RATTAN RESOURCES OF CHINA AND CURRENT STATUS OF CONSERVATION

Xu Huangcan, Zeng Bengshan, Yin Guangtian and Liu Ying

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FOREWORD

In the early 1960s, due to noticeable diminishing of rattan resources, the Chinese Academy of Forestry (CAF) initiated research at the Research Institute of Tropical Forestry (RITE), then located on Hainan Island. By the 1980s, it was clearly seen that there was a need to increase local rattan supplies, reduce imports and also ensure continuous employment for rural people involved with rattan. By 1985, the Ministry of Forestry strengthened research on rattan in association with the International Development Research Centre (Canada). A project, spanning a period of eight years was carried out by RITF in association with Sun Yat Sen University, South China Botany Institute and Yunnan Tropical Botany Institute.

In 1994, the International Plant Genetic Resources Institute (IPGRI), as part of joint INBAR - IPGRI (activities on genetic conservation of bamboos and rattans), requested RITF to carry out a survey on the rattan resources of China and the status of their conservation. The survey is summarized in this working paper.

Cherla B. Sastry
Director, INBAR

I.V. Ramanuja Rao
Principal Scientist, INBAR

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INTRODUCTION

Rattan is one of the important minor forest products in South China, especially in Hainan, Yunnan, Guangdong and Guangxi provinces, China has a substantial rattan based cottage and furniture making industry which employs 70,000 people, mostly in the south of the country. Nearly two thirds of the requirement of cane is imported from other cane producing countries, This dependency is expected to increase in the future as the demand for raw cane grows and local supplies diminish, The popular local cane, *Culumus hainensis, is* on the verge of extinction and urgent steps are required to conserve and promote rattan resources of China.

RATTAN RESOURCES

There are 41 species of rattans in China belonging to 3 genera: 36 in *Calamus,* 1 in Daemonorops and 4 in Plectocomia. They are distributed in 11 provinces across southern China from the SE coast to SW mountain areas to 29°30' N and in islands including Hainan, Hong Kong and Taiwan.

The distribution of rattans in the provinces is tabulated in Table 1. Analysis of the data shows that there are two centres where maximum diversity is found; one in the southeast, centred on Hainan, and the other in the southwest centred in Xishuangbanna.

In general, the rattans are usually found in the lowlands and mountain areas below 1800 m. They are found in diverse ecosystems but mostly in tropical mountain rainforests, tropical evergreen monsoon forests or secondary forests, although a few species can he found growing in tropical semi-deciduous monsoon forest and also in sub-tropical evergreen broad-leaved forest.

The climatic requirements of most species are annual temperatures of 19 - 25" C, more than 1300 mm annual rainfall (with R.H. 80%). Ecologically, they require ca. 50% shade from the forest canopy and fertile, damp soils with 1.2 - 4.9% humus and pH of 4.5 - 6.5.

Utilization of species

Most of the species (except for a few of Plectocomia and *Culamus)* have been utilized in China. In the past, the rattan supply has been entirely from the wild, and harvesting fell progressively from ca. 10,000 tonnes in 1950 to less than 4,000 tonnes by the 1980s. By 1994-95, this had increased to 6,500 tonnes, mainly from Hainan and Yunnan, but this increase was in part due to development of plantations. Emphasis was placed on plantation development of indigenous species: *Culumus* tetradactylus, a clustering, small-diameter cane; and *Daemonorops margatritae,* a clustering, medium to large-diameter cane, (Some experimentation has also been focussed to a lesser degree on indigenous C. egregius, a small to medium-diameter cane),

In Hainan, 30,000 ha of natural forest were interplanted with 20 million seedlings *by* 1980, but this was not overly successful. However, in Guangdong, Fujian and Guangxi, small-scale plantations, totalling 4,000 ha were more successful The three commercial species produced at least 18 tonnes/ha over a 20 year period.

The rattan industry is comparatively well developed and a variety of products are produced for local sale and export. By 1993, the value of products was over US $100 million, earning US $60 million in exports.

It is predicted that annual demand for supply could rise to 30,000 tonnes. At present much of the raw material is imported from Southeast Asia. However, since the ban on export from Indonesia, supplies from Myanmar, Vietnam, Laos and the possibilities of Papua New Guinea are being explored,

Conservation

In the mid 197Os, attention was given to conservation and the Virgin Tropical Forest Reserves were established at Jianfengling (Hainan) and at Xishuangbanna (Yunnan). RITF and the Yunnan Tropical Botanical Institute (YNTBI) started research on the ecological and biological characteristics of rattans.

Some ex situ collections were established, as part of the IDRC project, and these are located at RITF, Guangzhou, at Jianfelgling (Hainan), and at the Xishuangbanna Botanical Garden (Yunnan). In the main, these collections represent species and distinct botanical varieties, rather than broad genetic variation (Table 3).

RITF, in 1989, initiated research on in vitro culture of 8 species. Of these, cultures of C. egregius, C. .simplifolius and D. murgairitue have been maintained without need for subculture and still remains healthy and totipotent, with no obvious sign of mutations, It appears therefore that in vitro conservation is feasible.

Table 1. Distribution of rattan species in China

Species	Distribution										
	Hai	Gud	Gux	Fuj	Jia	Hun	Tai	Gui	Yun	Xiz	Zhe
I. ***Daemonorops***											
D. magaritae (Hance) Becc.	+	+	+	•					•		
II. ***Calamus***											
C. thysanolepis Hance		+		+	+						+
C. thysanolepis Hance var. *polylepis* Wei		+									
C. holites Dunn		+		+	+	+					
C. dianbaiaensis Wei		+	+								
C. yangchunensis Wei		+									
C. guangxiiensis Wei			+								
C. erectus Roxb.									+		
C. erectus Roxb. var. *birmaninus* Becc.									+		
C. oxycarpus Becc.				+				+			
C. macrorrhynchus Burret			+	+				+			
C. tonkinnensis Becc.			+								
C. walkerii Hance		+	+								
C. faberii Becc.		+									
C. faberii Becc. var. *brevispicatus* (Wei) Pei & Chen			+								
C. multispicatus Burret		+									
C. henryanus Becc.					+				+		
C. balansaeanus Becc.		•	+					+			
C. balansaenus Becc. var. *castaneolepis* (Wei) Pei & Chen		•	+								
C. pulchellus Burret		+									
C. tetradactyloides Burret		+	•								
C. melanchrous Burret				+							
C. formosanus Becc.							+				

Table 1. Contd.

Species	Distribution										
	Hai	Guad	Guex	Fuj	Jia	Hun	Tai	Gui	Yun	Xiz	Zhe
C. rhabdocladus Burret	+	+	+	+				+	+		
C. rhabdocladus Burret var. *globulosus* Pei & Chen	+	+							+		
C. viminalis Wild.var. *fasciculatus* (Roxb.) Becc.									+		
C. floribundus Griff.										+	
C. tetradactylus Hance	+	+	+	+					+		
C. bonianus Becc.	+	+	+	+					+		
C. yunnanensis Pei & Chen									+		
C. yunnanensis Pei & Chen var. *densiflorus* Pei & Chen									+		
C. yunnanensis Pei & Chen var. *intemedius* Pei & Chen									+		
C. feanus Becc. var. *medogenisis* Pei & Chen										+	
C. acanthospathus Griff										+	
C. flagellum Griff			+						+		
C. flagellum Griff. var. *furvifurfuraceus* Pei & Chen									+		
C. gracilis Roxb	+								+		
C. karinensis (Becc.) Pei & Chen									+		
C. compsostachys Burret.		+									
C. distichus Rild. var. *shungsiensis* Pei & Chen			+								
C. uvalong Pei & Chen									+		
C. giganteus Becc. var. *longistachys* Pei & Chen										+	
C. palustris Griff. var. *cochinchinensis* Becc.										+	
C. nambariensis Becc. var. *jingjiangensis* Pei & Chen										+	
C. nambariensis Becc.var. *alpinus* Pei & Chen										+	
C. nambariensis Becc. var. *xishuangbannaensis* Pei & Chen										+	
C. nambariensis Becc. var. *menglongensis* Pei & Chen										+	

Table 1. Contd.

Species	Distribution										
	Hai	Gud	Gux	Fuj	Jia	Hun	Tai	Gui	Yun	Xiz	Zhe
C. nambariensis Becc. var. *furfuraceus* Pei & Chen									+		
C. nambariensis Becc.									+		
C. obovoideus Pei & Chen									+		
C. platyacanthus Warb. ex Becc.									+		
C. platyacanthus Warb. ex Becc. var. *mediostachys* Pei & Chen									+		
C. austro-guangxiensis Pei & Chen			+								
C. orientalis Chang							+				
C. simplicifolius Wei	+	•	•	•							
C. egregius Burret	+	•									
C. siphonospathus Mart. var. *sublaevis* Becc.							+				
III. *Plectocomia*											
P. microstachys Burret									+		
P. himalayana Griff.									+		
P. assamica Griff.									+		
P. kerrana Becc.									+		
Total genera	3	2	3	1	1	1	1	1	3	1	1
Total species	14	12	11	4	1	1	3	4	15	3	1

The symbols + and • in the table indicate distribution and cultivation, respectively:

Hai : Hainan province
Gux : Guangxi province
Hun : Hunan province
Gui : Guizhou province
Xiz : Xizang province
Gud : Guangdong province
Fuj : Fujian province
Tai : Taiwan
Yun : Yunnan province
Zhe : Zhejian province

INFORMATION ON SPECIES

Distribution of rattan species in China is shown in Table and herbarium specimens are listed in Table 2. Notes are provided below on 6 species, followed by a note on the potential of these species.

1, CALAMUS TEIRADACTYLUS HANCE

Hance in Journ, Bot. 13: 289-290 (1875); Beccari in Ann. Roy. Bot. Gard. Calcutta, 1 l(1): 281-283 (1908); Burret in Notizbl. Bot. Gard, Berlin, 13: 595 (1937); C.F.Wei in Guihaia, 6(1/2): 33 (1986); S.J.Pei and S.Y. .Chen in Flora Reipuhlicae Popularis Sinicae, 13(1): 88-89 (1991)

A detailed description of the plant is provided by Xu and Yin in Dransfield and Manokaran (1994). No botanical varieties have been identified. It is widespread in southern China, in Hainan Island and the southern part of Guangdong, Guangxi and Fujian provinces south of latitude 20" 30' N, and also in Hong Kong.

It has been introduced in west Guangxi, south Yunnan, central Fujian and Guangdong and is cultivated in small scale plantations, with a total growing area of 200,000 square km..

Ecology

This is a lowland species, but occurs on hill slopes below 600 m in tropical and subtropical broad-leaved forests. In tropical monsoon rainforests at Jianfengling (Hainan), its frequency is 800 clumps/ha. Although, it is found in wet hollows and mountain valleys, it cannot with-stand flooding.

Diversity

The richest diversity is found at Ledong, Dongfang county and in Lingshui county of Hainan. In situ conservation areas have been established, However there is a need to identify superior genotypes,

Plantations

Propagation is usually by seed but suckers can be used, Seeds are grown in shaded sand beds. After 50-70 days, the seedlings are transplanted into potting hags and kept in the nursery until 15-18 months when with 7-9 leaves, these can be planted in the field. Planting should be carried out in the rainy season. Commercial planting can be at spacings of 1x3, 2x3 or 1x4 m. In small holdings, the plants can be used in agroforestry.

Harvesting is possible 6-7 years after planting, giving yields of ca. l-2 tonnes/ha with a value of 4,200 Yuan RMB. A second harvest is at 11 years after planting, with yields of 1.0-I .5 tonnes/ha and thereafter even 3-6 years but not beyond ca. 25years. Over a 25 year period, up to 6 tonnes/ha is obtained with a value of 36,000 Yuan RMB. The benefit cost return is ca. 1.71, and the internal rate of return is 26%. There is potential to more than double the yields cited above.

Table 2. Herbarium information on the selected rattan species

Scientific Name	Vernacular	Place of Collection	Number of Collection	Name of Collector
1. *Calamus tetradactylus*	Baiteng (generally known as white rattan throughout southern China) called as Jiteng in Hainan	Hainan Province:		
		Baoting;	28077	X.Q. Liu
		Baoting;	71779	K. Z. He
		Yaxian;	70983	K. Z. He
		Yaxian;	44536	J.R. Zhuo
		Jianfengling, Ledong;	7	H.F. Zhong
			10066	G.T. Ying
		Jianfengling, Ledong;	10125	G.T. Yin
			13307	H.C. Xu
		Chegjiao;	12171	J.G. Fu
		Wenchang;	10054	Y.D. Li
		Ledong;	12165	H.Y. Wang
		Shanya;	12177	H.Y. Wang
		Bawangling;	12182	H.Y. Wang
		Nankai, Baisha;	12186	H.Y. Wang
		Qizhiling, Baoting;	12187	H.Y. Wang
		Wanning;		S.Q. Chen
		Hanlin, Dingan;	7531	L. Deng
		Dengmai;	3826	Z. Huang
		Guangdong	41721	Z.F. Wei
		Province;	733012	
		Xuwen;	123177	S.Z. Zhang
		Xuwen;		
		Hailing, Yangjiang;	13268	S.R. Liang
		Dawanshan,	69411	S.F. Liang
		Zhuhai;	35271	W.L. Zhang
		Xiaoliang, Dianbai;	11279	Q.X. Zhonf
		Guangxi Province;	809165	
		Shangxi;		
		Bubai;		
		Bubai;		
		Nalin, Bubai;		
		Luchuan;		
		Bubai;	69411	S.R. Liang
		Bubai;	35271	S.F. Liang
		Nalin, Buhai;	11279	W.L. Zhang
		Lushuan;	809165	Q.X. Zhong
		Fujian Province;		H.C. Xu
		Yunxiao;	88345	H.C. Xu
		Zhaoan	88346	

Table 2. Contd.

Scientific Name	Vernacular	Place of Collection	Number of Collection	Name of Collector
2. *Calamus tetradactyloides*	Duoci Jiteng; Gaoshan Jiteng;	Hainan Province: Yaxian; Yaxian; Yaxian; Jianfengling Ledong Jianfengling Ledong Jianfengling Ledong Jianfengling Ledong Jianfengling Ledong Bawanglin, Changjiang; Shanqu, Dongfang;	 33367 61972 62713 34 506 11076 11069 10006 10065	 C. Wang H.Y. Liang H.Y. Liang H.F. Zhong D.C. Zhu W.L. Zhang Y.D. Li W.L. Zhang G.T. Yin
3. *Calamus palustris*	Zhesheng	Yunnan Province;		
3a. var. *palustris*	Teng	Mengla;	18866	S.Y. Chen
3b. var. *longistachys*	Changsui Shengteng	Yunnan Province; Mengla;	18865	S.Y. Chen
3 c. var. *cochinchinensis*	Dianyue; Shengteng	Yunnan Province: Shangyong, Mengla; Laojushan; Xishangbala;	 12001 18974 11414	 Z.H. Yang S.Y. Chen W.L. Zhang
4. *Calamus nambariensis.*				
4a. var. *nambariensis*				
4b. var. *yingjianensis.*	Yingjiang Shengteng	Yunnan Province: Tongbiguan, Yingjiang; Tongbiguan, Yingjiang; Tongbiguan, Yingjiang; Tongbiguan, Yingjiang;	 17907 17914 17907 13370 13369 18952 723 11208-3 10247-3 10248-1	 G.D. Tao G.D. Tao G.D. Tao G.D. Tao G.D. Tao S.Y. Chen S.Y. Chen G.T. Yin G.T. Yin G.T. Yin

Table 2. Contd.

Scientific Name	Vernacular	Place of Collection	Number of Collection	Name of Collector
4c. var. *alpinus*	Gaodi Shengteng	Yunnan Province: Nangongshan, Mengla; Jinghong; Mengla; Mengla; Menglong; Huanglianshan, Luchun Mengsong; Mengsong; Xishangbanla	14287 18954 18985 - 1 18985 - 2 32890 621 760 19000 1124 - 4	S.J. Pei G.D. Tao S.Y. Chen S.Y. Chen S.Q. Tong S.Y. Chen S.Y. Chen S.Y. Chen W.L. Zhang
4d. var. *xishuangbannaensis*	Banla Shengteng	Yunnan Province: Menglong, Jinghong;	14324	S.Y. Chen W.L. Zhang
4e. var. *menglongensis*	Menglong Shengteng	Yunnan Province: Menglong; Jinghong, Menglong, Jinghong;	19991 622	G.D. Tao S.Y. Chen
5. *Calamus platycanthus*				
5a. var. *platyacanthus*	Kuanci Teng, Kuanci Shengteng	Yunnan Province: Mingla; Jinghong; Xishangbanla; Xishangbanla; Xishangbanla;	776 35 11204 - 1 11205 - 1 11239 - 5	S.Y. Chen S.Y. Chen W.L. Zhang W.L. Zhang W.L. Zhang
5b. var. *mediostachys*	Zhongsui Shengteng	Yunnan Province: Yaoqu, Mengla; Yaoqu, Mengla; Yaoqu, Mengla; Jinghong;	12406 12476 12905 8929	Z.H. Yang Z.H. Yang Z.H. Yang S.J. Pei
6. *Calamus viminalis*,				
6a. var. *viminalis*				
6b. var. *fasciculatus*	Mengpeng Shengteng	Yunnan Province: Mengpeng, Mengla; Mengpeng, Mengla; Mengpeng, Mengla; Yingjiang; Xishangbanla;	18961 18964 18994 - 1 17880 11216 - 5	S.J. Pei S.Y. Chen S.Y. Chen G.D. Tao W.L. Zhang

2. ***C TE7RADACTYLOIDES***
Burret in Notizbl. Bot. Berlin, 3: 596 (1937)

This slender, clustering species climbs to 10 m or more. The stem is up to 5 mm in diameter without leaf sheaths, and stalks are up to 10 mm in diameter. The leaf is up to 50 cm long (including the sheath); there is no leaf cirrus and sheaths are densely armed with hair-like spines. There are 4-10 leaflets on each side of the rachis and 4 in a group at the apex, The ripe fruit is l-seeded, generally rounded, 6-8 mm in diameter. The fruits weigh 890-l 16O/kg, each seed weighing ca, 0.25 g.

This species is endemic to Hainan Island and is restricted to the mid-mountain area. It has been introduced to arboreta in Guangdong province.

Ecology

C. tetradactyloides usually occurs in the mountain rainforest between 800 and 1,000 m, the annual rainfall is more than 2,500 mm, and the mean annual temperature is ca, 20° C, but in the winter the maximum air temperature is ca.3° C, Soils are rich, moist, red-yellow with humus content more than 6.5% and pH 5.5-6.5. Its frequency in natural populations varies from 2,590 to 3,950 clumps/ha.

3. *C. PALUSTRIS*

Griffith in Ann. Roy. Bot, Garden, Calcutta, 11: 405 (1908); Griffith in Calc. J. Nat. Hist., 5: 61 (1866), Griffith in Palms of British India: 7 I (1850).

A detailed description of the plant is provided by Manokaran in Dransfield and Manokaran (1994). It is distributed from Myanmar and southern China to Malaysia and the Andaman Islands of India. In China, it is only found in south and south-eastern Yunnan Three botan ical varieties have been recognized:

var. plaus tris Griff

var. *longistachys* S.J. Pei and S.Y. Chen in Acta Phytotax. Sin., 27: 138 (1989). This variety is characterised by the male inflorescence being very long, and the second inflorescence is also longer than the typical types.

var. *cochinchinensis* Beccari in Bot, Sur, Ind., 2:21 (1902) and Ann, Roy. Bot. Gard. Calc., 11:405 (1908); see also S.J. Pei and S.Y. Chin, Acta Phytotax. Sin., 27: 138 (1989). This variety possesses a slender stem and fewer leaflets, The female inflorescence is short and the fruit smaller, This variety also occurs in Vietnam and Laos.

Ecology

This species occurs in mountain tropical rainforest between 600 and 900 m where the mean annual temperature is 19-50" C, and annual rainfall is 1200-2400 mm. However, only a few plants are found in natural habitats. In many parts of its broader range, occurrences are anthropogenic, It grows well in rich, moist soil with pH 5,5.-6.5 and requires about 50% light.

Diversity

In China, diversity is found in the counties of Mengla, Jinghong and Menghai of Yunnan. Some *ex situ* collections are maintained in RITF, YNTBI and Minglun Botanical Garden

4. *C. NAMBARIENSIS*

Beccari in Ann. Roy. Bot. Gard. Calc., 11: 433 (1908). Botanical varieties have been described by S. J. Pei and S. Y. Chen in Acta Phytotax. Sin., 27: 140-141 (1989).

This clustering, moderate-sized species has stems climbing to 25 m or more. Stems without leaf sheaths are 12-1 5 mm in diameter, with sheaths of 30-40 mm, The internodes are up to 40 mm long, leaves up to 3 m long and leaf cirrus up to 1 m long. Leaflets are about 60 cm long x 4.0-55 cm wide; 2-4 leaflets are usually grouped. The male inflorescence branch up to 3 orders. These are about 1-3 m long, with 6-7 branches, The female inflorescence branch up to 2 orders, and are about 1 m long. Fruits are rounded or ovoid (ca. 25 mm diameter) and are covered with 21-26 vertical rows of scales, There are 190-210 fruits/kg; seeds weigh ca. 1.76 g.

The species is distributed in northern India. The typical variety is not found in China but the following varieties are found in Yunnan:

var. *jingjiungensis* Pei and Chen.

var. *alpinus* Pei and Chen with shorter node inflorescences with 3-6 branches and few and scattered flowers.

var. *xishuangbannensis* Pei and Chen with 2 1 leaflets grouped at regular distances and lower number of fruits/kg (160-180) but with heavy seeds (ca. 1,98 g).

var. *menglongensis* Pei and Chen with more densely spiny leaf sheaths.

Ecology

The species occurs between 1400 and 1900 m in evergreen broad-leaved forest at densities of 45 to 100 clumps/ha. Var. *jingjiangensis* grows at slightly lower altitude (1359-1450 m). Annual average temperature is 17-21° C, annual rainfall from 1200-2400 mm, Soils are rich and pH 5.5-6.5.

Diversity

Var. *jingjiangensis* is found in Yingjiangenis Tongbiguan, Yingjianag county in SW Yunnan; and other varieties are found in Ni Clan village, Mingsong county, Huangliansan Nature Reserve, Luchan county and Minglong Jinghang county in Xishhangbanna region of S. Yunnan. *Ex situ* specimens are maintained in RITF and YNTBI,

5. C. PLATYACANTHUS

Worb. ex Beccari in Ann. Roy. Bot. Gard, Calc., 11: 422 (1908). A variety is described by S.J. Pei and S.Y. Chen in Flora Repub. Popularis Sin., 13: 106-107 (1991): This clustering moderate-sized species rarely forms dense clumps and climbs to 40 m or more. Leaves are up to 2.5 m long with a cirrus 1.0 m long. Leaflets are in groups of 2-4 . Male and female inflorescences are similar, branching to 2 orders. Fruits are 13x22 mm covered with 18 vertical rows of scales, and have seeds measuring 12x7 mm.

Var. *mediotachys* Pei and Chen produces a more branched inflorescence and bears less fruit. The species is distributed in China (Yunnan) and Vietnam but var. *mediostachys* is limited to southern Yunnan.

Ecology

The species is found in mountain tropical rainforests and up to 700-800 m, where air temperature is 17-20° C and there is over 1300 mm rainfall. Soils have high humus and a of 5-6.

Diversity

Jinghong and Minglong counties in Xishangbanna region of southern Yunnan are areas of diversity. Some material is maintained in RITF, YNTBI, and at the Experimental Centre of Tropical Forest in western Guangxi province.

6. *C. VIMINALIS*

Willd. in Sp. P1.2: 203 (1799)s ee also Beccari in Bot. Surv. Ind., 2: 203 (1902) and in Ann Roy. Bot. Gard, Calc., 11: 202 (1908).

This moderate-sized species climbs to 30 m or more, Stems are of small diameter, 12-15 mm without leaf sheaths. Leaves have no cirrus and the leaf is up to 1.5 m long. Then leaflets are regularly damaged. Fruits are round, one seeded, 10-13 in mm diameter and are covered in 18-20 vertical rows of scales. Seeds weigh ca. 0.13 g.

The species is found in Peninsular Malaysia, Thailand, Sumatra, Java, Bali, India, Bangladesh, Myanmar and Indo-China. In China var. *fasciculatus Becc.* is found in southwest and southern Yunnan.

Ecology

In China, the species is found in mountain tropical rainforest and in evergreen broad-leaved forest between 800 and 1000 m. Elsewhere, e.g. in Indonesia it is found in lowland and in Java, in submaritime Savannah. In China, ecology of the species is similar to C. *namhariensis.*

Diversity

In Yunnan diversity is found in Yingjiang and Menglong counties. Some stocks are maintained by YNTBI.

7. POTENTIAL OF THE SPECIES

Of the species noted above, C. *tetradactylus* has become a major commercial species in China. Daemonorops margaritae and C. *simplicifolius* are also commercial. *C.egregius,* a good quality species in China, has proved successful on a small scale, hut expanded cultivation will depend on ‘rapid vegetative propagation.

Basic data has been gathered on cultivation and potential of the other species: C. *playacanthus* shows potential; C. *tetradactyloides is* probably of low potential; C. *nambariensis* and C. *viminalis* may be widely planted by villagers but agronomy and enhanced use has not been studied in depth. C. *Palustris* has not been studied in great depth in China, although INBAR has recently considered this to he one of the highest priority species for commercialization.

Many other species such as C. yunnanensis, C. rhabdocladus and C. wailong have been traditionally cultivated in indigenous systems. Emphasis has to he placed on a limited number of species, although conservation of traditional production systems is also important and will require research.

After decades of focussed research on rattans, that has provided knowledge on a broad front, it is almost certain that new steps have to he taken, including the move to selection of superior genotypes and mass propagation.

Current efforts on genetic conservation are outlined in Table 3. Several minor species are maintained as specimens in ex *situ* reserves and 10 are being researched for *in vitro* storage.

Table 3. Current genetic conservation of rattans (including introduced species)

Conservation Species	*In Situ*	*Ex Situ*		*In Vitro*		
	Site	Sur.	Site	Cult. Type	Storage duration (months)	Lab.
Plectocomia microstachys	JFLOTER, HN	+	ESTF, HN			
P. kerranna		+	RITF, GZ			
P. jenkinsiana		+	RITF, GZ	Shoot	12	RITF
Daemonorops mollis		+	RITF, GZ			
Calamus tetradactylus	LDYM, HN	+	RITF, GZ	Multiple Shoots	6	RITF
C. egregius	JFOTER, HN	+	RITF, GZ	Shoots	12	RITF
C. simplicifolius	JFOTER, HN	+	ESTF, HN RITF, GZ	Shoots	12	RITF
C. dioicus		+	ESTF, HN RITF, GZ	Multiple Shoots	7	RITF
C. ornatus		+	RITF, GZ	Plantlets	9	RITF
C. merrillii		+	RITF, GZ	Plantlets	6	RITF
C. gracilis	XSBNTBG, YN	+	ESTF, HN	Shoots	4	YNTBI
C. yunnanensis var. *densiflorus*	XSBNTBG, YN	+	RITF, GZ	Shoots	4	YNTBI
C. yunnanensis var. *xishangbanaensis*	XSBNTBG, YN	+	RITF, GZ	Shoots	4	YNTBI
C. obovoideus	XSBNTBG, YN			Shoots	4	YNTBI
C. guangxiensis		+	RITF, GZ			
C. manillensis		+	RITF, GZ			
C. autralus		+	RITF, GZ			
C. thwaitesii		+	RITF, GZ			
C. huegelianus		+	RITF, GZ			
C. compsostachys		+	RITF, GZ ESTF, HN			
C. melanoloma		+	RITF, GZ			
C. yuangchunensis		+	RITF, GZ			
C. melanochrous		+	RITF, GZ			
C. thysanolepis		+	RITF, GZ			
C. tonkinensis		+	RITF, GZ			
C. dianbaiensis		+	RITF, GZ			
C. khasianus		+	RITF, GZ			
C. caesius		+	RITF			
C. jagensis		+	RITF			

Table 3. Contd.

Conservation Species	*In Situ*	*Ex Situ*		*In Vitro*		
	Site	Sur.	Site	Cult. Type	Storage duration (months)	Lab.
C. viminalis var. *fasciculatus*		+	RITF, GZ XSBN, YN			
C. nambariensis var. *xishangbannaensis*	Mingsong, YN	+	RITF, GZ XSBN, YN			
C. nambariensis var. *menglonggensis*	Mingsong, YN	+	XSBN, YN			
C. nambariensis var. *alpinus*	Mingsong, YN	+	XSBN, YN			
C. nambariensis var. *longistachys*		+	XSBN, YN			
C. nambariensis var. *yingjiangensis*		+	RITF, GZ XSBN, YN			
C. flagellum		+	RITF, GZ			
C. palustris		+	RITF, GZ XSBN,YN			
C. distichus var. *shangsiensis*		+	RITF, GZ			
C. balansaeanus var. *castaneolepis*		+	RITF, GZ			
C. combojensis		+	RITF, GZ ESTF, HN			
C. tetradactyloides	JFLOTER, HN	+	RITF, GZ ESTF, HN			
C. pulchellus		+	RITF, GZ ESTF, HN			
C. faberii	JFLOTER, HN	+	ESTF, HN			

Notes :

RITF, GZ : Research Institute of Tropical Forestry, Guangzhou
YNTBI, YN : Yunnan Tropical Botanical Institute, Yunnan
ESTF, HN : Experiment Station of Tropical Forestry
JFLOTER : Jianfengling Original Tropical Forest Reservation
XSBNTBG : Xishangbanna Tropical Botanical Garden

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