance collected: Seeds were collected from South Andamans.

Nature of species: This is a solitary, large diameter rattan, stem without sheaths to 4.5 cm in diameter.

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

Conservation status: Vulnerable (Renuka, 2001). This rattan is extracted in large quantities from the islands.

Uses: This cane is extensively used in the rattan furniture industry in the island as well as in the main land. Bhat *et al.* (1996) reports superior mechanical properties for this cane. The leaves are commonly used for thatching

2. Calamus baratangensis Renuka & Vijayakumaran Acc. No. 102

Distribution: This species is reported from South and North Andamans (Renuka and Vijayakumaran, 1994). It is very common in the Baratang island of S. Andamans.

Provenance collected : Seeds were collected from the populations of the Baratang island of South Andamans.

Nature of species : This is a clustering, medium diameter rattan, stem without sheaths to 1.2 cm in diameter. The species display morphological variations in the diameter of the

stem and in the armature of the sheath. But these variations are observed in the same clump. The diameter of the cane varies from 0.5 to 1.2 cm in the same clump. The younger sheaths are more spiny than the older ones.

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

Conservation status: Vulnerable (Renuka, 2001). This rattan is extracted in large quantities from the islands.

Uses: Extensively used in the furniture industry. Commonly used for tying rafts.

3. Calamus brandisii Becc. ex Becc. & Hook. f. (Cheru choral) Acc. No. 114

Distribution: This species is seen in the evergreen forests between 1000-1500 m asl in Kerala and Tamil Nadu part of Western Ghats (Renuka, 1992b).

Provenance collected : Seeds were collected from the populations seen in Pandimotta coming under Kulathupuzha forest range.

Nature of species : This is a cluster forming, slender rattan, stem without sheaths up to 0.8 cm in diameter.

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

Conservation status: Vulnerable (Renuka, 2001). This rattan is extracted in large quantities from the W. Ghats.

Uses: This is reported to be a moderately strong cane (Bhat, 1992). Extensively used in the furniture and handicraft industries.

4. Calamus delessertianus Becc. (Pacchachural, Ottamoodan) Acc.No. 112

Distribution: This species is seen in the Karnataka and Kerala part of Western Ghats (Renuka, 1999 b) between 700 – 1200 m asl.

Provenance collected : Seeds were collected from Nelliampathy coming under Nemmara Forest Division.

Nature of species : No phenotypic variation was reported so far among the populations. This is a solitary, medium diameter rattan, stem without sheaths 2 – 2.5 cm in diameter.

Flowering: August – September. **Fruiting:** May – June.

Conservation status: Vulnerable (Renuka, 2001).

Use: Used in the furniture industry.

5. Calamus dransfieldii Renuka Acc.No. 117

Distribution: This rattan is endemic to the Dhoni forests of Palakkad District (Renuka, 1992b). **Provenance collected :** Suckers were collected from Dhoni forests. So far no seeds were obtained from this population. Hence suckers were collected and planted out. Since only very small number of plants were available, suckers were planted at Peechi only. **Nature of species :** This is a solitary, large diameter rattan, stem without sheaths about 2.5 cm in diameter.

Flowering: October – December

Conservation status: Critically endangered (Renuka, 2001). At present only 4- 5 seedlings and one mature plant survive in the originally reported area.

Uses: This is classified as moderately strong cane (Bhat, 1992) and used for furniture and walking sticks.

6. Calamus gamblei Becc. ex Becc. & Hook. f. (Pacchachural) Acc.No. 121

Distribution: *C. gamblei* is reported from Kerala, Tamil Nadu and Karnataka part of W. Ghats. This species occur at higher elevations, from 700 m asl upwards (Renuka, 1992b).

Provenance collected : Seeds of *C. gamblei* var. *gamblei* were collected from Peerumedu.

Nature of species : This is a clustering, moderate sized rattan, stem without sheaths to 1.5 cm in diameter. Two varieties are reported under this species, *C. gamblei* var. *gamblei* and *C. gamblei* var. *sphaerocarpa*

Flowering: July – August. **Fruiting:** May – June.

Conservation status: Endangered (Renuka, 2001).

Uses: This is used in furniture industry. Bhat (1992) reports this as a comparatively strong cane and graded under Class 1.

7. Calamus guruba (Buch. – Ham.) ex Mart. Acc.No. 119

Distribution: This species is seen in West Bengal, Assam and Meghalaya. Its distribution extends to Bangladesh, Myanmar and Thailand (Basu, 1992).

Provenance collected: The seeds were collected from the population in Assam.

Nature of species : This is a cluster forming slender rattan, stem without sheath to 1 cm in diameter.

Flowering: January- March. **Fruiting:** March –April

Conservation status: At Lower risk.

Uses: Largely used for making rough baskets. Used in furniture industry also.

8. Calamus hookerianus Becc. (Velichural, Kakkachural, Vanthal, Kallan, Chentakara)

Acc.No. 108

Distribution: This is a common species occurring in the evergreen forests up to 1000m asl through out the W. Ghats of Kerala, Tamil Nadu and Karnataka (Renuka, 1992b).

Provenance collected : The seeds were collected from Nelliampathy (Pakuthipalam) of Nemmara Forest Division.

Nature of species : This is a clustering, medium diameter rattan, stem without sheaths to 2.5 cm in diameter. Phenotypic variations are noted in the size and colour of the spines only.

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

Conservation status: At present it is considered under the ‘Lower risk’ category.

Uses: It is considered as a moderately strong cane (Bhat, 1992). Extensively used in the furniture industry and in basket making. Shoot tip is edible.

9. Calamus huegelianus Mart. Acc.No.109

Distribution: This species is endemic to Silent valley National Park in the evergreen forest from Walakkad to Sispara within an elevation of 1300 – 2200 m asl (Renuka and Anto, 1998). Only a very small population exists.

Provenance collected : Seeds were collected from Silent valley National Park.

Nature of species : This is a clustering, medium diameter rattan, stems without sheaths to 2 cm in diameter.

Flowering: July – August. **Fruiting**: May – June.

Conservation status: Critically Endangered (Renuka, 2001).

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

10. Calamus karnatakensis Renuka & Lakshmana (Sukkubeth) Acc.No. 110

Distribution: This species occurs in the W. Ghats of Karnataka and southern Goa in the evergreen forests between 530 – 1200 m asl (Renuka, 1992b).

Provenance collected : Seeds were collected from Thalakaveri , Karnataka.

Nature of species : This is a clustering, medium diameter rattan, stem without sheaths to 1.5 cm in diameter. No variation is noted so far.

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

Conservation status: Considered as at 'Lower risk' (Renuka, 2001).

Uses: Used in the furniture industry.

11. Calamus lakshmanae Renuka (Halubetha) Acc.No. 111

Distribution: This species is reported from Karnataka. Seen in the evergreen forests at about 85 m asl (Renuka, 1992b).

Provenance collected : Seeds were collected from Makkut, Karnataka.

Nature of species : This is a clustering, medium diameter rattan, stem without sheaths to 1 cm in diameter.

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

Conservation status: Vulnerable (Renuka, 2001).

Uses: A good quality cane used for furniture (Bhat, 1992).

12. Calamus longisetus Griff. Acc.No. 115

Distribution: This species is fairly common in South Andamans and seen in the evergreen forests. The distribution extends to Bangladesh, Myanmar, Thailand and Malay Peninsula (Renuka,1995b).

Provenance collected : Seeds were obtained from Wumburlygung, South Andamans.

Nature of species : This is a clustering, large diameter rattan, stem without sheaths 3 cm in diameter. The outer scaly cover of the fruits of this species is mottled like a leopard's skin.

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

Conservation status: Vulnerable (Renuka, 2001).

Uses: This is reported to be a very strong cane (Bhat *et al.*, 1996) and is used in the furniture industry.

13. Calamus metzianus Schltr. (Odiyan Chural) Acc.No. 124

Distribution: This species is restricted to plains in the marshy areas, along the backwaters and coasts and in sacred groves in Kerala. It is also reported from disturbed forests at low altitude in Karnataka (Renuka, 1992b).

Provenance collected : Seeds were collected from Pattakarimbu, Nilambur.

Nature of species : This is a slender clustering rattan, stem diameter without sheaths to 1 cm in diameter.

Flowering: September - October. **Fruiting:** March –April

Conservation status: Vulnerable

Uses: Not a good quality cane and hence is used only for basket making.

4. Calamus nagbettai Fernandez & Dey (Nagabetha) Acc.No. 122

Distribution: The species is seen in the Subrahmanya forests in Karnataka. Even though this species is reported from Sheduruni Valley in Kerala, only one or two plants are seen in that area (Renuka, 1992b).

Provenance collected : Seeds were collected from Subrahmanya forests in Karnataka.

Nature of species : This is a clustering, large diameter rattan, stem without sheaths to 3 cm in diameter, with black patches at the basal portion.

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

Conservation status: Considered as ‘Vulnerable’(Renuka, 2001).

Uses: This cane is considered to be very sacred and is worshiped in many households in Karnataka. This is a very robust cane and hence used in the furniture industry. Beautiful walking sticks are made out of this cane. Bhat (1992) reports this as a very strong cane.

15. Calamus neelagiricus Renuka

Distribution: This species is reported only from Silent Valley National Park. It is seen in the evergreen forests at 1100 m asl (Renuka *et al.*, 1997).

Provenance collected : Seeds were collected from Silent Valley National Park.

Nature of species : This is a solitary, large diameter cane, stem without sheaths to 3 cm in diameter.

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

Conservation status: Critically endangered (Renuka, 2001).

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

16. Calamus palustris Griff. Acc.No. 116

Distribution: This species is seen in the evergreen forests of South and Little Andamans.

Provenance collected : Seeds were collected from the population seen in Mannarghat, South Andamans (Renuka, 1995b).

Nature of species : This is a solitary, medium diameter rattan, stem without sheaths to 1.5 cm in diameter.

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

Conservation status: Vulnerable (Renuka, 2001).

Uses: Used in furniture industry and also for making walking sticks. Bhat *et al.*, (1996) reports that this cane is of low commercial value since it is not very strong.

17. Calamus prasinus Lakshmana & Renuka (Ontibetha). Acc.No.128

Distribution: *C. prasinus* is reported from the southern part of Karnataka. Generally seen in the evergreen forests at about 530 m asl (Renuka, 1992b).

Provenance collected: The seeds were collected from a population at Sampaje, Karnataka.

Nature of species : This is a solitary medium diameter rattan, stem without sheaths to 1.2 cm in diameter.

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

Conservation status: Vulnerable (Renuka, 2001).

Uses: A good quality cane and is used in the furniture industry

18. Calamus pseudotenuis Becc. ex Becc. & Hook. f. Acc.No. 120

Distribution: This species occurs in the W. Ghat of Kerala and in Sri Lanka. *C. pseudotenuis* occurs at higher elevations usually from 700 m asl upwards (Renuka, 1992b).

Provenance collected : Seeds were collected from Peerumedu, Kerala.

Nature of species : This is a clustering, medium diameter rattan, stem without sheaths about 2.5 cm in diameter. In Kerala phenotypic variations are noted in the spine characters only.

Flowering: July – August; **Fruiting:** April – May.

Conservation status: ‘Lower risk’ (Renuka, 2001).

Uses: Bhat (1992) reports this as moderately strong cane. Used in furniture industry and in basket making. Shoot tips edible.

19. Calamus rotang L. (Cheru chural) Acc.No. 123

Distribution: *C. rotang* is restricted to plains and coastal areas of Tamil Nadu and Andhra Pradesh (Renuka, 1992b).

Provenance collected: Seeds were collected from Padugai along the coast of River Cauveri, Trichi.

Nature of species : This is a clustering, slender rattan, stem without sheaths to 1 cm in diameter.

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

Conservation status: Vulnerable (Renuka, 2001).

Uses: It is reported to be a very good quality cane but not available in sufficient quantities. Used in the furniture industry. Fruits are edible.

20. Calamus stoloniferus Renuka (Jedubetha). Acc.No. 127

Distribution: *C. stoloniferus* is endemic to forests at Makkut in south Karnataka and is seen in the evergreen forests at about 85 m asl (Renuka, 1992b).

Provenance collected: The seeds were collected from Makkut, Karnataka.

Nature of species : It is a clustering, stoloniferous, medium diameter rattan, stem without sheaths to 1.2 cm in diameter.

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

Conservation status: Vulnerable (Renuka, 2001)

Uses: A good quality cane (Bhat, 1992) and is used in the furniture industry, but not available in sufficient quantities.

21. Calamus tenuis Roxb. (Pani bet) Acc.No. 118

Distribution: *C. tenuis* is seen in the Sub – Himalayan hills and valleys of north and north eastern India. Its distribution extends to Bangladesh, Myanmar and South Vietnam. Common in lower hill valleys and seasonal swamps (Basu, 1992).

Provenance collected : The seeds were collected from Thripura.

Nature of species : It is a cluster forming slender rattan, stem without sheaths to 1 cm in diameter.

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

Conservation status: Considered as at 'Lower Risk' (Renuka, 2001).

Uses: One of the most commonly exploited canes in India. Used in the furniture industry. Ripe fruits and shoot tips are edible.

22. Calamus thwaitesii Becc. & Hook.f. (Pannichural, Thadiyan chural, Vandichural)

Acc. No. 125 (Acc. No. 125 Goa - Seeds collected from Goa, Acc. No. 125 Achencoil - Seeds collected from Achencoil, Acc. No. 125 Kulathupuzha - Seeds collected from Kulathupuzha, Acc. No. 125 Katilappara - Seeds collected from Katilappara, Acc. No. 125 Ariencavu - Seeds collected from Ariencavu).

Distribution: Seen through out the Western Ghats. This species grows in the evergreen, semi evergreen and moist deciduous forests between 75 to 900 m asl. Seen inside teak plantations also (Renuka, 1992b).

Provenance collected : Seeds were collected from different populations representing the variations. Populations represented are from Goa, Achencoil, Kulathupuzha, Katilappara and Ariencavu.

Nature of species : This is the thickest cane available in the Western Ghats. Very robust, clump forming, large diameter rattan, stem without sheaths to 3.5 cm in diameter. Definite variations were reported between the populations of northern and southern regions of W. Ghats (Renuka *et al.*, 1998). Among the populations of southern region also variations were noted in the diameter of the stem and in the nature and arrangement of spines on the leaf sheath.

Flowering: June – July. **Fruiting:** April – May.

Conservation status: Considered as at 'Lower Risk'(Renuka, 2001).

Uses: This is a very strong cane and graded as Class 1 (Bhat, 1992). Used extensively in the furniture industry. A good cane for making walking sticks and sports goods.

23. Calamus travancoricus Bedd. ex Becc. & Hook .f. (Arichural) Acc.No. 113

Distribution: This rattan is seen in the evergreen forests from 200 – 500 m asl in Kerala and Karnataka part of W. Ghats (Renuka,1992b).

Provenance collected : Seeds were collected from Ariencavu.

Nature of species : This is a very slender, clustering rattan, stem without sheaths to 0.4 cm in diameter. The cane is of very good quality but at present not available in sufficient quantities. Variation is noted in the size of the fruit in the populations seen at Moozhiyar in the Ranni Forest division.

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

Conservation status: It is reported to be ‘Vulnerable’ (Renuka, 2001).

Uses: Used in handicraft industries.

24. Calamus unifarius Wendl. var. **pentong** Becc. (Hara beth). Acc.No.103

Distribution: This species is reported from Great Nicobar and is seen in the evergreen forests (Renuka, 1995).

Provenance collected : The seeds were collected from a population near Galathea Wildlife Camp, Great Nicobar.

Nature of species : This is a solitary, medium diameter rattan, stem without sheaths up to 2 cm in diameter and green in colour when exposed. No variation is reported.

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

Conservation status: At Lower risk (Renuka, 2001).

Uses: Used locally in the furniture industry in a limited scale. This cane is not exploited much due to transportation problems from Great Nicobar to other islands and to the main land. Basu and Chakraverty (1994) report that the cane is not strong and durable. This cane was introduced to the Indian Botanic Garden in the year 1971 and it is seen from the cultivated specimens that the cane splits after drying.

25. Calamus vattayila Renuka (Vattayilayan, Ottaman) Acc.No. 126

Distribution: This species is very sporadic in occurrence even though it is seen throughout the W. Ghat region of Kerala and Karnataka. Generally seen in the evergreen forests between 200 to 750 m asl (Renuka, 1992b).

Provenance collected : Seeds were collected from Nilambur.

Nature of species : This is a single stemmed, medium diameter rattan, stem without sheaths to 1.8 cm in diameter and is a moderately strong cane (Bhat, 1992). No variation is noted so far among the different populations.

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

Conservation status: Vulnerable (Renuka, 2001).

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

26. Calamus viminalis Wild. (Jungli beth) Acc.No. 107

Distribution: This species is reported from Andhra Pradesh, north eastern states and Andaman islands. This species is common in the disturbed forest of low lying areas, in scrub jungles etc. It is seen even outside the forest (Basu, 1992; Renuka,1995).

Provenance collected : The seeds were collected from Wrightmyo, South Andamans.

Nature of species : It is a clustering, medium diameter rattan, stem without sheaths to 1.3 cm in diameter.

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

Conservation status: At Lower risk (Renuka, 2001).

Uses: Bhat *et al.*, (1996) reports this to be a moderately strong cane. Used extensively in the furniture industry and for basket making. Fruits and shoot tips edible.

27. Daemonorops kurzianus Becc. Acc.No. 104

Distribution: D. kurzianus is reported from S. Andaman islands and is widespread. This is seen in the evergreen forests as well as in the disturbed areas (Renuka, 1995).

Provenance collected : Seeds were collected from S. Andamans.

Nature of species : It is a clustering large diameter rattan, stem without sheaths to 4 cm in diameter. No variation is reported so far.

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

Conservation status: At Lower risk (Renuka, 2001).

Uses: Bhat *et al.*, (1996) classified this rattan as a very strong one. This is extensively used in the furniture industry. The leaves are used for thatching.

28. Daemonorops manii Becc. Acc.No. 105

Distribution: Reported from a small locality in South Andamans (Renuka, 1995).

Provenance collected : The seeds were collected from Wrightmyo, S. Andamans.

Nature of species : This is a clustering, medium diameter rattan, stem without sheaths 1.5 -2 cm in diameter.

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

Conservation status: Endangered (Renuka, 2001).

Uses: Cane used in the furniture industry, but not available in sufficient quantities.

29. Korthalsia laciniosa (Griff.) Mart. (Lal beth) Acc.No. 106

Distribution: This species is common in Andaman and Nicobar islands (Renuka, 1995).

Provenance collected : The seeds were collected from Mannarghat, S. Andamans.

Nature of species : This is a clustering, medium diameter rattan, stem without sheaths to 1.7 cm, branching. Not much variation is reported.

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

Conservation status: At Lower risk (Renuka, 2001).

Uses: Used in the furniture industry and for making walking sticks

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Rattan germplasm plot at Nilambur



Calamus huegelianus Mart.

Calamus baratangensis Renuka & Vijayakumaran



Calamus rotang Linn.



Calamus nagbettai Fernandez & Dey

Korthalsia laciniosa (Griff.) Mar

Calamus unifarius Wendl. Var., pentong

Damenorops kurzianus Becc.



Calamus andamanicus Kurz.



Calamus longesetus Becc.



Calamus palustris Griff.