International Tropical Timber Organization (ITTO)

Project Technical Report

ITTO PD 100/01 Rev. 3 (I)

Capacity building for the development of a sustainable rattan sector in China based on plantation sources (2003-2009)




ICBR

International Centre for Bamboo and Rattan (ICBR)
State Forestry Administration
People's Republic of China

April 2010
Beijing, P R China

1. Project Identification

* Project Number: PD 100/01 Rev. 3 (I)
* Starting Date of the Project: August 1, 2003
* Actual Duration (months): Sixty six (66) months
* Project Costs (US$): 983,582
* Type of the Report: Project Technical Report

2. Project technical and scientific staff

* Project consultancy group:	Prof. Peng Zhenhua, Beijing, China
	Prof. Chen Xuhe, Beijing, China
	Prof. Wang Kanlin, Kunming, China
	Dr. Lee Ying Fat, Sabah, Malaysia
* Project director:	Prof. Jiang Zehui, Beijing, China
* Assistant project director:	Dr. Huang Shineng, Guangzhou, China
* Director of project mgt. office:	Dr. Sun Qixiang, Beijing, China
* Financial officer:	Ms. Li Lan, Beijing, China
* Main contributors[1]:	Prof. Jiang Zehui, ICBR, Beijing
	Prof. Wu Yuzhang, ICBR, Beijing
	Prof. Fei Benhua, BFMRI, Beijing
	Prof. Cai Denggu, CAF, Beijing
	Dr. Ren Haiqing, CAF, Beijing
	Dr. Huang Shineng, RITF, Guangzhou
	Prof. Yin Guangtian, RITF, Guangzhou
	Prof. Xu Huangcan, RITF, Guangzhou
	Dr. Yang Hua, RITF, Guangzhou, China
	Dr. Li Rongsheng, RITF, Guangzhou, China
	Dr. Yang Jinchang, RITF, Guangzhou, China
	Mr. Zou Wentao, RITF, Guangzhou, China
	Mr. Xian Guangyong, RITF, Guangzhou
	Ms. Zhao Xia, RITF, Guangzhou, China
	Ms. Zheng Yi, RITF, Guangzhou

[1] Please refer to the specific paper for the institution's full name and address. Staff members who did not contribute to the papers collected herein are not listed.

Dr. Zeng Bingshan, RITF, Guangzhou
Mr. Feng Changlin, ECTF, Guangxi, China
Mr. Guo Wenfu, ECTF, Guangxi, China
Dr. Lu Wenhua, CRIWI, Beijing
Dr. Wang Yurong, CRIWI, Beijing, China
Dr. Huang Xuemei, SCAU, Guangzhou
Mr. Niu Guocai, SCAU, Guangzhou
Dr. Lee Ying Fat, Shaba, Malaysia

3. Implementing agency:

International Centre for Bamboo and Rattan (ICBR)
No.8, Futong Dongdajie, Chaoyang District
Beijing 100102, P R China
Tel: +86-10-6472 8877
Fax: +86-10-8471 3704
Email: jiangzehui@forestry.ac.cn or hsn@ritf.ac.cn

4. Issued place and date:

Beijing, P R China; April 30, 2009

5. Disclaimer:

ACKNOWLEDGEMENTS

The International Centre for Bamboo and Rattan (ICBR) gratefully acknowledges the International Tropical Timber Organization (ITTO) for its support of the Project, *Capacity building for the development of a sustainable rattan sector in China based on plantation sources*. ICBR, as the Executing Agency of the Project, extends its deep appreciation to the individuals serving on the Project Implementation Team (PIT), the Project Steering Committee (PSC), the Project Technical Committee (PTC) and the Technical Consultancy Group (TCG) for their significant contributions of time, talent and ideas in the conduct and successful completion of the project. Membership lists of these three groups were included in the previous Project Progress Reports and in the Project Completion Report.

ICBR further acknowledges the work of the following individuals for their leadership and contributions to the final report and other project products: Dr. Huang Shineng, Research Institute of Tropical Forestry (RITF) of the Chinese Academy of Forestry (CAF), who assisted me in managing the project as the Assistant Project Director; Dr. Sun Qixiang, CAF's Research Institute of Forestry, served as the director of the Project Management Office; Prof. Peng Zhenhua, CAF, who served as the leader of TCG; Prof. Chen Xuhe, ICBR, who served as the chair of PTC; and Ms. Li Lan, ICBR, who served as the financial officer of the project.

Gratitude and appreciation are also extended to Dr. Manoel Sobral Filho, Dr. Emmanuel Ze Meka, Dr. Hwan Ok Ma, Dr. Tetra Yanuariadi, Mr. Ramon Carrillo and Dr. Lauren E. Flejzor of ITTO and the dedicated officials of the Ministry of Commerce, the State Forestry Administration and the Guangzhou Municipal Forestry Administration of China for their constant guidance, input and support, and to all collaborating institutions and individuals who contributed significantly to project implementation.

Prof. Jiang Zehui

Project Director, PD 100/01 Rev. 3 (I)

& Director General, ICBR

LIST OF ACRONYMS

BFMRI	Beijing Forestry Machinery Research Institute of CAF
CAF	Chinese Academy of Forestry
CNY	Chinese Yuan (Renminbi)
CRIWI	Research Institute of Wood Industry of CAF
EA	Executing Agency
ECTF	Experimental Center of Tropical Forestry of CAF
FAO	Food and Agriculture Organization of the United Nations
ICBR	International Centre for Bamboo and Rattan
INBAR	International Network for Bamboo and Rattan
ITTO	International Tropical Timber Organization
MOFCOM	Ministry of Commerce of the People's Republic of China
PD	Project Document, Project Director
PMO	Project Management Office
PRC	People's Republic of China
PSC	Project Steering Committee
PTC	Project Technical Committee
RITF	Research Institute of Tropical Forestry of CAF
SCAU	South China Agricultural University
SFA	State Forestry Administration of the People's Republic of China
WWF	World Wide Fund for Nature

TABLE OF CONTENTS

7. Physiological changes in fresh-cuts of *Daemonorops margaritae* shoots during storage at low temperature by *Zhang Jujun, Huang Shineng, Zhao Xia* et al.
8. A preliminary study on processing techniques for canned *Daemonorops margaritae* shoots by *Zhao Xia, Huang Shineng, Xian Guangyong* et al.
9. The effects of different storage temperatures on POD, PPO and CAT activities of *Daemonorops margaritae* shoots by *Zhao Xia, Zheng Yi, Huang Xuemei* et al.
10. Study on physiological and biochemical changes and preservation of fresh-cut *Daemonorops margaritae* shoots by *Zhang Junjun* (abstract of 86 pages Master's thesis)
11. Studies on the antioxidation activity of *Daemonorops margaritae* shoots by *Niu Guocai* (abstract of 48 pages Master's thesis)

PART IV: Management of Cane Producing Rattan Plantations in Natural Secondary Forests and in Tree Plantations

1. A comparison of planting effect of tube seedling and normal seed seedling of *Calamus simplicifolius by Yang Jinchang, Yin Guangtian, Zeng Bingshan* et al.
2. An analysis of growth character of tissue culture families of *Calamus simplicifolius by Yang Jinchang, Xu Huangcan, Yin Guangtian* et al.
3. The density effect of *Daemonorops margaritae* plantation *by Yang Jinchang, Xu Huangcan, Yin Guangtian* et al.
4. Application of five growth equations to establishing growth models for *Calamus simplicifolius* and *Daemonorops margaritae* plantations *by Yang Jinchang, Yin Guangtian, Li Rongsheng* et al.
5. Effects of tree canopy adjustments on the early growth performance of *Daemonorops margaritae by Zhao Xia, Huang Shineng, Xian Guangyong* et al.

PART V: Harvesting and Cane Property

1. Effect of different harvesting regimes on economic benefit of interplanting *Daemonorops margaritae* with *Pinus massoniana* plantation *by Yang Jinchang, Yin Guangtian, Li Rongsheng* et al.
2. Review of rattan cane properties *by Jiang Zehui, Lu Wenhua, Ren Haiqing* et al.

PREFACE

This report is an up-to-date collection of the research, findings and recommendations resulting from the Project, *Capacity building for the development of a sustainable rattan sector in China based on plantation sources*, supported by ITTO and authored by ICBR, the Executing Agency of the Project, and collaborators. The objective was to compile and synthesize the information available on the capacity building of China's rattan sector.

This report has benefitted from the significant inputs and collaboration of numerous partners that comprised the different groups of people acknowledged above. Although only the technical notes and research papers that had been published in sci-tech journals and/or presented in relevant symposia/workshops were collected, the findings and recommendations address data and information gaps and needs, and provide valuable information for guiding the next steps in the process of developing a sustainable rattan sector in China. ICBR believes that more valuable papers can be anticipated with the continuing summing-up of the project work.

As an assembly of different contributions, the writing style of this report could not fully follow the ITTO standard format for Project Technical Report. Nevertheless, this report, and the project's many associated components, provides a wealth of information about the approaches to capacity building in China's rattan sector. Report appendices, which include technical reports generated by the project, are also available at www.chinarattan.org.

Prof. Jiang Zehui
Project Director, PD 100/01 Rev. 3 (I)
& Director General, ICBR

PART I:

General Issues

1. A Review of current research and development on rattan *by Y. F. Lee & Huang Shineng*
2. Report on rattan study tour to Thailand *by Huang Shineng*
3. Report on rattan study tour to Malaysia *by Huang Shineng, Zhao Xia, Yang Jinchang* et al.
4. Study tour report on rattan sector in Indonesia *by Li Rongsheng*

A REVIEW OF CURRENT RESEARCH AND DEVELOPMENT ON RATTAN

Y.F. LEE & HUANG SHINENG

Abstract: Current and recent research and development (R&D) in the rattan sector is discussed in this paper. Emphasis is given to the East and South-east Asian regions. The priority areas of R&D in the following fields are suggested: rattan biology, rattan cane production, cane processing and manufacturing, production of edible shoots, socio-economic issues, institutional and policy framework, and extension. The critical problem of lack of sustainability of rattan resource caused by the depressed price of cane in the international market, particularly in East and South-east Asia, is discussed in detail, and ways of overcoming this problem are proposed. This review complements several reports on the status of the rattan sector has been prepared by experts in the recent past.
Key words: Rattan, research and development, review,

1. INTRODUCTION

Rattans are spiny climbing palms which belong to the subfamily *Calamoideae* and are found in the tropical and subtropical forests of Asia, Africa, Australia and the Western Pacific. There are 13 genera and 600 known species of rattan (Uhl & Dransfield 1987).

Rattan is the raw material for the cane furniture industry, and is also used widely in matting, cordage, construction, basketry and thatching. In several parts of East and South-east Asia, several species are cultivated for their edible shoots. Rattan provides sustainable income to some of the most disadvantaged segments of people living in and on the fringes of forests. The global rattan industry is worth over US$7 billion per annum (Sastry 2002). It has been estimated that 0.7 billion people in the world use or are involved in the trade of rattan and rattan products (Sastry 2002).

This paper gives an overview of the current and recent research and development (R&D) in the rattan sector, drawing on the experience that has been comprehensively documented in Dransfield *et al.* (2002), and reviews reports published mainly from about 2000 onwards. From this review, gaps in knowledge are identified. As the authors' experiences are mainly restricted to East & South-east Asia, the recommended strategies and priorities of research are generally applicable to this region, and may not necessarily be valid in some cases to other parts of the world.

2. RECENT REVIEWS ON RATTAN R&D

Comprehensive reviews of the various aspects of R&D of rattan were prepared by the Expert Consultation on Rattan Development held in Rome in 2000 (Dransfield *et al.* 2002). The reports in the proceedings of this consultation cover various aspects from the local, national, regional and global perspectives and revolve around the following three main topics:

- Biological Background & Rattan Resources
- Rattan Processing & Utilization
- Socioeconomics & Institutional Framework

2.1 BIOLOGICAL BACKGROUND & RATTAN RESOURCES

Overviews of the biological background, past and present R&D on management of the rattan resources are given in Dransfield (2002) and Sunderland and Dransfield (2002). These papers cover the following aspects:

- History of rattan research
- Rattan taxonomy and phylogeny
- Ethnobiology
- Ecology, including demographic studies
- Genetic studies, including reproductive biology
- Cane structure
- Seed physiology
- Inventory
- Cultivation
- Conservation

2.2 RATTAN PROCESSING & UTILIZATION

A comprehensive review of rattan processing and utilization has been prepared by Liese (2002). This review covers the following:

- Primary processing which includes deglazing, fumigation, bleaching, seasoning, oil curing and grading
- Secondary processing involving steaming, bending, peeling, splitting, sanding and finishing
- Structural and anatomical properties of canes

According to Liese (2002), the following priority research needs for rattan processing and utilization identified by Williams *et al.* (1991) were still valid:

- Investigations on the properties of commercial and some neglected species in order to facilitate assessment of the utilization potential of currently non commercial species
- Means of protecting rattan products with environmentally acceptable preservatives, as rattan is susceptible to biological deterioration
- Improved processing technologies to produce a wide range of products of better quality – especially the development of better surface finishes for enhanced visual appearance and greater wear resistance
- Diversification of products based on species properties
- Methods of coloring and finishing for rattan for use in furniture making
- Development of panel and walling products
- Studies on waste utilization and waste reduction
- Development of cost effective designs in keeping up with contemporary style
- Development of hand tools and hardware

In addition, the problems of local shortage of raw material, obsolete technology, financing and marketing were highlighted.

2.3 SOCIOECONOMICS & INSTITUTIONAL FRAMEWORK

Belcher (2002) has outlined the approach adopted by CIFOR (Center for International Forestry Research) in the development of non-wood forest products such as rattan. He argued that the understanding of the role, potential, and dynamics of such products in development is inadequate, and

that in order to realize the potential of these products, studies are needed to help target investments. The following analyses were suggested by him:

- The types of forest products which are suited to meeting development and conservation objectives
- The conditions needed to facilitate this development and, conversely, the conditions which are likely to lead to failure
- The way the role and potential of forest products change with economic development
- The role of policy in determining sustainable and equitable use of forest products

Such analyses would help the formulation of policy options and guidelines for governments and development agencies that would in turn facilitate more effective investments in forest product conservation and development.

The socio-economic and institutional framework of the rattan sector can be considered as a key aspect of the production to consumption system. Viewed in this manner, problems which are not technological (i.e., not related to rattan resource and utilization technology) in nature can be identified. Belcher (2002) analyzed a case of rattan production to consumption system in Kalimantan, Indonesia, and concluded that, even the rattan garden in Kalimantan that can technically be managed sustainably can be seriously undermined by outside forces. Examples of such forces are:

- Misguided policies: e.g., imposition export quota on "lampit/tatami" or rattan matting in Indonesia resulting in the rattan "tatami" market in Japan being substituted by cheaper bamboo "tatami" from China, and reduced demand for small diameter canes from Kalimantan; progressively increased restrictions on export of raw and semi-processed canes from Indonesia, though had the effect of encouraging the domestic processing industry, had a strong depressing effect on raw material prices, at great cost to the people involved in raw material extraction and cultivation.
- More profitable land use such as oil palm or industrial wood plantation.
- Labour shortage due to other better employment opportunities.

As the price of the raw cane from Indonesia, the dominant rattan producing country in the world, has remained low for almost a decade, the international cane price has been depressed especially in the surrounding countries in South-east Asia.

2.4 Summary of Expert Consultation on Rattan Development

The key findings of the Expert Consultation on Rattan Development are summarized in Appendix 1 (Dransfield *et al.* 2002). The consultation also identified the key actions to be initiated immediately for enhancing sustainable supply of rattan.

2.5 Other Reviews

Earlier a Study Team was engaged by the International Development Research Centre (IDRC) of Canada in 1991 and prepared a comprehensive report on the research needs (Williams *et al.* 1991).

The Regional Conference on Sustainable Development of Rattan in Asia was held in Manila, the Philippines, in early 2004, and identified a list of research and development needs that could be pursued through regional cooperation (Lapis *et al.* 2004, Appendix 2).

3. REVIEW OF CURRENT R&D ON RATTAN

The literature on rattan research and development (R&D) is very extensive. The recent comprehensive report on rattan R&D (Dransfield *et al.* 2002) contains state of the art reviews of the research and development of the rattan sector throughout the world, and gives recommendations to develop this important sector.

Recent and ongoing rattan related activities published since about 2000 are summarized under the following main headings in Appendix 3.

- Rattan Biology
- Rattan Cane Production
- Cane Processing and Manufacturing
- Production of Edible Shoots
- Socio-economic Issues
- Institutional & Policy Framework
- Publicity & Extension

Based on the analyses in Appendix 3, we suggest the following research priorities. These suggestions are best considered as being complementary to the priorities and urgent actions documented in Dransfield *et al.* (2002) and Lapis *et al.* (2004).

- Studies on the rattan flora of Myanmar, Cambodia, Sulawesi, Maluku and New Guinea
- DNA studies on rattans in established laboratories which have facilities for this type of research
- Reproductive biology of the commercial species, particularly those in Africa
- Development of a cost effective way of rattan inventory
- Seed technology for the commercial species, particularly those in Africa
- Development of practical methods to boost the early growth of rattan, i.e., to shorten the rosette stage
- Permanent sample plot in rattan stands to monitor the growth and yield to provide basic data for sustainable management
- Monitoring and control of pests and diseases in rattan stands
- In intensively managed plantations which require a lot of inputs, studies on nutrient budget and fertilizer application, use of appropriate support trees and canopy manipulation, interaction between rattan and support trees, genetic improvement, and development of appropriate harvesting techniques
- Cane properties of planted rattan and lesser utilized species
- Enhancement of quality and value of cane products
- Environmentally friendly cane preservation methods to stop infestation by powder post beetles and blue stain fungi
- Economics of edible shoot production
- Transfer of technology on the production of edible rattan shoots from Lao PDR, North eastern Thailand & Taiwan China, to other parts of the world

- Efficient ways of extension
- Socio-economic, policy and institutional constraints that have resulted in the low price of canes which is a problem faced by all rattan harvesters and cultivators in Asia and possibly other parts of the world

4. THE CRITICAL ISSUE: DEPLETION OF RATTAN RESOURCE

Among the various constraints faced by the rattan sector, we have identified the most critical problem of lack of sustainability of rattan resource, which is caused by the depressed price of cane. This problem exists throughout East and South-east Asia, and can be traced to the depressed rattan collection and cultivation subsector in Indonesia, which supplies about 80 percent of the world's rattan raw materials (Sastry 2002). The reasons for the low price of raw canes in Kalimantan, one of the most important rattan producing regions in Indonesia, are discussed Subsection 2.3.

4.1 JUSTIFICATIONS FOR SUSTAINABLE MANAGEMENT OF RATTAN RESOURCE

Despite the unfavorable conditions in Kalimantan which threaten many rattan gardens, Belcher (2002) has identified the factors contributing to the resilience of rattan gardens, i.e., these systems:

- Offer a valuable risk management tool in which the rattan is available as a long lived, low maintenance source of savings/income. This is especially important in systems without other, well developed risk management institutions (people do not have bank accounts, let alone insurance policies).
- Play an important "marker" function for property "ownership". Within the traditional system, rattan gardens are respected as a sign of occupation. Under the present circumstances, with large scale state sanctioned land appropriation by oil palm, pulpwood plantations and mining companies, rattan gardens have been used successfully to demonstrate ownership and claim financial compensation from the company (however meagre).
- Provide a source of cash income in areas where there are few other opportunities to earn cash. For example, Yang et al. (2004) estimated that the income from rattan sales contributed about 66% to the total income in the Nanchang village and provided more than 50% income for nearly all of the 40 households.
- Provide other valuable forest products and services as the rattan gardens function as secondary forests, giving habitat for medicinal plants, ritual plants, and plants and animals valued for food.
- Retain important cultural values; rattan gardens represent important traditions and provide links to ancestors (many rattan gardens have been inherited from fathers and grandfathers).
- Live long, with little input required. Thus they have a high degree of inertia.

Other arguments for supporting rattan cultivation & sustainable management of rattan resource for cane production are as follows (Belcher 2002):

- The stresses placed on the system have been, for the most part, generated from outside, and it seems that the system could be economically competitive if provided with a level playing field.

- There are also other benefits to be considered. The rattan garden system offers important ecological benefits, in terms of biodiversity, forest cover, carbon sink and climate stabilization. The financial value of the rattan makes a long fallow period of shifting cultivation feasible. During the long fallow, the forest can regenerate and increasingly provide these ecological services.
- The rattan cultivation system supports a valuable export industry, generating employment and foreign exchange earnings.

Several policy options that could be pursued (Belcher 2002) to increase the price of raw canes and sustain the rattan resource are as follows:

- Reducing trade barriers that depress domestic raw material prices (including internal barriers, such as the illegal fees charged to traders, and official export taxes).
- Assistance to the rattan sector to become more competitive. This could be achieved through more efficient raw material production (through research and extension to improve the cultivation system) and trade (especially through improved market information) and through improved design, quality, efficiency and marketing of manufactured products.
- More careful land use planning to ensure that important rattan growing areas are not converted to industrial estate crops (such as oil palm).

Other complementary measures are: strengthening the horizontal linkage of rattan gatherers and cultivators so that they will have more bargaining power, and encouraging the manufacturers to cultivate rattan to sustain the rattan industries; these measures have been put into practice in the Philippines (Belcher 1999).

In places where rattan cultivation for the production of edible shoots is practised (*Calamus tenuis* in Lao PDR, *C. viminalis* in north eastern part of Thailand, and *C. formosanus* in Taiwan Island, China) or potentially feasible (e.g., Guangdong, China), research, development and promotion of cultivation for edible shoot production should be intensified. Belcher (1999) has identified two main economic differences of edible shoot production from cane production: short gestation and frequent harvesting; and an open, competitive market with a large number of potential buyers willing to purchase in small volumes. Combining edible shoot production with cane production is another approach which is being tried out (e.g., in Southern China) to generate return from edible shoots at an early stage while waiting for the canes to mature.

4.2 Comparison of sustainable rattan production with sustainable forest management

Rattan management for cane production, with the associated support trees whether in natural forests or plantations, is closer to natural forest management than monoculture of agricultural plantations such as those of oil palm to which many rattan stands in South-east Asia have been converted. In a recent study on sustainable (mainly natural) tropical forest management (SFM) commissioned by the International Tropical Timber Organization, the following were concluded (ITTO 2006):

- The most debilitating weakness in building the practice of sustainable forest management (SFM) is the failure to develop an adequate and reliable system on a global scale for funding the additional costs involved in putting SFM into practice in the forest.
- For the various practices involved at the national level, alternative land uses turn out to be more profitable. SFM will be more readily achievable if it is seen as a competitive land use. This will be best achieved if prices for timber from natural tropical forests are strong and/or the important services provided by such forests, such as water production, biodiversity conservation and carbon storage, are paid for. The study recommended "that the international forest related community accords number one priority to the development of a system for ensuring that SFM is a financially remunerative land use".

The same conclusions can be drawn in the case of sustainable management of natural or planted rattan stands. These conclusions are supported by Evans (2002) who has stated that:

> "Low international cane prices are a key constraint to investment in either plantations or sustainable wild harvesting. Many other deep rooted socio-economic constraints also combine to make the prospects for large scale sustainable harvesting poor in Indo-China".

Siebert (2002) has also argued "that managed harvesting of wild rattan and rattan cultivation will likely require significant long term financial assistance, as well as technical and marketing support, and that private, state and international support for rattan management and cultivation can be justified as compensation for the public benefits provided by natural forests and diverse agro ecosystems".

5. CONCLUSIONS

This paper discusses the current and recent research on the rattan sector at the global level. Important areas of research, which can enhance the contribution of the rattan sector, are identified. The analyses given in preceding sections demonstrate that rattan is a non-wood forest product which is important economically, ecologically and socially, justifying the continuing support to the rattan sector, even in countries and regions where financially more attractive land uses than sustainable rattan management and cultivation exist.

REFERENCES

Abasolo W.P., Yoshida M. Yamamoto H. & Okuyama T. (2005) Influence of structure and chemical composition on thermal softening of Palasan canes (Calamus merrillii). IAWA Journal 26(3): 363-374.

Abasolo W.P., Yoshida M., Yamamoto H. & Okuyama T. (2000) Microfibril angle determination of rattan fibers and its influence on the properties of the cane. Holzforschung 54(4): 437-442.

Abasolo W.P., Yoshida M., Yamamoto H. & Okuyama T. (2001a) Silica in several rattan species. Holzforschung 55(6): 595-600.

Abasolo W.P., Yoshida M., Yamamoto H. & Okuyama T. (2001b) Influence of structure and chemical composition on thermal softening of Palasan canes (Calamus merrillii). IAWA Journal 26(3): 363-374.

Abasolo W.P., Yoshida M., Yamamoto H. & Okuyama T. (2002a) Thermal softening of rattan canes: influence of the hemi cellulose lignin matrix. Journal of Bamboo and Rattan. 1(4): 317-331.

Abasolo W.P., Yoshida M., Yamamoto H. & Okuyama T. (2002b) Influence of heat and loading time on the mechanical properties of Calamus merrillii. Holzforschung 56(6): 639-647.

Achmad B. & Waluyo T.K. (2000) Model sebaran kadar air pada batang rotan manau di Aek Nauli, Sumatera Utara. (The moisture content distribution model of the manau rattan at Aek Nauli, North Sumatera). Buletin Penelitian Kehutanan Pematang Siantar 15(2): 27-35.

Anon. (2002) Proceedings of the Training Course on processing and packaging of rattan shoot 2002. Royal Forest Department, Bangkok Thailand.

Bacilieri R. & Appanah S. (1999) Rattan cultivation: achievements, problems and prospects. An international consultation of experts for the project: Conservation, genetic improvement, and silviculture of rattans in South-east Asia, Kuala Lumpur, Malaysia, 12 14 May 1998. v + 246 pp. CIRAD Foret, Montpellier, France.

Baker W.J. & Dransfield J. (2004) Calamus suaveolens a new rattan from Sulawesi. Kew Bulletin 59(1): 69-71.

Baker W.J., Bayton R.P., Dransfield J. & Maturbongs R. (2003) A revision of the Calamus aruensis (Arecaceae) complex in New Guinea and the Pacific. Kew Bulletin 58(2): 351-370.

Belcher B. (1999) Constraints and opportunities in rattan production to consumption systems in Asia. In Bacilieri R. & Appanah S. (Ed.) Rattan cultivation: achievements, problems and prospects. An international consultation of experts for the project: conservation, genetic improvement, and silviculture of rattans in South-east Asia, Kuala Lumpur, Malaysia, 12 14 May 1998. pp. 116-138.

Belcher B. (2002) CIFOR research: forest products and people rattan issues. In Dransfield J., Tesoro F. O. & Manokaran N. (Ed.) Rattan. Current research issues and prospects for conservation and sustainable development'. Proceedings based on the outcome of the FAO Expert Consultation on Rattan Development held at FAO, Rome, Italy, 5 7 December 2000. Non-Wood Forest Products 14: 49-62.

Bi, I.A.Z. & Kouakou K.L. (2004a) Etude de la filiere rotin dans le district d'Abidjan (Sud Cote d'Ivoire). Study of rattan production to consumption system in the district of Abidjan (South Cote d'Ivoire). Biotechnologie, Agronomie, Societe et Environnement 8(3): 199-209.

Bi, I.A.Z. & Kouakou K.L. (2004b) Vegetative propagation methods adapted to two rattan species *Laccosperma laeve* and *L. secundiflorum.* Tropicultura 22(4): 163-167.

Chowdhury M.Q. (2004) Assessment of some physical and mechanical properties of Golla bet (*Daemonorops jenkinsiana*) from north eastern region of Bangladesh. Journal of Bamboo and Rattan 3(3): 195-201.

Danesh Miah & Lutfor Rahman (2002) Status of rattan based small scale cottage industries in urban and semi urban area of Chittagong, Bangladesh. Journal of Bamboo and Rattan. 1(3): 251-261.

Danesh Miah, Ahmed R. Uddin M.B. (2003) Rattan husbandry and its potentiality for income generation in the village groves of floodplain area of Bangladesh. Journal of Bamboo and Rattan 2(3): 249-259.

Dransfield J. (2000) *Calamus griseus* (Arecaceae), a new species of rattan from Peninsular Thailand, Malaysia and Sumatra. Thai Forest Bulletin Botany 28: 157-159.

Dransfield J. (2002) General introduction to rattan the biological background to exploitation and the history of rattan research. In Dransfield J., Tesoro F. O. & Manokaran N. (Ed.). Rattan. Current research issues and prospects for conservation and sustainable development'. Proceedings based on the outcome of the FAO Expert Consultation on Rattan Development held at FAO, Rome, Italy, 5 7 December 2000. Non-Wood Forest Products. 14: 23-34.

Dransfield J. & Baker W.J. (2003) An account of the Papuasian species of *Calamus* (Arecaceae) with paired fruit. Kew Bulletin. 58(2): 371-387.

Dransfield J., Tesoro F.O. & Manokaran N. (Ed.) (2002) Rattan: Current research issues and prospects for conservation and sustainable development. Proceedings based on the outcome of the FAO Expert Consultation on Rattan Development held at FAO, Rome, Italy, 5 7 December 2000.) Non-Wood Forest Products. 2002; (14): Food and Agriculture Organization of the United Nations (FAO), Rome, Italy. viii + 272 pp.

Evans T. & Sengdala K. (2001) The Indochinese rattan *Calamus acanthophyllus* a fire loving palm. Palms 45(1): 25-28.

Evans T. (2002) The status of the rattan sectors in Lao People's Democratic Republic, Vietnam and Cambodia with an emphasis on cane supply. In Dransfield J., Tesoro F. O. & Manokaran N. (Ed.) Rattan. Current research issues and prospects for conservation and sustainable development'. Proceedings based on the outcome of the FAO Expert Consultation on Rattan Development held at FAO, Rome, Italy, 5 7 December 2000. Non-Wood Forest Products 14: 115-144.

Evans T.D. & Tran Phuong Anh (2001) A new species of *Calamus* (Arecaceae: Calamoideae) from Vietnam. Kew Bulletin 56(3): 731-735.

Evans T.D. & Viengkham O.V. (2001) Inventory time cost and statistical power: a case study of a Lao rattan. Forest Ecology and Management. 150(3): 313-322.

Evans T.D., Sengdala K. Viengkham O.V. & Thammavong B. (2001) A field guide to the Rattans of Lao PDR: covers all 51 species known from Lao PDR and nearby areas. Royal Botanic Gardens, Kew, Richmond, U.K. 96 pp.

Fisher J.B., Tan H.T.W.& Toh L.P.L. (2002) Xylem of rattans: vessel dimensions in climbing palms. American Journal of Botany 89(2): 196-202.

Girija T. & Srinivasan P.S. (1999). Metabolic changes associated with desiccation in *Calamus* seeds. In Marzalina M., Khoo K.C., Jayanthi, N., Tsan F.Y. & Krishnapillay, B. (Eds.) IUFRO Seed Symposium 1998 "Recalcitrant seeds": Proceedings of the Conference, Kuala Lumpur, Malaysia, 12 15 October 1998. 199l. Forest Research Institute Malaysia, Kuala Lumpur, Malaysia. Pp. 25-28.

Goh D.K.S., Bon M.C., Aliotti F., Escoute J., Ferriere N. & Monteuuis O. (2001) In vitro somatic embryogenesis in two major rattan species: *Calamus merrillii* and *Calamus subinermis.* In Vitro Cellular and Developmental Biology Plant. 37(3): 375-381.

Goh D.K.S., Aliotti F., Ferriere N., Monteuuis O. & Bon M.C. (2001) Somatic embryogenesis in three rattan species of major economic value. Bois et Forets des Tropiques. 267: 83-90.

Guo L.X & Wei Z.F. (2005) Leaf epidermis morphology of the genus *Calamus* L. from China. Journal of Tropical and Subtropical Botany 13(4): 277-284.

Guo L.X., Wei Z.F. & He J.Y. (2004) Pollen morphology of the genus *Calamus* L. from China. Journal of Tropical and Subtropical Botany 12(6): 515-520.

Harada K. Mogea J.P. & Rahayu M. (2005) Diversity, conservation and local knowledge of rattans and sugar palm in Gunung Halimun National Park, Indonesia. Palms 49(1): 25-35.

Henderson A. (2005) A new species of *Calamus* (Palmae) from Taiwan. Taiwania 50(3): 222-226.

Hunter I. Hahn C.G.von, Zhu Z.H. & Zhou Y.H. (2003) Stabilizing forest margins by growing non timber forest products: a novel example from Hainan Island, China. Land Use Policy 20(3): 225-230.

ICBR (International Centre for Bamboo and Rattan, China) (2006) Unpublished report.

Indira E.P. & Anto P.V. (2002) Karyotype analysis in *Calamus palustris* Griff. Journal of Bamboo and Rattan 1(3): 199-203.

ITTO (2006) Status of tropical forest management 2005, Summary Report. A special edition of the Tropical Forest Update 2006/1. 35 pp.

Jasni, Rachman O.& Malik J. (2001) *Penentuan faktor konversi dalam proses pengolahan rotan sebagai dasar pembayaran tarif iuran hasil hutan dan efisiensi produksi.* (Determination of the conversion factor for rattan processing as a basis for payment of the forest product fee and assessment of production efficiency) Buletin Penelitian Hasil Hutan 19(3): 175-184.

Jayasree V.K., Renuka C. & Rugmini P. (2003) Root development in rattans 1. A quantitative study of the roots in two species of *Calamus* L. Journal of Bamboo and Rattan 2(2): 135-151.

Jayasree V.K., Sujatha M.P., Renuka C. Rugmini P. (2004) Root morphology and development in rattans. 3. Root system development in *Calamus thwaitesii* Becc. and *Calamus rotang* L. in relation to the physical properties of a degraded lateritic soil. Journal of Bamboo and Rattan 3(2): 81-90.

Jayasree V.K., Renuka C. & Rugmini P. (2004) Root development in rattans 2. Soil requirements and efficiency of the root systems of *Calamus thwaitesii* Becc. and Hook. f. and *Calamus rotang* L. in the seedling stage. Journal of Bamboo and Rattan 3(1): 3-11.

Johnson D.V. & Sunderland T.C.H. (2004) Rattan glossary and Compendium glossary with emphasis on Africa. Non-Wood Forest Products (16): vi + 77 pp.

Kumar H.N.K. & Ramaswamy S.N. (2003) Contributions to the study of microsporogenesis in *Calamus* L. (Arecaceae). Taiwania 48(3): 180-193.

Kumar H.N.K. & Ramaswamy S.N. (2004) Studies on the distributional and phenological aspects of *Calamus* L. in Karnataka. Indian Forester130(2): 224-230.

Lakshmana A.C. & Raj J.N. (2002) Prospects of *Calamus nagabettai* cultivation under garden conditions. Myforest 38(2): 117-122.

Lapis A.B., Faraon A.A., Bueser K.G. & Pablo N.R. (2004) Rattan Reborn. ITTO Tropical Forest Update 14(4) 12-13.

Lee Y.F. (1999) Morphology and genetics of the rattan *Calamus subinermis* in a provenance *cum* progeny trial. . In Bacilieri R. & Appanah S. (Ed.) Rattan cultivation: achievements, problems and prospects An international consultation of experts for the project: conservation, genetic improvement, and silviculture of rattans in South-east Asia, Kuala Lumpur, Malaysia, 12 14 May 1998. pp. 38-50.

Li F.G., Yang H., Yin G.T., Xu H.C. & Gan S.M. (2004) Genomic DNA extraction and RAPD protocols for rattan. Forest Research, Beijing 17(6): 824-828.

Li R.S., Yin G.T., Xu H.C. Yang J.C., Yang H. & Chen H.M. (2004) Comparison between albino and normal seedlings of *Calamus nambariensis* Becc. var. *xishuangbanensis.* Forest Research, Beijing 17(6): 819-823.

Liese W. (2002) Challenges and constraints in rattan processing and utilization. Non-Wood Forest Products. 2002 (14): 35-42.

Liu Y., Zeng B.S. & Yin G.T. (2000) Selection of in vitro buds of two rattan species for elongation and rooting. Forest Research, Beijing 13(6): 679-683.

Lucas E.B. & Dahunsi B.I.O. Harvesting, processing and utilization of rattan canes in Western Nigeria. Southern African Forestry Journal. 202: 37-44.

Lucas E.B. & Dahunsi, B.I.O. (2004) Characteristics of three western Nigerian rattan species in relation to their utilization as construction material. Journal of Bamboo and Rattan 3(1): 45-56.

Maitreyee K. & Rupnarayan S. (1999) Regeneration through organogenesis in rattan. Plant Cell, Tissue and Organ Culture 59(3): 219-222.

Maitreyee K. & Sanjay C. (2001) Preliminary studies on dessiccation and storage of *Calamus tenuis* Roxb. seed. Newsletter Project on Handling and Storage of Recalcitrant and Intermediate Tropical Forest Tree Seeds. 2001; (9): 29-31.

Manjunatha K.C., Babu D.T.S., Raju B.M., Kumar A.S.D. & Shaanker R.U. (2005) Growth response of Rattans seedlings to gibberellic acid. Annals of Forestry. 13(1): 72-78.

Olorunnisola, A.O. (2004) Briquetting of rattan furniture waste. Journal of Bamboo and Rattan. 3(2): 139- 149.

Oteng Amoako A. & Obiri Darko B. (2002) Rattan as sustainable industry in Africa: the need for technological interventions. In Dransfield J., Tesoro F. O. & Manokaran N. (Ed.) Rattan. Current research issues and prospects for conservation and sustainable development'. Proceedings based on the outcome of the FAO Expert Consultation on Rattan Development held at FAO, Rome, Italy, 5 7 December 2000. Non-Wood Forest Products (14): 89-100.

Paudel S.K. & Chowdhary C.L. (2005) Managing rattan as a common property: a case study of community rattan management in Nepal. Journal of Bamboo and Rattan 4(1): 81-91.

Paudel S.K. (1999) Tharus' faith over rattan. Banko Janakari 9(2): 47.

Razali A. Kadir (2001) Variation of strength properties of locally grown *Calamus scipionum* and *Daemonorops angustifolia.* Journal of the Institute of Wood Science 15(6): 289-296.

Renuka C.; Rugmini P.; Thomas J.P. & RanganV.V. (2004) The growth performance of different commercially important rattans at eight years after planting. Journal of Bamboo and Rattan. 3(3): 187-193

Roszaini A.K.(2000) Effect of age and height on the stem characteristics of *Calamus scipionum* (rotan semambu). Journal of Tropical Forest Products. 6(2): 190-199.

Salleh M.N. (2002) policy and institutional framework for sustainable development of rattan. In Dransfield J., Tesoro F. O. & Manokaran N. (Ed.) Rattan. Current research issues and prospects for conservation and sustainable development'. Proceedings based on the outcome of the FAO Expert Consultation on Rattan Development held at FAO, Rome, Italy, 5 7 December 2000. Non-Wood Forest Products (14): 245-248.

Sastry C.B. (2002) Rattan in the twenty first century an outlook. In Dransfield J., Tesoro F. O. & Manokaran N. (Ed.) Rattan. Current research issues and prospects for conservation and sustainable development'. Proceedings based on the outcome of the FAO Expert Consultation on Rattan Development held at FAO, Rome, Italy, 5 7 December 2000. Non-Wood Forest Products (14): 237-244.

Sengdala K. & Evans T. (1999) Rattan cultivation in Lao PDR: achievements, problems and prospects. In Bacilieri R. & Appanah S. (Ed.) Rattan cultivation: achievements, problems and prospects An international consultation of experts for the project: conservation, genetic improvement, and silviculture of rattans in South-east Asia, Kuala Lumpur, Malaysia, 12 14 May 1998. 210-216.

Sett R., Kundu M. & SharmaP . (2002) Regeneration of plantlets through organogenesis in *Calamus tenuis.* Indian Journal of Plant Physiology 7(4): 358-361.

Siddiqi N.A., Ara R. & Merry S.R. (1998) Raising seedlings of *Calamus viminalis* and their performance after out planting. Bangladesh Journal of Forest Science. 27(1): 63-68.

Siddiqi N.A., Ara R. & Merry S.R. (2000) Growth and harvesting of common rattans in Bangladesh. Bangladesh Journal of Forest Science. 29(2): 97-105.

Siebert S.F. (2000) Survival and growth of rattan intercropped with coffee and cacao in the agroforests of Indonesia. Agroforestry Systems. 50(1): 95-102.

Siebert S.F. (2001) Tree cutting to float rattan to market: a threat to primary forests? Journal of Bamboo and Rattan. 1(1): 37-42.

Siebert S.F. (2004) Demographic effects of collecting rattan cane and their implications for sustainable harvesting. Conservation Biology. 18(2): 424-431.

Siebert S.F. (2005) The abundance and distribution of rattan over an elevation gradient in Sulawesi, Indonesia. Forest Ecology and Management. 210(1/3): 143-158.

Siebert S.F. (2002) Harvesting wild rattan: opportunities, constraints and monitoring methods. In Dransfield J., Tesoro F. O. & Manokaran N. (Ed.) Rattan. Current research issues and prospects for conservation and sustainable development'. Proceedings based on the outcome of the FAO

Expert Consultation on Rattan Development held at FAO, Rome, Italy, 5 7 December 2000. Non-Wood Forest Products (14): 227-236.

Steiner H. & Aminuddin M. (2001) Survey of hesperids found in three age groups of *Calamus manan* planted under rubber trees. Journal of Tropical Forest Science 13(2): 270-282.

Sudarmonowati E. (2003) The use of isozyme marker for identifying desired traits related to growth and insect resistance in several tropical forest tree species. In Rimbawanto A. & Susanto M. (Ed.) Advances in genetic improvement of tropical tree species. Proceedings of the International Conference, Yogyakarta, Indonesia.1 3 October,2002. Pp. 71-75.

Sudarmonowati E., Mogea J.P., Hartati N.S., Hong L. & Rao,V.R. (2004) Morphology and genetic variation of manau rattan (*Calamus manan,* Miq.) in Sumatra, Indonesia. Journal of Bamboo and Rattan. 3(2): 123- 137.

Sunderland T.C.H. & Dransfield J. (2002) Species profiles rattans (Palmae: Calamoideae). In Dransfield J., Tesoro F. O. & Manokaran N. (Ed.) Rattan. Current research issues and prospects for conservation and sustainable development'. Proceedings based on the outcome of the FAO Expert Consultation on Rattan Development held at FAO, Rome, Italy, 5 7 December 2000. Non-Wood Forest Products. 14: 9-22.

Sunderland T.C.H. (2002) Status of rattan resources and use in West and Central Africa. In Dransfield J., Tesoro F. O. & Manokaran N. (Ed.) Rattan. Current research issues and prospects for conservation and sustainable development'. Proceedings based on the outcome of the FAO Expert Consultation on Rattan Development held at FAO, Rome, Italy, 5 7 December 2000. Non-Wood Forest Products (14): 77-87.

Sunderland T.C.H. (2001) Hapaxanthy and pleonanthy in African rattans (Palmae: *Calamoideae*). Journal of Bamboo and Rattan 1(2): 131-139.

Sunderland T.C.H. (2002) Two new species of rattan (Palmae *Calamoideae*) from Africa. Journal of Bamboo and Rattan 1(4): 361-369.

Sunderland T.C.H. (2003) Two new species of rattan (Palmae: *Calamoideae*) from the forests of West and Central Africa. Kew Bulletin 58(4): 987-990.

Supriadi A., Martono D., Puspitodjati T. & Rachman O. (2002) *Analisis teknis dan ekonomis pengolahan rotan.* (Technical and economical analysis of rattan processing) Buletin Penelitian Hasil Hutan 20(2): 127-141.

Tomlinson P.B., Fisher J.B., Spangler R.E. & Richer R.A. (2001) Stem vascular architecture in the rattan palm *Calamus* (Arecaceae *Calamoideae Calaminae*). American Journal of Botany 88(5): 797-809

Uhl, N.W. & Dransfield, J. (1987) Genera palmarum: a classification of palms based on the work of H.E.Moore Jr.The International Palm Society & the Bailey Hortorium, Kansas, USA. 610 pp.

Vantomme P. (2003) Growing imbalance between supply and demand for rattan. Journal of Bamboo and Rattan. 2(4): 407-415.

Wahab R., Sulaiman O. & Samsi H.W. (2004) Basic density and strength properties of cultivated *Calamus manan.* Journal of Bamboo and Rattan 3(1): 35-43.

Wan Tarmeze W.A. (2001) Strength and stiffness properties of joints in rattan furniture: withdrawal resistance. Journal of Tropical Forest Products 7(1): 57-66.

Wang K.L., Xie J., Zhang T. & Gu, J.T. (2005) A karyological study of four species in *Calamus* (Palmae: *Calamoideae*). Acta Botanica Yunnanic. 27(1): 87-91.

Williams, J.T., Dransfield, J., Ganapathy, P.M., Liese, W., Salleh M. N. & Sastry, C.B. (1991) *Research needs for bamboo and rattan to the year 2000*. Washington, DC, Intern. Fund Agric. Res.. 81 pp.

Yang H., Gan S.M., Yin G.T. & Xu H.C. (2005a) Identification of random amplified polymorphic DNA markers linked to sex determination in *Calamus simplicifolius* C. F. Wei. Journal of Integrative Plant Biology 47(10): 1249-1253.

Yang J.C., Xu H.C., Yin G.T. & Li R.S. (2004) Socio-economic benefit of rattan: a case study in Nanchang village, Baoting county, Hainan province, P. R. China. Journal of Bamboo and Rattan 3(2): 151-158.

Yang J.C., Yin G.T., Xu H.C., Li R.S., Feng C.L. & Lu L.H.(2005b) An economic analysis of the interplanting of *Calamus simplicifolius* with *Gmelina arborea* plantation. Forest Research, Beijing. 18(1): 16-21.

Younus U.M. (1999) Preservative treatment of golla cane (*Daemonorops jenkinsiana*) by soaking method. Bangladesh Journal of Forest Science. 28(2): 109-113.

APPENDIX 1

Key findings of the Expert Consultation on Rattan Development in Rome, December, 2000 (Dransfield *et al.* 2002)

- Some 10 percent of the world's approximately 600 species of rattans were commercial species. Many species, including some of commercial importance, had very restricted natural ranges. The majority of the world rattan resources (by volumes and by number of species) were in one country - Indonesia.
- Rattan was an important commodity in international trade. At the local level, it was of critical relevance for rural livelihood strategies as a primary, supplementary and/or emergency source of income. Rattan collection complemented agriculture in terms of seasonal labour and as a source of capital for agricultural inputs.
- The rattan sector was characterized by a variety of stakeholders with different needs and interests, such as rattan growers, raw material collectors, manufacturers and traders, and it functioned within a complex and dynamic socio-economic, political and ecological context. Rattan was gathered by unorganized or organized collectors, the latter either under contract or in debt relationships with traders and farmers/cultivators. In addition, there was a loss of traditional rattan management practices, while at the same time increasing competition for resources. Linkages between industry, traders, collectors/cultivators and research and development efforts were weak. Rattan manufacturing and trade were fragmented and diverse in size and markets, with a focus on export.
- Taxonomic knowledge on species was patchy and available information conflicting. Likewise patchy was the knowledge of biological aspects, e.g. pollination and gene flow. The conservation status of rattans was not well known and it was difficult to assess and monitor. In addition, rattan species were assumed not to be "safe" in protected areas or in national parks, as harvesting in such areas was usually permitted or tolerated. It was also assumed that the genetic basis of rattan species was narrowing. Some species were likely to be at risk of extinction.
- There could be no sustainable supply of rattan, if the forests in which they grew were not managed sustainably. In its natural habitat, rattan was not as yet managed, and rattan received low priority in national forest and conservation policies. There was no dedicated rattan development institution in any country as rattan was usually subsumed within the forestry services, and the few existing national rattan programmes were weak and with limited research and development capacity. With a few exceptions, national forest inventories did not include rattan, and information on the resource base was scarce. However, in large tracts of degraded and logged over forests, (re)introduction and management of rattan had the potential to complement significantly the value of these forests.
- Significant advances had been made in the understanding of growing rattan as a plantation crop. Although community based or smallholder rattan gardens could be profitable in some situations, the profitability of industrial scale plantations in Asia was currently uncertain, as

other land uses were more lucrative. As a result of this, private sector investment in industrial scale rattan plantations had declined. The meeting took note that existing rattan plantations had been converted into more profitable crops like oil palm.

- Rattan production was also affected by the low return to gatherers, resulting in weak incentives for sustainable rattan harvesting and management. A number of factors contributed to the low returns. Foremost among these were uncertain property rights, the dispersed nature of production and inconsistent cane quality. In several countries, prices and competition had been affected by the remoteness of collecting areas and poor transportation; "illegal" harvesting; poor market information; lack of organization among collectors; large post harvest losses due to insect and fungal infestation; prohibitive tax policies; export barriers; and informal taxes that depressed raw material prices.

The consultation also identified the following key actions for enhancing sustainable supply of rattan.

1. RESOURCES
   - Intensifying ex situ and in situ conservation efforts in a more coordinated and organized manner among countries in the regions;
   - Developing suitable methods for resource assessments, including studies on growth, yield, basic biology and taxonomy of rattan species;
   - Improving techniques of enrichment planting and management of rattan in degraded forests, and a wide dissemination of the available guidelines for rattan planting.
2. PRODUCTS
   - Increasing the knowledge of the properties of commercial species and of the potential of underutilized/lesser known species;
   - Improving and disseminating technologies for reducing post harvesting losses, biological deterioration, improved storage and processing;
   - Introduction of quality grading.
3. POLICIES AND INSTITUTIONAL SUPPORT
   - Raising awareness on the importance of the rattan sector to decision makers at all levels;
   - Institutional strengthening and coordination regarding rattan conservation, management and processing issues, including the promotion of more government and private sector cooperation/coordination to enhance the contribution of rattan for poverty alleviation and economic prosperity;
   - Providing tenure security to rattan gatherers and planters by incorporating them into community based forest management schemes;
   - Introducing incentive schemes for rattan cultivation to increase the economic benefits for rural households and smallholder plantations in Asia, such as providing credit and technical assistance for small scale plantation development and favorable harvesting and marketing arrangements;

- Introducing market deregulation to benefit rattan collectors and traders (i.e. removing transport barriers; support for improved collection and dissemination of market information; extension in processing techniques);
- Providing comprehensive training and support to local specialists in rattan producing countries in taxonomy, management and processing, complemented with "twinning arrangements" among relevant institutions in the regions.

APPENDIX 2 POTENTIAL AREAS OF COOPERATION IN RATTAN R&D IN ASIA

The Regional Conference on Sustainable Development of Rattan in Asia held on 2 –23 January 2004 in Manila, the Philippines, identified the following list of research and development needs that could be pursued through regional cooperation (Aida B. Lapis *et al.* 2004).

ITTO Tropical Forest Update 14/4 (2004) P.12-13

1. RESOURCE INVENTORY

1.1 TAXONOMY

1.2 EXTENT OF NATURAL STAND/PLANTATION

a) Field guides
b) An expert to guide the preparation and validate the contents of the field guides
c) A standard rattan inventory design (standard ASEAN inventory)
d) Establish a practice to conduct inventory before restocking especially in logged over areas
e) ASEAN checklist

2. NURSERY ACTIVITIES

2.1 PROPAGATION

2.2 SEEDLING CARE AND MAINTENANCE

a) Further develop the technology using chemical induction to break the phase of rosette stage that may hasten growth of rattan
b) Establish research and development for rattan orchard where male and female individuals will be identified through molecular techniques using isozyme and DNA analysis
c) Conduct a study on developing the regeneration system: (1) for natural stand - the seed rattan method regeneration system to sustain production; and (2) for plantation - clustering/solitary system in time with rotation of support trees
d) Study proven germination techniques on lesser used species
e) Study potential/lesser used species (anatomical, physiological, chemical analysis)

3. PLANTATION ESTABLISHMENT

3.1 SITE REQUIREMENT

3.2 SITE PREPARATION

3.3 OUTPLANTING

3.4 MAINTENANCE AND PROTECTION

a) Study eco physiological site characterization, including light and water, with a program to test intercropping with rattan
b) Document a comparative analysis of Intercropping rattan with other tree species versus rattan as the primary crop
c) Assess the silvicultural requirements (to link production with utilization) of potentially commercial but underutilized rattan species

d) Undertake ex situ conservation to establish germplasm and seedbanks; this includes setting up rules and policies similar to biodiversity guidelines
e) Study harvesting cycle/economic rotation, intensity of other rattan species
f) Analyze demand versus annual allowable cut to determine sustainable levels of resource supply and demand
g) Develop a planting technology for edible shoots and cane

4. HARVESTING SYSTEM AND GRADING STANDARDS

a) Develop a technology for waste reduction during harvesting and alternative uses of rattan waste products in forest, cane production
b) Develop appropriate tool for harvesting small and large diameter canes
c) Develop and adopt an ASEAN grading standard
d) Study the best season/timing of harvest to reduce susceptibility to insect destruction or staining

5. POST HARVEST ACTIVITIES

a) Conduct a comparative study on preservation practices used by other ASEAN countries
b) Apply existing technology; training on kiln drying for rattan
c) Improve product design based on market demands for rattan
d) Share technology on mechanized weaving
e) Develop improved bleaching technologies that are environmentally friendly
f) Develop new preservation technologies at depot

6. SOCIOECONOMIC ASPECTS

a) Study socioeconomic aspects of rattan (includes financial analysis, indigenous knowledge system, gender roles), computation of its contribution to carbon sequestration
b) Study consumption patterns and market preferences
c) Review the market chain to determine what is economically viable for farmers

7. STRENGTHEN ASEAN COLLABORATION THROUGH A NETWORK

a) Establish a national herbarium with a rattan section in each country
b) Establish an ASEAN database
c) Establish a seedbank and germplasm
d) Establish an ASEAN certification system and fair trade practices
e) Establish an ASEAN rattan network that would discuss and share policies that constrain, complement or support implementation of rattan projects (e.g. transboundary issues)
f) Coordinate, compile documents for sharing; e.g. dissemination of information through electronic bulletin using the website of the Forest Research Institute of Malaysia

8. TRAINING NEEDS FOR RATTAN PRODUCTION

a) Training on seed production, seed germination and plantation establishment at the community/village level
b) Training on rattan taxonomy
c) Training on rattan inventory

d) Training on rattan harvesting

9. TRAINING NEEDS FOR RATTAN PROCESSING AND UTILIZATION

a) Training on the application of post harvest technology

b) Training on processing technologies

APPENDIX 3 SUMMARY OF RECENT REPORTS ON RATTAN R&D AND DISCUSSION ON RESEARCH PRIORITIES

FIELD & AREA OF RESEARCH	SUMMARY OF RECENT STUDIES	NOTES ON RESEARCH PRIORITIES
1. RATTAN BIOLOGY		
1.1 Rattan classification & taxonomy	In recent years, new species of rattans continued to be discovered (e.g. Henderson 2005, Sunderland 2002 & 2003; Baker & Dransfield 2004; Baker *et al.* 2003, Dransfield 2000; Evans & Tran 2001). A field guide to the Rattans of Lao People's Democratic Republic covering all 51 species known from Lao PDR and nearby areas has been prepared by Evans *et al.* (2001). Guo & Wei (2005) demonstrated variation in the morphology of leaf epidermis among *Calamus* species from China. Pollen morphology of 15 *Calamus* species from China and the significance of pollen traits in the classification at the genus were reported by Guo *et al.* (2004). Wang *et al.* (2005) described the chromosome morphology of four *Calamus* species (*C. gracilis;* 2n=2x=26=16m+10sm for *C. nambariensis* var. *yingjiangensis*; n=2x=26=14m+12sm for *C. platyacanthus*; 2n=2x=26=14m+12sm for *C. nambariensis* var. *alpinus*), and deduced phylogenetic relationship based on the arm ratio.	The rattan flora of Myanmar, Cambodia, Sulawesi, Maluku and New Guinea remains poorly known (Dransfield 2002), and should be given high priority in rattan taxonomic research at the global level.
1.2 Molecular biology	Genomic DNA extraction and Random Amplification of Polymorphic DNA (RAPD) protocols for rattans were developed with *Calamus simplicifolius* and *Daemonorops* margaritae (=*D. jenkinsiana?*) (Li *et al.* 2004). Yang *et al.* (2005a) generated 500 base pairs of male specific DNA fragment in the dioecious *Calamus simplicifolius.* Sudarmonowati (2003) used isozyme markers for identifying desirable traits in *Calamus manan.* Morphological and isozyme variation in *Calamus manan* was reported by Sudarmonowati *et al.* (2004).	Very few DNA studies have been carried out on rattan. Such studies should be pursued in established laboratories which have facilities for this type of research.

APPENDIX 3 CONT'D

FIELD & AREA OF RESEARCH	SUMMARY OF RECENT STUDIES	NOTES ON RESEARCH PRIORITIES
1.3 Reproductive biology	Kumar & Ramaswamy (2004) reported the phenology of *Calamus* spp. in Karnataka and microsporogenesis in *Calamus* (Kumar & Ramaswamy 2003). A study was undertaken to determine the phenological behaviour of *Calamus nagbettai* in Bangalore under garden conditions (Lakshmana & Raj 2002). Hapaxanthy and pleonanthy in African rattans have been described by Sunderland (2001). No obvious flowering and fruiting phenological pattern has been observed in African rattans (Sunderland 2002). An account of the Papuasian species of *Calamus* (Arecaceae) with paired fruit was given by Dransfield & Baker (2003).	The reproductive biology of many commercial rattan species has been elucidated. More detailed studies in this area may be needed if breeding programmes is carried out.
1.4 Other aspects of rattan biology	Indira & Renuka (2002) reported the occurrence of albinos in Calamus hookerianus. Li *et al.* (2004a) compared the rate of photosynthesis of albino and normal seedlings of *Calamus nambariensis* var. *xishuangbanensis*, and found that the rate of the former to be only about 20% of the latter. Root morphology and development in *Calamus thwaitesii* and *C. rotang* in Kerala were reported by Jayasree et al. (2003, 2004a & 2004b). The ecology of the fire loving Indochinese rattan *Calamus acanthophyllus* was reported by Evans and Sengdala (2001). Vessel dimensions in rattan stems were studied by Fisher *et al.* (2002), while the stem vascular architecture in *Calamus* was reported by Tomlinson *et al.* (2001).	

APPENDIX 3 CONT'D

FIELD & AREA OF RESEARCH	SUMMARY OF RECENT STUDIES	NOTES ON RESEARCH PRIORITIES
2. CANE PRODUCTION		
2.1 Resource assessment & inventory	Evans and Viengkham (2001) reported a study on the inventory design for rattan in Lao PDR. They concluded that for a resource of moderate value such as rattan cane, very prolonged or costly surveys are unlikely to be economically justified. In several parts of the world, assessment of rattan resource has been reported. For example, the distribution and natural habitats of *Calamus* spp. in Karnataka, India, were studied by Kumar & Ramaswamy (2004); in West Nigeria a survey of rattan resource was reported by Lucas and Dahunsi (2004).	The rattan resource in many parts of the world has not been inventoried, due largely to the high cost of accurate assessment. A cost effective way of rattan inventory should ideally be developed.
2.2 Sustainable management	Harada *et al.* (2005) recommended intensive cultivation of rattan as a strategy to achieve the coexistence of local communities with Gunung Halimun National Park, Java, Indonesia. Siebert has carried out studies on the sustainability of rattan resource and the associated forest ecosystem, particularly *Calamus zollingeri* which is in high demand (Siebert 2000, 2001, 2004a, 2004b). Paudel & Chowdhary (2005) reported a case of improvement of rattan management in the Terai region of Nepal; with the improved management (including controlling exploitation, harvesting only mature stems and protection of habitats), the income of the local community increased up to 30 times.	Sustainable management of the rattan resource has generally not been achieved in many parts of the world; this is discussed in Section 4.

APPENDIX 3 CONT'D

FIELD & AREA OF RESEARCH	SUMMARY OF RECENT STUDIES	NOTES ON RESEARCH PRIORITIES
2.3 Tissue culture	Regeneration of plantlets through organogenesis from callus cultures in *Calamus tenuis* was described by Sett *et al.* (2002), and in *Calamus flagellum* was reported by Maitreyee & Rupnarayan (1999). Somatic embryogenesis of *Calamus manan, Calamus merrillii* and *Calamus subinermis* has been observed by Goh *et al.* (2001a, 2001b). Selection of *in vitro* buds of *Calamus simplicifolius* and *Calamus egregius* for elongation and rooting was reported by Liu *et al.* (2000). Buds of different lengths were significantly different in elongation and rooting capacity.	Tissue culture studies are justified when there is a demand for quality clonal planting materials. The demand seems to be weak at present.
2.4 Seed technology	Preliminary studies on desiccation and storage of *Calamus tenuis* seed (Maitreyee & Sanjay 2001) showed that the reduction in viability of rattan seeds started below 13% moisture content of the whole seed and 16% of the embryo. Viability was completely lost when the seed and embryo moisture content was below 11 and 10%, respectively. No loss in seed viability was observed after a year if stored over water at room temperature. Elucidation of the biochemical changes during desiccation of *Calamus rotang* and *Calamus thwaitesii* revealed that hydrolysis of carbohydrates, degradation of proteins and accumulation of phenolic substances in the seed during desiccation can contribute to the death of the seed during desiccation (Girija & Srinivasan, 1999). Seed germination research on African rattans has been carried out (Oteng Amoako & Obiri Darko 2002).	The techniques for processing seeds of most commercial rattan species in Asia are well known; however, for the commercial species in Africa, there is a need for improvement of the techniques if there are plans to intensify planting of rattan.
2.5 Vegetative propagation	Bi and Kouakou (2004b) reported successful vegetative propagation *Laccosperma leave* and *L. secundiflorum* using sucker and rhizome.	

APPENDIX 3 CONT'D

FIELD & AREA OF RESEARCH	SUMMARY OF RECENT STUDIES	NOTES ON RESEARCH PRIORITIES
2.6 Early growth of seedlings	Manjunatha *et al.* (2005) demonstrated it is possible to boost the growth of *Calamus thwaitesii* and *C. nagbettai* seedlings by applying gibberellic acid at 200 and 300 ppm concentrations. This result can potentially be used to shorten the rosette phase of rattan growth. Salleh (2002) has also argued that techniques should be developed to reduce the period of the rosette stage of rattan. A method of raising seedlings of *Calamus viminalis* and their performance after out planting were reported in Bangladesh (Siddiqi *et al.* 1998).	Practical methods to boost the early growth of rattan, i.e., to shorten the rosette stage, need to be developed.
2.7 Growth & yield studies	Renuka *et al.* (2004) reported the growth performance of several commercially important rattan species (*Calamus baratangensis, C. pseudotenuis, C. caesius, C. gamblei, C. andamanicus, C. karnatakensis* and *Daemonorops kurzianus*) at the age of 8 years at two sites in Kerala, India. A study was undertaken to determine the growth increments of *Calamus nagbettai,* raised under garden conditions in Bangalore (Lakshmana & Raj 2002). The growth of *Calamus tenuis, C. viminalis* and *Daemonorops jenkinsiana* raised in semi evergreen/deciduous forests of Bangladesh was reported by Siddiqi *et al.* (2000).	Permanent sample plots need to be established in rattan stands to monitor the growth and yield to provide basic data for sustainable management.
2.8 Pests & diseases	Several species of hesperids, *Gangara thyrsis, Erionota hiraca, Quedara monteithi, Salanoemia sala,* and *Zela* sp. were observed in *Calamus manan* planted under rubber trees (Steiner & Aminuddin 2001).	Although the level of infestation has been low, pests and diseases should be constantly monitored in rattan stands.

APPENDIX 3 CONT'D

FIELD & AREA OF RESEARCH	SUMMARY OF RECENT STUDIES	NOTES ON RESEARCH PRIORITIES
2.9 Intensively managed plantation and genetic improvement	In the ongoing Project on "Capacity Building for the Development of a Sustainable Rattan Sector in China Based on Plantation Sources" funded by the International Tropical Timber Organization and implemented by the International Center for Bamboo and Rattan (ICBR), the following studies are in progress (ICBR 2006, unpublished report): – Fertilizer application trial for cane production – Tree canopy adjustment trial – Family test of *Daemonorops margaritae* (*=D. jenkinsiana?), Calamus simplicifolius* and *C. nambariensis* var. *xishuangbannaensis* – Effects of age and interval of harvesting for cane production From 1994 to 1998, a research project on rattan conservation, genetic improvement and silviculture was carried out the Forest Research Institute Malaysia, the Forestry Research Centre of Sabah (Malaysia), Innoprise Corporation Sdn. Bhd. (Sabah, Malaysia), CIRAD Foret (France) and the Royal Botanic Gardens, Kew (UK). Some of the findings of this project were reported in Bacilieri and Appanah (1999). Many of the long term studies undertaken in the project are being continued. For example, in Sabah, the provenance cum progeny trial on *Calamus subinermis* reported by Lee (1999) is still being maintained and monitored.	In intensively managed plantations which require a lot of inputs, studies with the objective to maximize production are justified. Examples of such studies are: nutrient budget and fertilizer trial, use of appropriate support trees and canopy manipulation, interaction between rattan and support trees, genetic improvement, and development of appropriate harvesting techniques.
3. CANE PROCESSING AND MANUFACTURING		

APPENDIX 3 CONT'D

FIELD & AREA OF RESEARCH	SUMMARY OF RECENT STUDIES	NOTES ON RESEARCH PRIORITIES
3.1 Properties of canes	Chowdhury (2004) reported the physical and mechanical properties of *Daemonorops jenkinsiana* from Bangladesh. The silica content in 9 rattan species (*Calamus merrillii, C. ornatus, C. manan, C. scipionum, C. ornatus* var. *philippinensis, C. caesius, C. trachycoleus, C. javensis* and *Daemonorops robusta*) was studied by Abasolo *et al.* (2001). Basic density and strength properties of cultivated *Calamus manan* cane of age ranging from 7 to 24 years were reported (Wahab *et al.* 2004). Razali (2001) investigated the variation of mechanical and fibre properties of cultivated *Calamus scipionum* and *Daemonorops angustifolia*. Fibre diameter, percentage of fibre area, frequency and size of vascular bundle decreased with age in planted *Calamus scipionum* (Roszaini 2000). From the study on the microfibril angle of the fibres of *Calamus merrillii* cane, Abasolo *et al.* (2000) concluded that the influence of microfibril angle on the properties of rattan cane is similar to its influence on the properties of wood.	The cane properties of many planted rattan remain unknown; little information on cane properties of lesser utilized species is available.

APPENDIX 3 CONT'D

FIELD & AREA OF RESEARCH	SUMMARY OF RECENT STUDIES	NOTES ON RESEARCH PRIORITIES
3.2 Utilization & manufacturing	Harvesting, processing and utilization of rattan in West Nigeria were reported by Lucas & Dahunsi, (2004a). The physical and mechanical properties of three western Nigerian rattan species were found to be adequate for use as reinforcement in lowly stressed concrete elements (Lucas & Dahunsi, 2004b). The influence of heat and loading time on the mechanical properties of *Calamus merrillii* was studied by Abasolo *et al.* (2002a). Abasolo *et al.* (2005, 2002b) investigated thermal softening of palasan (*Calamus merrillii*) canes Stable briquettes were produced from strands of rattan (mixture of *Laccosperma secundiflorum* and *Eremospatha macrocarpa*) mixed with cassava starch paste (Olorunnisola, 2004) Assessment of the resistance of rattan against blue stain was carried out by Supriadi *et al.* (2002) The moisture content distribution model of *Calamus manan* in Aek Nauli, north Sumatera was described by Achmad & Waluyo (2000). The strength and stiffness properties of joints in rattan furniture in Malaysia were studied recently (Wan Tarmeze, 2001). The status of rattan based small scale cottage industries in urban and semi urban area of Chittagong, Bangladesh, was reported by Danesh Miah & Lutfor Rahman (2002).	There is a need to intensify research and extension on the enhancement of quality and value of cane products in many parts of the world.
3.3 Preservation	Jasni *et al.* (2001) found bubuy rattan (*Plectocomia elongata*) treated with tannin extracted from the bark of *Acacia mangium* trees at 4% or higher concentration, caused 100% mortality in powder post beetles and increased its durability significantly. Preservative treatment of *Daemonorops jenkinsiana* with borax and boric acid by soaking method was reported to be successful (Younus 1999).	Environmentally friendly preservation methods are needed to stop infestation by powder post beetles and blue stain fungi.

APPENDIX 3 CONT'D

FIELD & AREA OF RESEARCH	SUMMARY OF RECENT STUDIES	NOTES ON RESEARCH PRIORITIES
4. PRODUCTION OF EDIBLE SHOOTS	Cultivation of *Calamus tenuis* for edible shoot production was reported in Lao PDR (Sengdala & Evans 1999). Processing and packaging of edible shoots of *C. viminalis* in Thailand are well documented (Anon. 2002). In the ongoing ITTO funded Project on "Capacity Building for the Development of a Sustainable Rattan Sector in China Based on Plantation Sources", the following studies on shoot production are in progress (ICBR 2006, unpublished report): – Fertilization trial – Irrigation trial – Spacing trial – Transformation of rattan plantations from canes production into shoots production – Dual purpose management of rattan plantations for shoot and cane production	

APPENDIX 3 CONT'D

FIELD & AREA OF RESEARCH	SUMMARY OF RECENT STUDIES	NOTES ON RESEARCH PRIORITIES
5. SOCIO-ECONOMIC ISSUES	Vantomme (2003) reviewed available data on trade in rattan products and found that reported quantities remained within approximately the same levels from 1995 to 2001 and there was no indication of an imbalance between supply and demand or decreasing global cane supply. He found that Indonesia had become the main exporter of cane and China the world's biggest importer. Shortages in the supply of cane may in some cases be caused by dwindling resources of rattan in the forests, but in the economically successfully performing countries of South-east Asia, a shortage of cane is often more due to the fact that rural people are gradually less interested in rattan harvesting as other and better options to sustain their livelihoods become available. Yang *et al.* (2005b) performed an economic analysis of intercropping *Calamus simplicifolius* with *Gmelina arborea*, and showed more economic gain in mixed planting than in pure *G. arborea*. Yang *et al.* (2004) described a case study on the socio-economic benefit of rattan in Nanchang village, Hainan, China. They estimated that the income from rattan sales contributed about 66% to the total income in the village and provided more than 50% income for nearly all of the 40 households. A study of the rattan production to consumption system in the district of Abidjan (South Cote d'Ivoire) to determine the commercial channels and evaluate the economic benefit of rattan exploitation for each group of stakeholders involved was conducted by Bi & Kouakou (2004b). Paudel (1999) described the use of rattan (including *Calamus tenuis* and *Calamus acanthospathus*) in religious rites of the Tharus, Nepal; such practices contributed to the preservation and conservation of these rattan species.	Socio-economic issues are site specific and must be addressed at the local level. The low price of canes is a problem (discussed in Section 4) faced by all rattan harvesters and cultivators in Asia.

APPENDIX 3 CONT'D

FIELD & AREA OF RESEARCH	SUMMARY OF RECENT STUDIES	NOTES ON RESEARCH PRIORITIES
6. INSTITUTIONAL & POLICY FRAMEWORK	Hunter *et al.* (2003) described how the land tenure issue was tackled by granting government issued licenses to manage and utilize the rattan resources from a finite patch of secondary forest to individual farming families in Hainan Island, China.	Institutional and policy framework at the local, regional and national levels need to be set up carefully. The rattan policy of Indonesia, with its dominance in the world rattan market, has a profound effect on the global rattan sector.
7. PUBLIC AWARENESS & EXTENSION	Rattan glossary and Compendium glossary has been compiled (Johnson & Sunderland, 2004). In the ongoing ITTO funded Project on "Capacity Building for the Development of a Sustainable Rattan Sector in China Based on Plantation Sources", the following demonstration plots have been established (ICBR 2006, unpublished report): • Demonstration plot of intensively managed rattan plantations for shoots production were established with *Daemonorops margaritae* (*=D. jenkinsiana?*), *Calamus simplicifolius* and *C. nambariensis* var. *xishuangbannaensis* in Dongguan Longxiang Forest Farm • In Pingguo County, Guangxi Zhuang Autonomous Region, a 2 ha plantation of *Daemonorops margaritae* (*=D. jenkinsiana?*) has been established to demonstrate management of rattan plantations for the dual purpose of production of edible shoots and canes	Efficient ways of creating awareness and technology transfer need to be devised.

Report of Rattan Study Tour to Thailand

By

Dr. Huang Shineng, Assistant Project Director

ITTO Project PD 100/01 Rev. 3 (I)

"Capacity Building for the Development of a Sustainable Rattan Sector in China Based on Plantation Sources"

International Center for Bamboo and Rattan (ICBR)

July 2005, Beijing, China

Report of Rattan Study Tour to Thailand

By

Dr. Huang Shineng, Assistant Project Director

ITTO Project PD 100/01 Rev. 3 (I)

"Capacity Building for the Development of a Sustainable Rattan Sector in China Based on Plantation Sources"

1. BACKGROUND

The International Tropical Timber Organization (ITTO) funded project, "Capacity building for the development of a sustainable rattan sector in China based on plantation sources," proposed an activity under the expected Output 1 to organize study tours to Malaysia, Indonesia and Thailand in the first calendar year (August 2003 - July 2004) of the project. However, as China was hit by SARS in 2003 and early 2004, and later on the relevant institutions and people we proposed to visit had no time to help us organize the planned tours before January 2005, this activity had to be postponed again and again until June 26, 2005 when the first tour to Thailand was made possible.

One of the most important demonstrations of the project is to develop techniques for cultivation and management of rattan plantations for edible shoots production as China has put a high priority on developing edible rattan shoots market. A major development problem of edible rattan plantation management in China is the lack of techniques for cultivation and management of edible rattan plantations, while Thailand's 10 years efforts towards sustainable management of edible rattan plantations have earned recognition from reputable international forestry organizations. It is anticipated that with the proposed study tour to Thailand, this project will better benefit the local Chinese people in improving their knowledge of and techniques for using rattan shoots for producing foodstuffs in China.

2. ORGANIZATION OF THE STUDY TOUR

The study tour was proposed to comprise of seven project staff members, including project staff members from the Executing Agency and three collaborating institutions. However, since Ms. Li Lan, the Project Financial Officer, and Dr. Wang Ge, a project team member from the Executing Agency, and two project members from Guangzhou site were not available during

the planned visit period, the visiting group only consisted of three project staff members. They are: Dr. Huang Shineng, the Assistant Project Director from the Research Institute of Tropical Forestry, and Mr. Guo Wenfu and Mr. Feng Changlin from the Experimental Center of Tropical Forestry, the Chinese Academy of Forestry.

The organization of this Study Tour has lasted for about a year. Thanks to the kind help of Mr. Smit Boonsermsuk of the Royal Forrest Department of the Kingdom of Thailand, we finally made our study tour possible in June 2005.

3. OBJECTIVES OF THE STUFY TOUR

As one of the planned project activity, this Study Tour was to 1) familiarize the project staff members with different aspects of rattan plantation management for edible shoots production in Thailand, and 2) develop direct contact between forestry sectors, especially the rattan subsectors in China and Thailand.

4. ACTIVITIES AND OUTPUTS OF THE STUDY TOUR

4.1 Summary of the visiting program

Date	Venue	Event
June 26	China/Thailand	The team left China for Thailand, stayed overnight at the Fortune Hotel in Bangkok
June 27	Royal Forest Department and National Park, Wildlife and Plant Conservation Department, Bangkok	1. Met with ITTO funded project staff members and attended an information exchange meeting at the National Park, Wildlife and Plant Conservation Department; Dr. Huang Shineng gave the participants of the meeting a brief introduction to the ITTO PD 100/01 Rev. 3 (I), and Mr. Smit Boonsermsuk made a presentation on the ITTO PD 24/00 Rev. 1 (I) during the meeting; 2. Further detailed the visiting program with Mr. Smit Boonsermsuk at the Royal Forest Department

Date	Venue	Event
June 28	Muang District, Sakon Nakhon Province, Thailand.	1. Visited the Non-wood Forest Products Research Experimental Station of the Royal Forest Department, exchanged information on the two ITTO funded project being carried out in Thailand and in China; 2. Visited the rattan research and demonstration plots and edible rattan plantations belonging to the villagers
June 29	Angthong Province and Ayutthaya Province	1. Visited raw rattan material processing factory and rattan production company at Angthong Province; 2. Visited Bang Sai Art and Craft Centre in Ayutthaya Province
June 30	Krabi and Trang Provinces	b) Visited demonstration plot of rattan plantations for cane production under the ITTO funded project in Krabi; c) Visited a rattan nursery at the Khao Bantad Rattan Research Station, Royal Forest Department in Trung Province; d) Moved to Songkhla Province and stayed overnight at Songkhla
July 1	Songkhla Province and Bangkok	1. Visited rattan demonstration plot and nursery at Songkhla Forest Experimental Station; 2. Visited rattan plantation (*Calamus manan*) in natural forest at Tone Nga Chang Wildlife Sanctuary; 3. Back to Bangkok in the afternoon

July 2	Bangkok	Free day.
July 3	Ratchaburi Province	Visited Baan Kumphangsaen in Jombung District in Ratchaburi Province, a successful community on furniture and weaving production supported by ITTO project
July 4	Thailand/China	Got back to China

The above program of field visits, meetings and presentations resulted in a very successful series of exchanges of information and the establishment of contacts between China and Thailand. The following section presented some technical observations and comments that we made during our Study Tour.

4.2 Findings from the Study Tours (in Terms of Technical Aspects)

4.2.1 General implementation of the ITTO PD 24/00 Rev. 1(I), "Promotion of sustainable utilization of rattan from plantations in Thailand"

The ITTO PD 24/00 Rev. 1(I), "Promotion of sustainable utilization of rattan from plantations in Thailand," was jointly implemented by the Forest Management and Forest Products Research Office, Royal Forest Department, and Silviculture Research and Botany Section, National Park, Wildlife and Plant Conservation Department of Thailand. During the information exchange meeting held in the morning of June 27, 2005, we learnt from the keynote speech made by Mr. Thanee Viriyarattanaporn, Director of Forest Management and Forest Products Research Office of the Royal Forest Department and a PowerPoint presentation by Mr. Smit Boonsermsuk that the project had been successfully implemented, and remained only three days of its duration. The project was in the concluding stage when we visited, and the completion report and some technical reports in English were edited. The project leader promised that they will send us those technical reports when they are completed.

Dr. Huang Shineng informed the meeting participants that the ITTO PD 100/01 Rev. 3 (I) is going to organize a regional workshop on sustainable development of rattan sector in Asia in Beijing, China in October 2005 and would be able to fund two participants from Thailand to attend the workshop, after a brief introduction to the ITTO PD 100/01 Rev. 3(I). The Thai ITTO project staff members expressed their interests in participating at the workshop.

4.2.2 Cultivation of rattan plantations for edible shoots production

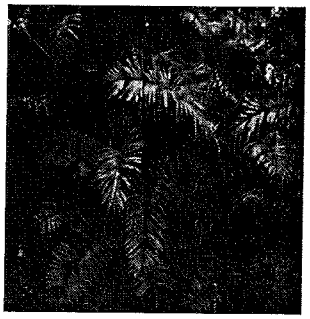
Thailand has traditionally used rattan shoots as daily diet and rattan shoot has now become more popular dishes in the North and Northeast parts. Small scale research on cultivation and management of edible rattan plantations was started in 1991-92 with the financial support from the Royal Forest Department. Systemic research and demonstration on edible rattan plantation management was started in 2001 when the ITTO PD 24/00 Rev. 1(I), "Promotion of sustainable utilization of rattan from plantations in Thailand," was funded by ITTO. With the ITTO's financial support, foresters in Thailand further developed techniques for producing canned rattan shoots, and tried to sell them in the super market. However, the sales of canned rattan shoots was not successful as people like consuming fresh shoots instead of canned or preserved shoots.

Studies on cultivation of edible rattans were mainly conducted in Sakon Nakhon Province. Three species, namely *Calamus viminalis*, *C. tenuis* and *C. Siamensis* had been tested (see Box 1), but only one species, *Calamus viminalis*, shows the potential for further development for edible shoots production and widely accepted and consumed by local people.

Box 1. Three edible rattan species tested in Sakon Nakhon Province, Northeast Thailand.

Calamus viminalis

Calamus tenuis



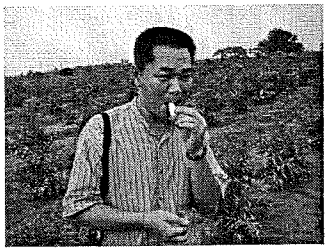
Calamus siamensis

The optimum spacing for establishing plantations of *C. viminalis* for shoots production is 3 m X 1.5 m. Normally 6-month-old seedlings are used for outplanting. Shoots can be harvested 10 -12 months after planting (see Box 2). A clear cut is applied to edible rattan plantations at ages of 6-8 years old, when the productivity appears rapid decreasing. The clear cut practice generally results in a higher productivity compared with the previous generation.

Box 2. *Calamus viminalis* starts producing tasty shoots 8 months after planting.

Harvesting of shoots

Processing...



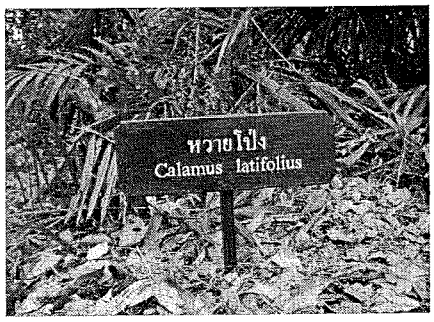
Taste good....

Cultivation of rattan plantations for edible shoots production is limited to the northern and northeastern regions of Thailand. This is because people in other places don't like to eat rattan shoots. We had not got the exact data of areas of edible rattan plantation during our visit. But we were told that plus some plantations managed for other purposes such as ecosystem protection and production of value-added forest products, the area of rattan plantations in the northern and northeastern regions accounts for about half of the total area of rattan plantations in Thailand.

4.2.3 Cultivation of rattan plantations for genetic conservation and/or seed production

Thailand started to cultivate rattan plantations for genetic conservation and/or seed production in 1960s. These plantations are sometimes used for silvicultural research. The species planted are mostly local ones, such as *Calamus longisetus, C. latifolius, C. palustris, C. peregrinus* and *C. rudentum*. The Khao Bantad Rattan Research Station in Nayong District of Trung Province has the biggest number of rattan species planted in Thailand (see Box 3).

Box 3. Planting of rattans for genetic conservation is popular in Thailand.



4.2.4 Cultivation of rattan plantations for cane production

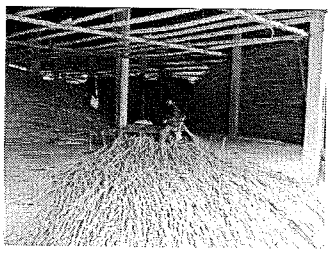
Compared with the area of rattan plantations for genetic conservation, seed production and edible shoots production, the area of rattan plantations for cane production in Thailand is very small. Cultivation of rattan plantations for cane production seems not to be a major production activity in Thailand, like China, because the quality of cane of most of local species is poor, and the seeds of introduced, high quality cane producing species are in short supply (see Box 4). Thailand's efforts to establish rattan plantations for seed production seem to be a good model from which China can learn a lot.

Box 4. *Calamus manan* produces high quality canes, but its seeds are in serious shortage of supply.

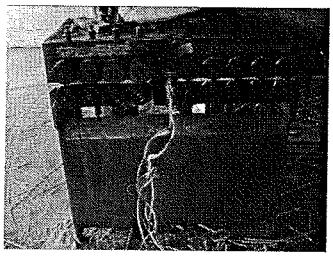
4.2.5 Rattan cane processing and production of rattan based products

In Thailand, rattan canes are mostly imported from Indonesia, Malaysia, Myanmar and Laos. The imported canes are usually transported to rattan raw material factories for sorting and grading. After sorting and grading, some of canes are bundled and packed into jute sack and sold to exporters for direct exportation, some are used to produce wickers and cores (see Box 5) and sold to manufacturers for production of furniture, handcrafts and semi-finished products, the later is usually sold to the exporters for exportation to other countries.

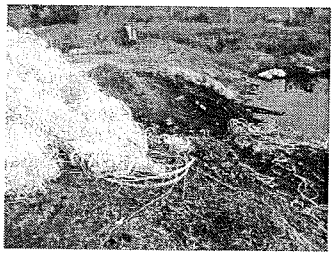
Box 5. Rattan canes processing in a rattan raw material factory.



Sorting and grading ☺



Wickers & cores producing ☺



.....Resources wasting ☹

It seems that rattan furniture and handicrafts making is not a vital industry in Thailand because of the lack of skillful workers and/or artisans. The Government of Thailand is

conducting a series of national training courses on rattan furniture and handicrafts making, but the number of young people who want to take this kind of training is very few. The successful community on rattan furniture and weaving production in Jombung District in Ratchaburi Province we visited is only in its early days of development and can only produce products that are suitable for selling in local markets. Development of human resources in the industry is, as we see, a major concern and challenge of the development of rattan sector in Thailand.

5. Observations and Concluding Remarks

There are a number of observations that were made during the visit as presented within the text. Among them the most important are:

5.1 Rattan has played an important role in Thailand's national economy. Production of rattan products, especially edible shoots, has generated employment and subsisting income for people, particularly for those who live in rural areas in the northern and northeastern regions of Thailand.

5.2 Cultivation of edible rattans features the current development of rattan sector in Thailand. We were told by Thai farmers in Muang District of Sakon Nakhon Province that planting of edible rattans is more profitable than management of fruit gardens and in the local dicker market one rattan shoot can exchange one kilogram of rice. Interestingly, under the initiative of the Royalty, Thailand in 1997 embarked a program of producing food from rattan, turning this species into a food bank, probably the first of its kind in the world.

5.3 Management of rattan plantations for genetic conservation and seed production is popular in Thailand. This practice can be seen as a far-sight measure that the Government of Thailand adopts to solve the problem of declining resource base of rattans. Like Thailand, China is encountering a similar problem in the development of rattan sector. The Thai experience is worth learning and cultivation of rattan plantations for genetic conservation and seed production should be a major concern of the rattan sector of China.

5.4 Rattan canes processing and production of value-added rattan products are somewhat less developed in Thailand due to the lack of skillful workers and/or artisans. There exist opportunities for Thailand and China to cooperate in the training of workers and/or artisans.

5.5 In conclusion, we would say that direct linkages between the rattan subsectors of Thailand and China have been established. We hope that the forestry authorities of the two countries can further explore more possibilities for the rattan research and development workers to develop future cooperation in rattan R&D in the two countries.

6. ACKNOWLEDGEMENT

We are very grateful to Mr. Smit Boonsermsuk of the Royal Forest Department, Kingdom of Thailand for his tireless effort in making all the necessary arrangement and in accommodating to our needs. The trip was superbly arranged and it maximized the limited time that we had in Thailand. Also, we would like to express our appreciation to all the forest officers, scientists and the local farmers we met for their co-operation and assistance provided us. Finally, we are very grateful to ITTO for their financial support, and to Prof. Jiang Zehui, Project Director of the ITTO PD 100/01 Rev. 3(I) for offering us an assignment as members of the Study Tour.

7. REPORT COMPLETED BY:

Huang Shineng, Ph.D.

Assistant Project Director, ITTO PD 100/01 Rev. 3(I)

International Center for Bamboo and rattan (ICBR)

July 2005, Beijing, China

Report of Rattan Study Tour to Malaysia

By

Huang Shineng, Zhao Xia, Yang Jinchang

ITTO Project PD 100/01 Rev. 3 (I)

"Capacity Building for the Development of a Sustainable Rattan Sector in China Based on Plantation Sources"

International Center for Bamboo and Rattan (ICBR)

June 2006, Beijing, China

Report of Rattan Study Tour to Thailand

By

Dr. Huang Shineng, Ms. Zhao Xia & Dr. Yang Jinchang

ITTO Project PD 100/01 Rev. 3 (I)

"Capacity Building for the Development of a Sustainable Rattan Sector in China Based on Plantation Sources"

1. BACKGROUND

The International Tropical Timber Organization (ITTO) funded project, "Capacity building for the development of a sustainable rattan sector in China based on plantation sources," proposed an activity under the expected Output 1 to organize study tours to Malaysia, Indonesia and Thailand in the first calendar year (August 2003 - July 2004) of the project. However, as China was hit by SARS in 2003 and early 2004, and later on the relevant institutions and people we proposed to visit had no time to help us organize the planned tours before January 2005, this activity had to be postponed until June 26, 2005 when the first tour to Thailand was made possible.

Among the rattan growing countries, Malaysia is the first country to establish large-scale commercial rattan plantations of the commercially important species in SE Asia, since 1980 in Sabah. It has the largest area of commercial rattan plantations, especially of the plantations of *Calamus manan* which is considered by many to be the best large-diameter cane, established under natural forests and rubber plantations in Sabah and Sarawak as well as in Peninsular Malaysia. Those rattan plantations have paid an important role in the supply of raw materials for the development of rattan industry in Malaysia. The study tour to Malaysia will help the project staff improve their knowledge of cultivation and management of large-scale rattan plantations. The proposed areas/organization of visit will include: Forest Research Centre of Sabah, Sabah Foundation (Innoprise Corporation Sendiran Berhad), and the Forest Research Institute of Malaysia.

2. ORGANIZATION OF THE STUDY TOUR

The study tour was proposed to comprise of five project staff members, including project staff members from ICBR and the Chinese Academy of Forestry. However, since Ms. Li Lan, the

Project Financial Officer, and Dr. Sun Qixiang, Director of the PMO, were not available during the planned visit period, the visiting group only consisted of three project staff members. They are: Dr. Huang Shineng, the Assistant Project Director, Ms. Zhao Xia and Dr. Yang Jinchang from the Research Institute of Tropical Forestry (RITF) of the Chinese Academy of Forestry.

The organization of this Study Tour has lasted for about half a year. Thanks to the kind help of Dr. Lee Ying Fah, Head of Forest Research Center of Sabah, Malaysia, we finally made our study tour possible in May 2006.

3. OBJECTIVES OF THE STUFY TOUR

As one of the planned project activity, this Study Tour was to 1) familiarize the project staff members with different aspects of large-scale rattan plantation management in Malaysia, and 2) develop direct contact between forestry sectors, especially the rattan subsectors in China and in Malaysia.

4. ACTIVITIES AND OUTPUTS OF THE STUDY TOUR

4.1 Summary of the visiting program

Date	Venue	Event
May 21	China/Malaysia	The team left China for Sabah, stayed overnight at the Tyng Garden Hotel in Sandakan, Sabah
May 22	Sandakan, Sabah	1. Visited a provenance cum progeny trial of *Calamus subinermis* and some species elimination trials of rattans under a natural (secondary) forest in Kolapis Experimental Station of Forest Research Center, Forest Department of Sabah. 2. Visited a spacing trial of *Calamus subinermis* under *Acacia mangium* plantation in Segaliud Lokan Experimental Station of Forest Research Center (FRC), Forest Department of Sabah.
May 23	Sandakan, Sabah	1. Visited the library of Forest Research Center, Forest Department of Sabah discussing with the library staff about the information exchange in rattan research and development.

Date	Venue	Event
May 23	Sandakan, Sabah	2. Visited Sepilok Orangutan Rehabilitation Center where there is one of the well protected natural rain forests in Sabah. 3. Visited the mangroves in the Labuk Bay and the Proboscis Monkey Sanctuary.
May 24	Sandakan/Kota Kinabalu/ Kuala Lumpur	1. Left for Kota Kinabalu in the morning; 2. Visited University Malaysia Sabah (UMS), met with some professionals working on tropical forestry and rattan research as well; exchanged information on tropical forest research and development at UMS and RITF. 3. Visited a rattan canes processing and furniture making factory in Kota Kinabalu. 4. Left for Kuala Lumpur.
May 25	Kuala Lumpur	1. Visited the Forest Research Institute of Malaysia (FRIM); 2. Took part in a colloquium organized by FRIM, Dr. Raja Barizan Rajia Sulaiman made a presentation on rattan resources and management in Malaysia and Dr. Mohd Tamizi Mustafa made a presentation on rattan industry in Peninsular Malaysia.
May 26	Kuala Lumpur	Free day
May 27 2	Kuala Lumpur/ Guangzhou	The team left for Guangzhou, China

The above program of field visits, meetings and presentations resulted in a very successful series of exchanges of information and the establishment of contacts between China and Malaysia. The following section presented some technical observations and comments that we made during our Study Tour.

4.2 Findings from the Study Tour (in Terms of Technical Aspects)

4.2.1 Rattan resources and management in Sabah and Peninsular Malaysia

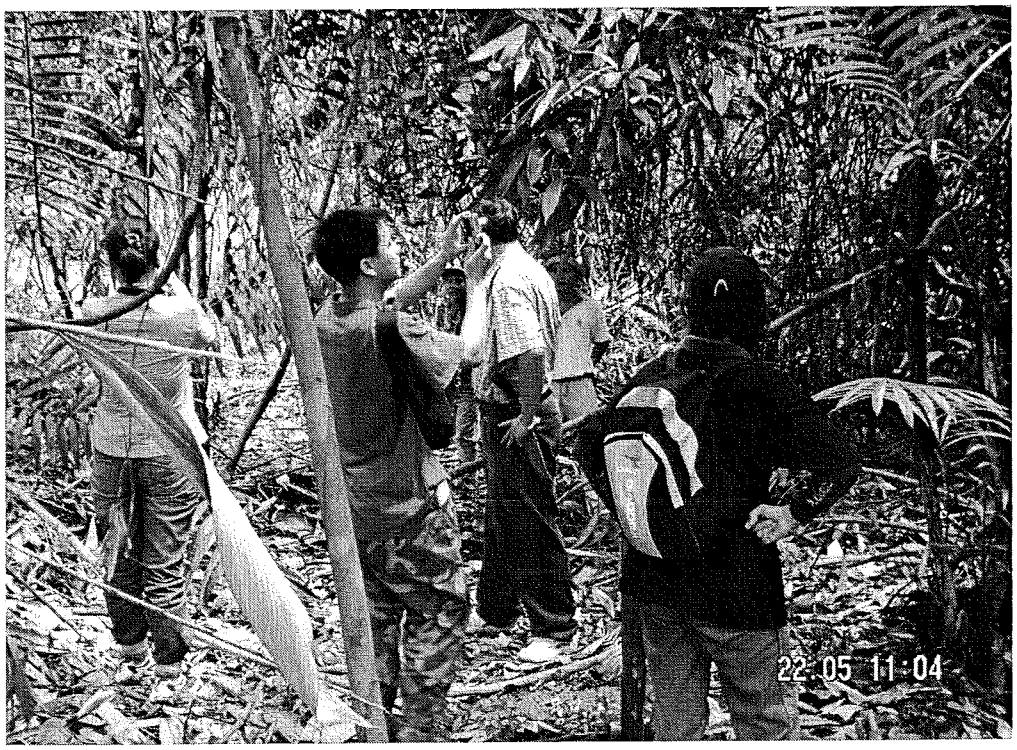
Sabah and Peninsular Malaysia were two of the major rattan producing areas in Malaysia, and had ever the biggest area of rattan plantation in the world. However, it is said that the low price of rattan canes in the world market resulted from the price competition from Indonesia

had led rattan growers in Sabah to clear up rattan plantations to plant oil palm trees, which generate more incomes and have a shorter investment cycle. This has furthered the rapid decrease in stock of wild rattans. Also, it has led the government to change its policy to support the establishment of oil palm plantations or cultivation of other cash crops. Rattan experts in Malaysia now have difficulties getting financial support from the government.

4.2.2 Provenance trials of rattan species

Malaysia is fortunate to be endowed with plenty of wild rattans from its tropical rainforest. However, little has been done in the species elimination trials and improvement studies. Up to date, only one provenance cum progeny test has been carried out for *Calamus subinermis*.

Box 1. Team members visited the provenance cum progeny test for *Calamus subinermis*



This test has not been assessed for quite a long time due to the lack of financial support.

4.2.3 Tree plantations intercropped with rattan species

Rattans planted for cane production need supporting trees. Hence intercropping becomes a common practice in rattan plantation management. The supporting trees used in Malaysia are mainly pines, rubber trees and acacias. In Sabah, we found that intercropping trials are usually associated with other trials such as spacing trials, provenance trials and progeny tests. However, assessment of those trials has been stopped for a long time, again due to the lack

of financial support.

Box 2. A spacing trial of *C. subinermis* under *Acacia mangium* in Sabah.

4.2.4 Processing and Manufacturing of Rattan in Sabah and Peninsular Malaysia

About 20 rattan species are used commercially in Malaysia. Most of the rattan processing mills in Malaysia are either individually or family operated with people having a very basic educational background. As such, they have poor accounting practices, inappropriate factory layouts and antiquated production techniques that result in low productivity levels and poor workmanship. Their activities are usually limited due to a lack of capital and difficulty in obtaining credit and bank loans. These difficulties prevent them from expanding and acquiring a permanent business site.

According to a survey by FRIM experts, processing and manufacturing of rattan seems to be a downfallen industry nowadays in Malaysia. The total rattan furniture exports have decreases from US$29.5 million in 1994 to US$ 11.8 million in 2005

5. Observations and Concluding Remarks

There are a number of observations that were made during the visit as presented within the text. Among them the most important are:

5.1 Malaysia is rich in rattan resources in terms of species diversity. Rattan once played an important role in Malaysia's national economy. Production of rattan products, especially furniture, has generated employment and subsisting income for people, particularly for those who live in rural areas in Sabah and Peninsular Malaysia.

5.2 Management of rattan plantations for cane production has become an insignificant production practice in Malaysian forestry sector. Rattan furniture accounted for about 6.3 % share of total furniture export in 1994, however in 2005 the share of rattan furniture export decreases to about 0.65 %.

5.3 Although direct linkages between the rattan subsectors of Malaysia and China have been established, we are not sure if opportunity for cooperation in rattan R&D in the two countries could be explored as rattan research and development have not listed as a priority research and development activity in Malaysia for years..

6. ACKNOWLEDGEMENT

We are very grateful to Dr. Lee Ying Fah, Head of Forest Research Center (FRC) of Forest Department of Sabah for his great efforts in making all the necessary arrangement and in accommodating to our needs. Also, we would like to express our appreciation to Ms. Chia Fui Ree of FRC, our filed guide for her painstaking care of us and live explanation that made our visit full of delight. We thank all forest officers, scientists and the local farmers we met for their co-operation and assistance provided us. Finally, we are very grateful to ITTO for its financial support.

7. REPORT COMPLETED BY:

Dr. Huang Shineng, Ms. Zhao Xia & Dr. Yang Jinchang

ITTO PD 100/01 Rev. 3(I)

International Center for Bamboo and rattan (ICBR)

June 2006, Beijing, China

印度尼西亚棕榈藤业考察体会

李荣生
(中国林业科学研究院热带林业研究所 广州 510520)

摘 要：考察认为印度尼西亚的棕榈藤资源丰富，藤条生产潜力大；人工种植施法自然，初植密度低，不施化学肥料，依靠天然淤泥肥地；重视天然资源保护，鼓励人工培育资源；单纯依靠棕榈藤作为发展手段效果不尽如人意；藤产品成为印度尼西亚国家的纪念品之一。

关键词：印度尼西亚；棕榈藤；人工培育

Study Tour Report on Rattan Sector in Indonesia

Li Rongsheng

Abstract: This paper deals with the opinions the author holds after conducting a study tour on the rattan sector in Indonesia. The opinions are described as following: (1) Indonesia is rich in rattan resources, and the capacity to produce canes is overwhelming; (2) Planting rattan at the density of natural occurrence and the sediment in rivers serve as fertilizer; (3) Implementing policy to conserve natural resources and promote rattan cultivation; (4) The effect of solely depending on rattan as development means is not as good as it was thought; (5) Rattan products is one of souvenirs of Indonesia.

Key Words: rattan; rattan cultivation; Indonesia

印度尼西亚是世界上棕榈藤种类和资源最丰富的国家，具有悠久的棕榈藤栽培和利用历史，是世界上藤条产量和出口量最大的国家，是一个棕榈藤研究人员向往已久的国度。

2006年10月10日作为国际热带木材组织资助项目“基于人工林资源中国棕榈藤业可持续发展的能力建设”的研究内容之一，我们一行5人抵达印度尼西亚首都雅加达，开始为期6天的考察之行。

*ITTO资助项目“基于人工林资源中国棕榈藤业可持续发展的能力建设”(ITTO PD 100/01 Rev. 3(I));
感谢印度尼西亚锯材木工协会(ISWA)的PHJ Nainggolan先生的安排和全程陪同。

1 印度尼西亚概况

印度尼西亚位于亚洲东南部，地跨赤道，是世界上最大的群岛国家，由太平洋和印度洋之间17 508个岛屿组成，陆地面积约190万km²，海洋面积约317万km²，海岸线总长54 716 km，有“千岛之国”之称。印度尼西亚北部的加里曼丹岛与马来西亚接壤，南部的新几内亚岛与巴布亚新几内亚相连，东北部面临菲律宾，东南部面临印度洋，西南与澳大利亚相望。

2004年印度尼西亚的总人口约为2.17亿，是世界上第四人口大国。全国有100多个民族，其中爪哇族占45%，巽他族占14%，马都拉族7.5%，马来族7.55%，其他26%。

律的研究[J]. 竹子研究汇刊, 2002, 21(1): 57-60
4 周芳纯. 竹林开花结实及其处理[J]. 竹类研究, 1996, 2: 19-29
5 付顺华, 吴家森, 等. 雷竹种子特性及苗期生长观察[J]. 山东林业科技, 2002, 1: 11-12
6 邢新婷, 傅懋毅, 等. 麻竹开花生物学特性观察及控制授粉的初步研究[J]. 北京林业大学学报, 2005, 27(6): 103-107
7 杨成华, 孙志红. 9种木兰科种子的场圃发芽率实验[J]. 贵州林业科技, 2003, 31(3): 19-21
8 游水生, 王海为, 等. 锥栗1年生播种苗的年生长规律[J]. 福建林学院学报, 2003, 23(2): 102-105
9 周永学, 宋世德, 等. 泡桐苗期高生长曲线的拟合及其分析[J]. 陕西林业科技, 1996, 3: 1-4
10 张纪卯. 毛果青冈1年生苗木生长规律及相关关系[J]. 中南林学院学报, 2006, 26 (3): 59-62

官方语言为印度尼西亚语，民族语言和方言约300种。约87%的居民信奉伊斯兰教，是世界上穆斯林人口最多的国家，6.1%的人口信奉基督教新教，3.6%信奉天主教，其余信奉印度教、佛教和原始拜物教等。

印度尼西亚耕地占国土面积11.18%，永久牧场占6.57%，森林和林地占67.23%，其它占15.02%。除爪哇西部的平原和低谷地区属热带草原气候外，其余地区均属热带雨林气候，具有温度高、降雨多、风力小和湿度大等特征。年均气候25~27℃，气温变化小，没有寒暑季节之分。除爪哇西部的平原和低谷地区和终年多雨的马鲁古群岛外，其它地区大部分受季风影响每年有明显的旱季和雨季。

2 考察路线

考察团第1天从雅加达出发，经南加里曼丹省的省府马辰市和中加里曼丹省的省府帕朗卡拉亚市最后到达中加里曼丹省的桑皮特地区；第2天参观桑皮特地区的"SUNGAI MENTAYA"河边的西加省藤人工林及其初加工；第3天沿原路返回到马辰市，途中参观粗鞘省藤人工林；第4天返回雅加达，参观雅加达大型商场中的藤制品销售处；第5天休息，第6天与印尼国家林业部相关人员座谈，考察路线（见图1）。

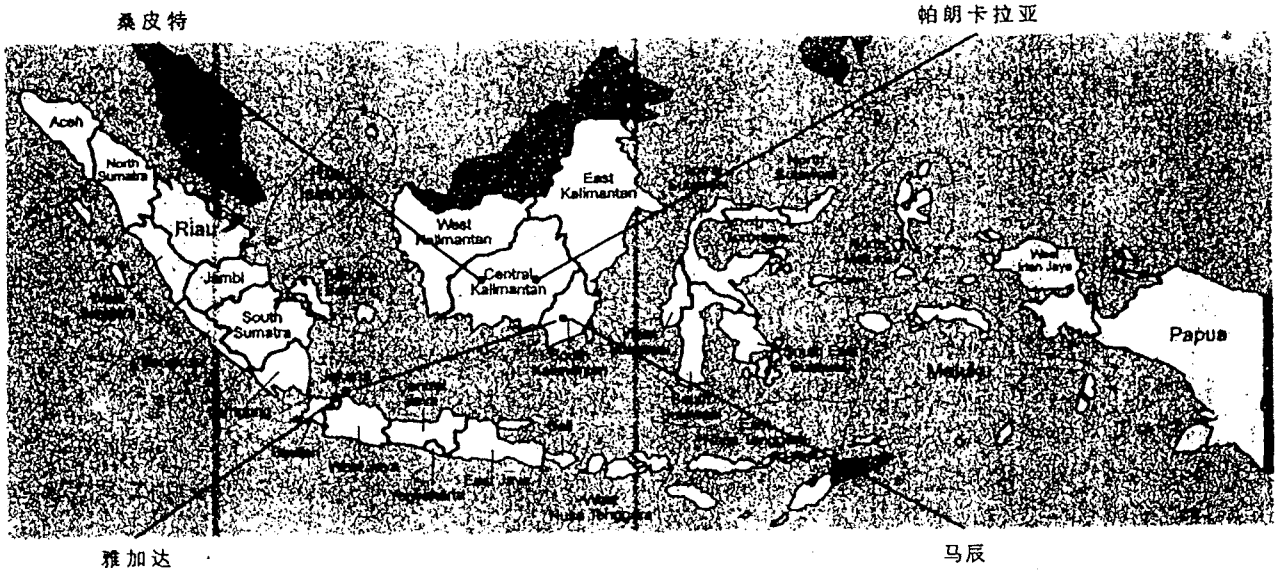


图1 印度尼西亚棕榈藤考察路线示意图

3 考察体会

3.1 棕榈藤资源丰富，藤条生产能力大

考察团从南加里曼丹省的马辰经中加里曼丹省的帕朗卡拉亚市到达中加里曼丹省的桑皮特地区，沿途公路两侧不仅可以看到或密或疏的森林，还可以看到多种棕榈藤植物。据统计，印度尼西亚棕榈藤植物有7属306种，可以利用的藤种有53种，包括世界上品质最好的玛瑙省藤、西加省藤和粗鞘省藤。

印度尼西亚的苏门答腊、爪哇、加里曼丹、苏拉威西、马鲁古、努沙登加拉和伊里安等面积较大的岛屿均有棕榈藤分布。某些大省如亚齐省、加里曼丹岛的所有省份、南苏拉威西省、中苏拉威西省和东南苏拉威西省和伊里安爪哇省等都是藤条的主要生产地。某些省份如西苏门答腊、中加里曼丹和东加里曼丹省的原住民小规模种植棕榈藤有100年以上的历史。据估算，印度尼西亚1 150万hm^2的有藤林地藤条储量达1 239万t。据印度尼西亚林业部1986年对15个省的调查，印度尼西亚藤条每年可采量为70万t。但实际上印度尼西亚藤条的年使用量只有12万t，由此可见印度尼西亚棕榈藤资源之丰富，藤条生产能力之强大，棕榈藤资源生产力还没有得到完全发挥。

3.2 施法自然，生态环保

考察团考察的棕榈藤人工林属于桑皮特地区"Terantang"村，"Sungai Mentaya"河沿村边流过。村民们不仅在村庄的橡胶林中间

种西加省藤，在河对面的天然林中也间种西加省藤。

据向导介绍，天然林中棕榈藤的初植密度仅45 株/hm^2，然后依靠天然下种更新和采割维持棕榈藤密度。由于印度尼西亚天然林中的天然西加省藤的密度是45 株/hm^2，因此人工种植时也采用这个密度。我们佩服印度尼西亚在棕榈藤种植施法自然的智慧。

印尼棕榈藤人工林经营期间不需要施用化学肥料，仅依靠雨季大水泛滥时带来的泥土肥地，因此没有化学污染和富营养化的问题。据我观察，这与当地特殊地理人文气候有密切关系。Sungai Mentaya 河是一条奇特的河流，由于海拔低，它的水流方向是变化的，上午是从内陆流向大海，下午涨潮时水流方向是从大海流向内陆，但水流速度平缓，容易淤积。沿河两岸有许多居民定居，房子沿河岸而建，一半在河里，一半在岸上。居民的全部生活离不开 Sungai Mentaya 河，日积月累，河里累积了大量有机肥，大水泛滥时，这些有机肥就被带到两岸林地，成为林地的天然肥料。

3.3 重视天然资源保护，鼓励发展资源

印度尼西亚虽然是世界上棕榈藤资源最丰富、藤条产量和出口量最大的国家，但也面临着天然资源锐减、部分种类灭绝的问题。为了保护天然棕榈藤资源，印度尼西亚从20 世纪70 年代末开始禁止藤条和半成品出口。虽然此举有利于印度尼西亚保护该国资源和促进藤工业的发展，但却抑制了藤条的价格和中国在内其它国家藤条的供应。

3.4 禁止出口价格低，贫农贱卖不由已

由于实施藤条出口禁令，印度尼西亚国内藤条价格走低，大大打击了农民从事棕榈藤种植和采割的积极性。然而对那些以棕榈藤为生的贫农来说，即使藤条价格走低时他们也不得不销售以维持生计。而那些有其它收入的富农则可以等待藤条价格上涨时出售，从而获得更高的经济收益。

棕榈藤被视为是贫农发展的重要手段，然而从印度尼西亚藤条的贫农更穷、富农更富的怪圈可以看出，如果仅依靠藤条来求发展，其效果并不尽如人意。因此需要结合其它手段才能帮助贫农真正发展。

3.5 产品特产化，销售大众化

在印度尼西亚不仅可以在大型商场看到棕榈藤产品销售，而且在机场土特产商店也可以看到有藤产品出售，品种有帽子、席子、箱子、手袋、提篮、装饰品和藤球等。从藤产品的销售地点和摆放位置来看，藤产品已成为印度尼西亚的特征之一，成为旅游纪念品的重要组成部分。

4 考察之外

4.1 兑换外币方便，兑换比率差异大

印度尼西亚兑换货币很方便，可以在宾馆、货币兑换公司和银行等地兑换多种货币。但宾馆、货币兑换公司和银行三者兑换比率差异很大，要求也不同。根据我的经验，在宾馆兑换比率最低，货币兑换公司次之，银行最高。以美元兑印尼盾为例，1 美元在宾馆只能兑换8745 印尼盾，在货币兑换公司平均可兑换8960 印尼盾，银行应该在9 200 印尼盾左右。虽然银行汇率最高，但银行要求也最严，不接受某些字母开头的美元和加盖印章的美元。另外，货币兑换机构对于不同字母开头的美元的兑换比率也不同。更重要的一点，在货币兑换机构，可以直接将人民币兑换成印尼盾。在人民币对美元日益升值的今天，直接将人民币兑换成印尼盾可以避开美元贬值的风险。

4.2 森林火灾难遏制，害人害已人人讨

考察期间我们碰到一种可怕的现象，那就是在野外考察时可以看到大量被火烧过和正在烧的森林，空气中充满森林被烧时释放的大量烟雾，不仅对人的呼吸和眼睛产生刺激，而且大大降低能见度，影响汽车出行、轮船行使和飞机起降。在印度尼西亚期间，我听到很多因烟雾而引发的车祸、轮船相撞、机场关闭和飞机停飞的新闻。小到我们考察路线被迫改变，大到马来西亚和新加坡两国深受印度尼西亚烟雾的毒害，国内外受害人士均强烈要求印度尼西亚政府采取有力措施控制森林火灾、消除烟雾的产生。

5 小 结

印度尼西亚棕榈藤业考察时间虽然很短，但已让我见识了印度尼西亚棕榈藤资源的优势

撑麻7号竹地上部分生物量分配研究

邱银河

（福建省华安县林业局 福 建 华 安 363800）

摘 要：通过对成林撑麻7号竹竹秆、竹枝、竹叶生物量的研究，结果表明：竹秆、竹枝含水率随竹龄增大呈下降趋势，竹叶含水率不受竹龄影响，1年生、2年生立竹含水率高低依次为竹秆、竹枝、竹叶，3年生、4年生立竹含水率高低依次为竹叶、竹枝、竹秆；构建了不同年龄单株立竹各器官生物量与立竹胸径的数学优化模型，进而分析知竹林中2年生立竹生物量占竹林总生物量最大47.0%，3年生、4年生立竹生物量无显著差异。竹林立竹器官生物量大小依次为竹秆、竹枝、竹叶，其中竹秆占竹林总生物量的72.9%。

关键词：撑麻7号竹；含水率；生物量；分配

Research of Aboveground Biomass Distribution of *Bambusa pervariabilis* × *Dendrocalamus latiflorus*

Qiu Yinhe

Abstract: Research on biomass of *Bambusa pervariabilis* × *Dendrocalamus latiflorus* indicated that the moisture content of bamboo culm and branch increased with age, while the leaf moisture content is constant. The moisture content of branch is higher than that of culm and less than that of leaf in 1 -year-old and 2-year-old bamboo, however, the branch moisture content is higher than culm and less than leaf in 3-year-old and 4-year-old bamboo. This paper established the model of biomass and DBH and the further analysis indicated that biomass of 2-year-old bamboo account for 47.0% of total aboveground biomass, which is significantly higher than bamboo with other ages in forest, while there is no significant difference between 3-year-old and 4-year-old bamboo. The biomass distribution order of bamboo parts is as follows: culm>branch>leaf, among which the biomass of culm account for 72.9% of total aboveground biomass of bamboo forest.

Key Words: *Bambusa pervariabilis* × *Dendrocalamus latiflorus*; moisture content; biomass; distribution.

撑麻7号竹是以撑篙竹(*Bambusa pervariabilis* McClure)为母本，麻竹(*Dendrocalamus latiflorus* Munro)为父本，经人工授粉培育出的杂竹，具有生长快，生态适应性较强，无性繁育容易，形态美等特点[1]。其竹秆高8~15m，地径5~12cm，笋期6~10月，是大型丛生材用竹种，具有很好的应用前景，1995年福建省华安竹类植物园从广东省林科院引种栽培，表现出良好的生态适应性和经济性状。结合区域林种结构调整和建立特色竹产业及生态环境建设的需要，为规模化推广应用撑

* 基金项目：福建省科技重点项目“福建省华安竹种种质资源圃优良竹种开发利用研究”内容。

作者简介：邱银河，福建华安人，助理工程师，主要从事营林生产、科技推广等。

和棕榈藤在乡村发展和森林保护中的作用。然而，遗憾的是行程安排不太合理，未能参观井里汶棕榈藤加工业和印度尼西亚的美丽风光。但通过这次考察，我对于中国棕榈藤人工林的高密度种植的和施用化学肥料有了新的思考。

致谢：感谢国际热带木材组织(ITTO)资助项目“基于人工林资源中国棕榈藤业可持续发展的能力建设”(ITTO PD 100/01 Rev. 3 (I))的组织和出资。同时，感谢印度尼西亚锯材木工协会(ISWA)的PHJ Nainggolan先生对此次考察日程的安排和全程陪同。

PART II:

Socioeconomics and Culture

1. Socio-economic benefit of rattan: a case study in Nanchang village, Baoting County, Hainan Province, P. R. China *by Yang Jinchang, Xu Huangcan, Yin Guangtian* et al.
2. Rattan culture in China *by Yang Jinchang, Cai Denggu, Yin Guangtian* et al.

J. Bamboo and Rattan, Vol. 00, No. 0, pp. 1–8 (2004)

Also available online - www.vsppub.com

Socio-economic benefit of rattan: a case study in Nanchang village, Baoting county, Hainan province, P. R. China

J. C. YANG *, H. C. XU, G. T. YIN and R. S. LI

The Research Institute of Tropical Forestry, The Chinese Academy of Forestry, Guangzhou 510520, P. R. China

Abstract—Rattans are climbing spiny plants that are regarded as an important kind of commercial non-timber forest products. A case study of the socio-economic benefit on the role of rattan in life was carried out in Nanchang village, Baoting county, Hainan province, P. R. China, to generate basic information and to provide some references for the program of anti-poverty. The 40 households with a total population of 217 all depend on agriculture. Each household owns forestland, varying in area from 0.67 to 2.67 ha. Forestland provides monetary income from rattan canes and fruits. The yield of rattan products fluctuates between years and households. On average, the income from rattan sales contributed about 66% to the total income in the village and provided more than 50% income for nearly all households during the three years of the study. It is believed that the development of rattan planting and improvement on management technique, together with the conditional access to the collection of rattan canes will not only increase the income of households but also help to alleviate the poverty in Nanchang village.

Key words: Socio-economic benefit; rattan; Nanchang village.

INTRODUCTION

Rattans are climbing palms under the subfamily Calamoideae of the family Palmae [1]. As a kind of multipurpose plant found in the forests in tropical and south subtropical regions,rattans are of great economic value and become an important forest product only second to wood and bamboo [2]. Humans have used rattans for livelihood and subsistence for many centuries throughout the documented history of mankind [3]. So far, the great importance of rattan and its products to the thriving domestic and international trade has been widely discussed [2–5], and the considerable contribution of the harvesting of rattan resource to rural area and cottage industry has also been expounded [6–9]. In contrast, few efforts have been focused on

*To whom correspondence should addressed. E-mail: cnyjc@sohu.com

quantitative estimates of the true economics/social value of rattan [3], let alone detailed description of socio-economic benefit of rattan at village level. Therefore, it is important to study the contribution of rattan to household income and village economy. Nanchang village is a small village in Baoting County, Hainan province, P. R. China. Although the average income in the village was low due to the mountainous area and poor education, as well as undeveloped industry, villagers possessed rich experience in protecting the ecological habitat and collecting rattan products, and managed to increase their income and maintain their livelihood by exploitation of cane and fruits of rattan. In 2002, the provincial government initiated a program of development of bamboo and rattan resources and established a rattan demonstration base in Nanchang village in an attempt to support the poor and to increase the income of villagers based on discussion and consultation with relevant experts [2, 10]. With the purpose of generating information on the socio-economic benefit of rattan to household income and providing references for the program of development of bamboo and rattan resources, a case study was carried out in Nanchang village in 2002.

STUDY AREA

Nanchang village is situated at 18°36′ North latitude and 109°30′ East longitude, belonging to Baoting County, Hainan province, P. R. China (Fig. 1). The topography is undulating terrain with some patches of low land where people grow rice. The elevation ranges from 550 m to 780 m. The area enjoys a tropical monsoon climate, characterized by long sunshine period, plentiful heat, abundant rainfall and obvious monsoon change. The frost-free period is 361 days with a sunshine duration of 1920 hours. The mean annual temperature is 24.5°C with the highest temperature

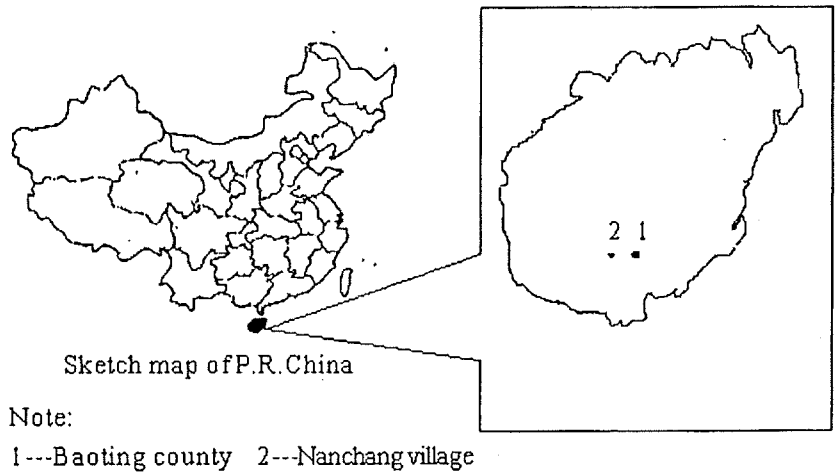


Figure 1. Sketch map of P. R. China with Baoting county and Nanchang village.

of 28.1 °C in June and the lowest of 19.4 °C in January, the mean annual precipitation is 1760 mm, occurring mostly from April to October.

All of the villagers are of Miao nationality. They are all farmers and dependent on agriculture. The villagers used to live in the remote mountains where they set up their houses thatched with rattan foliage and supported with bamboo. Aided by the provincial government in 1964, they moved into new brick houses and resettled in what is now Nanchang village. Tap water has been installed in 2000 aided by the township government. All households have been furnished with line and electricity. There are no public toilet facilities but only some simple private toilets, which together with excreta of livestock beside the house create a sanitation problem in the village. A town-level road in front of the village, linking with Baoting County, provides some convenience for the villagers. There is no health sub-centre, post office or primary school in the village, but these infrastructural facilities are available at Maogan township, 1 kilometre away from the village. There are daily and weekly markets in the town.

METHODS

In December 2002, a face-to-face questionnaire survey was conducted with the help of the director of Baoting County's forestry bureau, two officers of Maogan township and the head of Nanchang village. Prior to the questionnaire survey, a structured questionnaire was compiled, covering a wide array of subjects related to the number and age of people in the family, the area forestland, the source and amount of the income etc. (in 1999, 2001 and 2002). In order to make a smooth interview, the purpose of the survey was well explained and the full anonymity of respondents was guaranteed. During the process, all households were surveyed and heads of the household were interviewed with the help of the head of Nanchang village who served as an interpreter to overcome the barrier of communication when necessary. All the observations and points raised by interviewees were noted. Extensive interviews were also conducted and informal discussions were held with older farmers to ascertain the past utilization history of rattan utilization. In addition, the yield of canes and rattan fruits in 1999, 2001 and 2002 were surveyed together with the price of these products.

RESULTS

Demography characteristics

In 2002 Nanchang village had 40 households and a total population of 217. The male female sex ratio was 122 : 95. The number of people per household ranged from 4 to 7, with most households having 5 to 6 people (Table 1). Distribution of population in 2002 is shown in Fig. 2 according to age. Most people were 12–44

Table 1.
Composition of the households in 2002

Number of person per family	4	5	6	7
Number of families	6	16	13	5

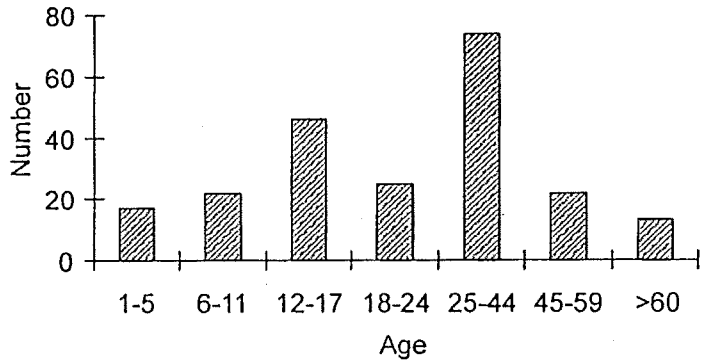


Figure 2. Distribution of population according to age in study area in 2002.

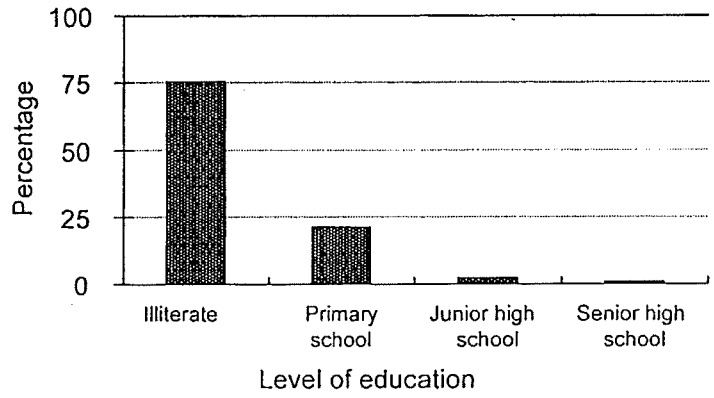


Figure 3. Educational status of villagers in study area in 2002.

years old and the number of these people is about 2/3 of the total while the number of the rest, including those younger than 11 and older than 60, only accounted for about 1/3 of all people. According to the local saying that person not younger than 18 can be regarded as a labourer, more than 60% of the total population were to agricultural labourers, so the work of collecting rattan canes and fruits can be done without employing outside labour. However, unlike the labour forces, the level of education level in the study area was quite low (Fig. 3). Most of villagers were illiterate and only a few villagers were educated. It was remarkable that almost all of those educated villagers were children.

Table 2.
The area of different forestlands per household in Nanchang village

Collective land		Private land	
Area (ha)	Number of families	Area (ha)	Number of families
0.40	2	0.67	12
0.67	13	0.80	3
0.80	15	1.00	9
1.00	6	1.33	13
1.20	2	2.00	1
2.40	1	2.33	1
4.00	1	2.67	1

The type and area of forestland

There are two types of forestland in the village, one is collective and the other is private. In 1994 the central provincial government announced an unprecedented 'National Natural Forest Protection Program' in an attempt to protect the environment [11, 12]. This ambitious program essentially bans any logging in natural forest. The collective forest belongs to natural forest, so any logging of woody plants is forbidden since. However, the owner is still allowed to manage and collect non-timber forest products such as rattans and medicine plants in collective forest land in order to provide a source of income. In contrast, the owner of private forestland gains full access to any forest products freely, including logging wood.

The area of private forestland was 43.7 ha, a bit higher than that of collective land (36.3 ha). Each household owned two types of forestland, but most families had an area of two types less than 1.5 ha both. The area of collective land per household ranged from 0.4 to 4 ha, while that of private varied from 0.67 to 2.67 ha (Table 2). The income level of each family was largely dependent on the size of forestland holding, that is to say, the more land he owned, the higher income he gained. Land was quite important to them because most of their income came from forestland.

The socio-economic benefit of rattan

According to the questionnaire survey, rattan has been used for various purposes in Nanchang village. Rattan leaf is often used to cover the ceiling of shed; the tender shoot of rattan is edible, being served as good vegetable in the season when cane collection is done; the cane is an excellent material for chair-making, binding and weaving; fruit was sometimes used for medical purpose. Therefore, rattan was closely linked with their daily life.

The income generated from rattan could be divided into two parts, one from cane and the other from rattan fruit. We were trying to collect the yield of both cane and fruit in each household, but failed to do so because most families remembered the income better than the yield of these products. Fortunately, the data of the total yield of these products in the village in different years are available from the

Table 3.
Yield of rattan products in different years

Rattan product	Year		
	1999	2001	2002
Rattan fruit (kg)	4000	24 000	5000
Rattan cane (pole)*	61 000	—	—

*The length of each pole is 3.6 m.

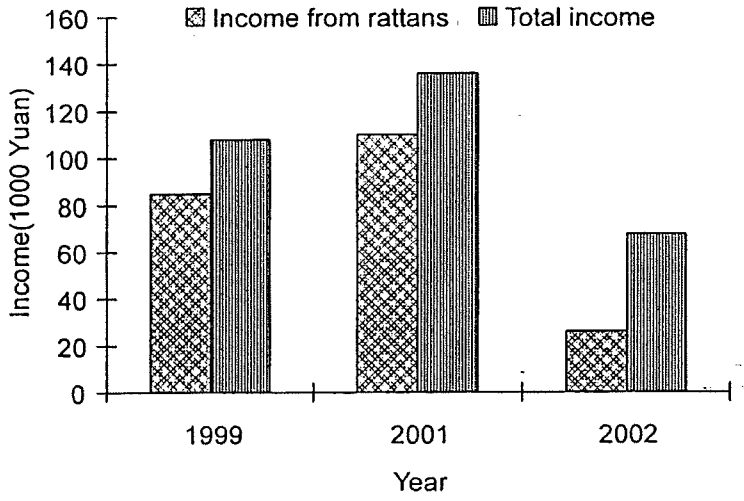


Figure 4. The income from rattan and its contribution to the total income.

forestry bureau of Baoting County (Table 3). The yield of rattan fruits and canes was discontinuous and wavy. In 1999 and 2002 the yield of rattan fruits was only 4000 kg and 5000 kg, respectively. The highest production of rattan fruits was recorded in 2001. Canes were only available in 1999. This fluctuation of production of cane and rattan fruits can be explained from two aspects. On the one hand, in 2000 villagers were not allowed to collect rattan fruits and canes by provincial government because the government was worried about the sustainable utilization of rattan products; since then, cane harvest has been banned but collection of rattan fruits has been allowed. On the other hand, typhoons struck the village twice, in 1999 and 2002, respectively, which caused a dramatic decrease of the production of rattan fruits.

Based on the yield of rattan products, the income sourced from rattans in different years was calculated. It is shown in Fig. 4 that the income from rattans varied from year to year. The income in 2001 was highest followed by in 1999 and in 2002.

Though there were some other sources of income besides rattan, the income from it made great contribution to the total income (Fig. 4). The percentage of income from rattan in the total income was at least 35%, even under the circumstance of

Table 4.
Mean percentage of rattan income in the total income per household in 3 years

Percentage (%)	31–40	41–50	51–60	61–70	71–80	81–90
Number of households	2	3	6	11	13	5

typhoon attack, and it could reach up to 80% in normal years. On average, rattan products contributed more than 60% to the total income of the village economy in 3 years, which indicates the great importance of rattan to the village.

At the household level, rattan also played an important role in family income (Table 4). All households got benefit from rattan to varied extent. Generally, for most households, more than half of the family income came from rattan.

CONCLUSIONS AND RECOMMENDATIONS

All households in Nanchang village had two types of forestland more or less, which in return provided them with major source of income for sustenance. Although other land use patterns were identified for a specific need, such as rice fields, the direct income was almost completely from forestland. The income from rattan was influenced by the forestland area to a large extent, indicating the real importance of forestland to the local villagers.

The income from rattan fluctuated from household to household and also varied in different years, closely correlated with the yield of rattan products. As a whole, most of villagers got more than half of their income from rattan that provided mean value of about 66% of income share to total income in the village in 3 years, despite the strike of a typhoon and the collection banning of rattan products, hence revealing the obvious and prominent socio-economic benefit of rattan to the studied village.

Although rattan did contribute much to the village economy, the mean value of rattan income per household was still low, thus leaving much to be improved. So far the income from rattan was confined to only one species, *Daemonorops Margaritae.* In fact, there are some excellent species, such as *Calamus simplicifolius* [13], left unexploited due to low species richness. Therefore, it is advisable to expand the planting of excellent species like *C. simplicifolius* by breeding. On the other hand, it is recommended that local government should make efforts to enhance the education level in the village and to enrich villagers' indigenous knowledge to improve the management technique [14] by organizing some training courses for them after the rattan demonstration base has been established. Finally, the provincial government had better give the villagers conditional access to collect the mature canes to improve their income.

Acknowledgements

The authors wish to express their heartfelt thanks to Dr. Huang Shineng, the Research Institute of Tropical Forestry, Chinese Academy of Forestry, to Mr. Tan

Chin Feaw, Malaysia, for revising the article and to Miss Yang Hua for editing the sketch map of Hainan and China. We also appreciated the suggestions of Dr. Supardi Noor, Forest Research Institute Malaysia. Finally, the authors are indebted to the staff from the Forestry bureau in Baoting county and the head of Nanchang village, as well as to Mr. Zhou Yongqin from the Hainan forestry bureau for their great help in questionnaire survey and collecting data. This research was sponsored by 10th five-year National Key project (Grant No. 2001ba506b04) and ITTO project (PD 100/01 Rev.3)

REFERENCES

1. J. Dransfield, The taxonomy of rattan, in: *A Guide to the Cultivation of Rattans*, M. Wan Razali, J. Dransfield and N. Manokaran (Eds), pp. 99–106. *Malayan Forest Records No. 35*, Forest Research Institute Malaysia (1992).
2. H. C. Xu and Q. P Sun, An overview on rattan research and development, in: *Sustainable Development of the Bamboo and Rattan Sectors in Tropical China*, Z. H. Zhu (Ed.), pp. 135–150. China Forestry Publishing House, Beijing (2001).
3. C. B. Sastry, Rattan in the twenty-first century-an outlook, in: *Rattan Current Research Issues and Prospects for Conservation and Sustainable Development*, J. Dransfield, F. O. Tesoro and N. Manokaran (Eds), pp. 237–244. FAO, Rome (2002).
4. T. C. H. Sunderland and J. Dransfield, Species profiles of rattans, in: *Rattan Current Research Issues and Prospects for Conservation and Sustainable Development*, J. Dransfield, F. O. Tesoro and N. Manokaran (Eds), pp. 9–22. FAO, Rome (2002).
5. INBAR, FAO/INBAR Expert Consultation on Rattan Development, *INBAR News Magazine* **8** (1), 10 (2001).
6. T. C. H. Sunderland, L. Defo, N. Ndam, M. Abwe and I. Tamnjong, A socio-economic profile of the commercial rattan trade in Cameroon, in: *New research on African rattans*, T. C. H. Sunderland and J. P. Profizi (Eds), pp. 115–140. Colour Max Publishers (2000).
7. D. Miah and L. Rahman, Status of rattan-based small scale cottage industries in urban and semi-urban area of Chittagong, Bangladesh, *Journal of Bamboo and Rattan* **1** (3), 251–261 (2002).
8. P. M. S. Ashton, B. M. P. Singhakumara, A. E. Evans, C. V. S. Gunatilleke and I. A. U. N. Gunatilleke, A financial analysis of rain forest silviculture in southwestern Sri Lanka, *Forest Ecology and Management* **154**, 431–441 (2001).
9. Z. Z. Zhou, H. C. Xu and G. T. Yin, A financial appraisal of three commercial rattan plantations, *Forest Research* **5** (1), 47–55 (1992).
10. J. Z. Han, The status and prospects of bamboo and rattan industries in Hainan province, in: *Sustainable Development of the Bamboo and Rattan Sectors in Tropical China*, Z. H. Zhu (Ed.), pp. 19–27. China Forestry Publishing House, Beijing (2001).
11. M. J. Zhao and K. Y. Liu, A report about implement effect on natural forest protection project in Hainan province, *Forest Economy* **4**, 26–28 (2000).
12. P. C. Zhang, Y. L. Xing and J. M. Zhang, The pioneer of natural forest protection, *China Forestry* **4**, 7–8 (1999).
13. G. T. Yin, Cultivation methods for *Calamus simplicifolius*, in: *Research on Rattans in China, Conservation, Cultivation, Distribution, Ecology, Growth, Phenology, Silviculture, Systematic Anatomy and Tissue Culture*, H. C. Xu, A. N. Rao, B. S. Zeng and G. T. Yin (Eds), pp. 57–63. IPGRI-APO, Serdang, Malaysia (2000).
14. Y. F. Arifin and R. Mitlöhner, Traditional rattan gardens in Central Kalimantan, Indonesia, in: *Congress Proceedings (B-forests for the Planet), 12th World Forestry Congress*, Québec, Canada, p. 314 (2003).

第18卷 第4期
2005年8月

世界林业研究
World Forestry Research

Vol. 18 No. 4
Aug., 2005

藤文化浅析

杨锦昌[1] 蔡登谷[2] 尹光天[1] 许煌灿[1] 李荣生[1] 杨 华[1]

(1 中国林业科学研究院热带林业研究所,广州 510520;2 中国林业科学研究院,北京 100091)

摘要:自古以来,藤以其广泛的实用价值和独有的魅力深受人们的喜爱,并在中华民族悠久文化的画卷中绘上了浓墨重彩。为弘扬中华民族文化,拓展藤产业和贸易,促进社会经济的发展,文中概述了藤类的地理分布、植物分类、材料特性,力求循着人类文明发展的脉络,详尽介绍我国各民族的藤类利用水平,分析我国藤产业与商品贸易的沿革与发展。

关键词:中国,藤,文化,利用,产业,贸易

中图分类号:S759.8 文献标识码:A 文章编号:1001-4241(2005)04-0054-6

Rattan Culture in China

Yang Jinchang[1] Cai Denggu[2] Yin Guangtian[1] Xu Huangcan[1]
Li Rongsheng[1] Yang Hua[1]

(1 Research Institute of Tropical Forestry, Chinese Academy of Forestry, Guangzhou 510520, China;
2 Chinese Academy of Forestry, Beijing 100091, China)

Abstract: Rattan has gained much favor due to practical value and unique glamour, and ployed an important role in the age-old culture history in China. This paper outlined geographic distribution and botanic classification as well as material characteristic of rattan, specified the utilization level of rattan among nations and analysed the development of rattan industry and trade in an attempt to propagate Chinese culture, to expand rattan industry and its commerce.

Key words: rattan culture, utilization, industry, trade

人类在其社会经济发展的长河中,不断创造物质和精神文明。藤以其优良的工艺特性,早为我们的先民所利用,并且创造了优秀的藤文化。中国作为世界五大文明古国之一,历史悠久,文化灿烂。在中华文明的发展中,藤以其独特的魅力占有一席之地。

藤以其广泛的实用价值深受人们的青睐,与人们生活紧紧相关,与历史文化息息相连。藤条集强度、韧性、弹性和易于造型等优良工艺特性于一身,是家具制作和工艺器具编制的优良材料;棕榈藤的羽状或扇状叶片,绿叶如盖,柔韧耐腐,是乡村农舍屋顶构件的好材料;棕榈藤的茎端嫩稍营养丰富,鲜美可口,是蔬菜的上品;棕榈藤的果实酸甜兼之,为热带优质水果;某些棕榈藤种的鳞果分泌的果胶可萃取"麒麟血竭"制成名贵药品。

早在葡萄牙人将东方的藤器商品带回欧洲之前,棕榈藤在乡村是十分珍贵的,以至于可以说是东南亚的一种特有文化[1]。中国古籍《隋书》出现了以藤为贡物的记载,明朝正德年间编撰的《正德琼台志》及随后的《崖州志》记述了棕榈藤的种类分布和利用,陈列于福建泉州博物馆的明朝郑和下西洋的沉船上保存着精美的藤编器具文物,证实了当时我国藤编织的发展水平。藤的悠久文化可见一斑[2]。

为此,我们叙藤的种类与分布概况、说藤与生产生活的联系、述藤产业和贸易的发展,以增进对藤的了解,更好地见证我国的藤文化发展水平。

1 藤的种类与分布

根据植物茎的生长形态特征,人们通常把自

· 收稿日期:2004-10-29
基金项目:国家"十五"攻关项目"棕榈藤种质资源培育及利用技术"(2001BA506B04);ITTO项目"基于人工林资源中国棕榈藤业可持续发展的能力建设"(PD 100/01 Rev. 3)

然界中的高等绿色植物分为直立植物和藤本植物。藤本植物又包括木质藤本和草本藤本2个大类。本文所指的藤类仅指木质藤本中的棕榈藤(rattan)。从地植物学上讲，棕榈藤属旧世界(Old World)热带分布；根据现代的植物分类系统，棕榈藤属棕榈科(Palmae)省藤亚科(*Calamoideae*)省藤族(*calameae*)，是一类果实外被鳞状果皮、具体刺的攀援植物[3,4]。

棕榈藤是热带雨林中的主要层间植物，在自然状态下，它依存于其他灌木和乔木树种的枝干支撑搭挂攀缘向上生长，直至林冠的最上层，张展其浓绿的羽状藤冠，形成热带雨林突出的妖娆景观之一。棕榈藤植株茎长可从几米至百余米，曾有170 m的记载。

全世界已知有13属，约600余种，主要分布于亚洲热带地区。其中有10属分布于东南亚及邻近地区，4属分布于西非热带地区(其中3属为该区特有)。

我国疆域辽阔，从东南沿海及其岛屿到西南山地，大致在24°N以南的热带和南亚热带区域，处于全球棕榈藤中心分布区的北缘，天然分布3属40种21变种，约占全世界总属数的23.1%。由于我国东南部和西南部自然地理和气候条件的明显差别，形成了分别以海南岛和云南西双版纳为中心的东南部和西南部两大分布区：东南分布区包括华南诸省(区)及台湾，有3属25种6变种；西南分布区包括云、贵、藏3省(区)及广西西南部局部区域，有2属19种16变种。

我国棕榈藤天然分布区的北缘线东起浙江省南部的平阳，经福建北部的建阳、邵武，湖南省南部的郴州，广西的桂林，贵州省西部的榕江、荔波，云南的文山、红河、盈江，到西藏的察隅、墨脱和亚东，包括海南、云南、广东、广西、福建等省(区)以及浙江、江西、湖南、贵州和西藏等省区的局部地区。分布区北缘线大致与≥10℃年积温为7 000℃的等值线相近似，跨越了南亚热带至中亚热带4个气候区的6个植被带/亚地带。

在热带湿润雨林、热带山地雨林、热带常绿季雨林和南亚热带常绿阔叶林等植被类型中，棕榈藤分布的种群数量大、密度高，热带山地雨林分布7种，总密度达5 690株/hm²，热带常绿季雨林分布6种，总密度1 450～2 380株/hm²。

我国原藤年产量约为4 000～6 000 t，主产于海南岛和云南西双版纳地区，其中海南岛以黄藤、白藤、大白藤、单叶省藤及华南省藤为主，年产量约3 000～4 000 t，云南以小糯藤、大糯藤为主，年产量在1 000～2 000 t，两产区产量占全国总产量的90%以上，是当地人民生活生产用品和中小型藤器加工厂的主要原料来源[3]。

2　藤与人们生产生活的联系

棕榈藤是多用途的植物类群，是天然分布区人民维持生产和生活的重要植物资源。当地人们爱藤、护藤、种藤、用藤，并在生产活动中形成了独具特色的藤文化。可以说，藤的利用几乎渗透到了人们生产生活的每一个角落。

2.1　藤与物质文明

土地是万物之本，人类生存和繁衍的载体；森林是人类文明的摇篮，提供生活空间和基本物质来源。“树叶蔽身，摘果为食，钻木取火，构木为巢”是森林孕育人类文明的真实写照[5]。

棕榈藤作为一种重要的森林资源，与人民的物质文明密切相关。在热带和亚热带棕榈藤分布区的当地原住民，利用棕榈藤创造了多姿多彩的物质文明。人们从森林中采集藤条，或把原藤劈成藤篾，用于编制成日常生产和生活器具，如篮子、凉席、家具、扫帚柄、搅拌器、拐杖、鱼杆，动物圈套、鸟笼等。在生活中，凡是需要强度、弹性、柔韧性兼备的物质器具几乎都取棕榈藤为材料。拴牲畜、农耕用具和车船固定的绳子，船锚、桥梁的缆绳，及防船只碰撞的船铃，也多用藤条作成；房屋、栅栏、桥梁构建，甚至船只，都可以用捆绑在一起的藤条作成；成熟的棕榈藤叶柔韧、耐腐、离水，是构建村舍屋顶的好材料；嫩叶可做卷烟的纸；植株顶部嫩梢富含营养，可食用；果实可食或入药。几乎所有的藤种的各个器官都可得到有效的利用，其用途之多，无法一一列举，但可以概括为以下几个方面。

2.1.1　生活用具

在日常生活中，藤用途极广，名目繁多。西周时，竹笥主要用来盛衣物。据《尚书·说命中》记载：“惟衣裳在笥”，为了使其坚实耐用，常用藤条穿缠加固。张籍《太白老人》曰：“日观东峰幽客住，竹巾藤带亦逢迎。”张籍曾赠王建藤杖及笋鞋，并赋《赠太常王建藤杖笋鞋》诗：“蛮藤剪为杖，楚笋结成鞋”。以藤杖笋鞋相赠友人，正显示了古代文人之间的君子之交[6]。

海南岛的黎族人常用藤编制簸箕或用较细的

藤条做晒衣服和拴牛用的绳子。台湾高山族常用的背篓上有藤索做成的背负带，背负时顶于前额，或挂在双肩而负于背上；同样，曹人背婴儿用的前篓就用藤皮条系之，挂于肩上。福建东部的畲族以细藤篾编织成头笠，既用于遮阳挡雨，又用于装饰。我国西双版纳既盛产竹类，又盛产藤类，傣族人自古便有用藤编织生活用品的习惯。他们根据藤的不同特性和不同要求，编织篮、篓、筐、箱、桌、凳及其他生活用具。在东南和西南的部分地区，一些艺人精通藤席的制作。用藤编织成的席子篾纹细致、平软光滑、散热清凉。在炎热的夏天置身于藤席时，有身上汗水顿消，身下凉意习习的奇效。

自古以来，藤家具以其美观素雅，轻便灵巧，结实耐用而广为人们所喜爱。随着科技的发展和设计的创新，藤家具的品种及规格日益增多，舒适大方的藤家具和各种器具因更加贴近自然，独具时尚风格而为高级的会展中心和宾馆饭店所广纳。

2.1.2 生产工具

在中国古代生产中，无论是简单工具还是复杂工具，都有着藤的重要参与；无论是耕地、施肥还是收获、装运和加工，都闪现着它的身影。旧时用牛犁田时，常用一种叫单叶省藤或短叶省藤的藤条作牛与犁之间的传送带(故该藤也叫犁藤)；或者用藤皮搓成绳子拴牛耕田。至今，一些偏远的热带山区还保留着这种利用方式。在一些山村，人们用藤作装人畜肥的木桶的挑带，这样既结实又轻便。劈柴或收获时用的刀，其刀把也有用藤作成。云南德宏傣族的打谷棍用藤条(或竹子)制成，形似拐杖，用它反复敲打谷穗，直到谷粒全部掉下。装运谷物用的箩筐也常用藤来制作。高山族的藤制装运农具有背篓、谷筒。一部分藤制的筛子和簸箕也出现于中国古代扬米农具中。据《农政全书》载："架也，集韵作笕，竹竿也，或省作笕…"，而其中省即为藤，故晒禾的农具也少不了藤。此外，固定船舶等的索具也用到藤[6]。

2.1.3 建筑与交通

唐朝白居易诗句有："驿吏引藤舆，家僮开竹扉"，说明藤用于建筑已有很长的历史。乡村盖房时用藤条捆扎屋架，或用藤篾绑扎椽子、行条等框架，且通常不使用一根螺钉；屋顶所用草排亦用藤篾捆扎；海南岛的黎族人所建的房屋，常以藤叶盖顶、竹子成墙，洋溢着浓郁的乡土气息，成为田园风光的一大胜景。

在我国西南地区，幽深的峡谷，湍急的河流形成了对外交通的重重阻隔，可是西南各族人民建造了各种巧夺天工的竹藤索桥，成为我国西南峡谷交通的特色，创造了自己辉煌的文化。他们称竹藤索桥为"笮"，今纳西语、彝语中的桥与"笮"非常接近，正是历史的遗存。而傈僳族地区的竹桥则用藤条作网，供过桥人做扶手。古时民间广泛普及的竹轿一般用2根比较细长而耐用的竹竿，在其间扎上一把藤(竹)椅就制成了。台湾高山族中的阿美人在近海航行中使用竹筏是取粉竹6～8根，用藤皮缚于由4根粗竹组成的横竹上而做成的[6]。海南省南部三亚市的藤桥镇，因以藤建桥而得名。凡此种种，无不体现出藤在地理、建筑与交通方面的应用。

2.1.4 食品及药用

民以食为天，在博大精深的中国饮食文化中，藤笋以其营养丰富，鲜美可口而成为特色佳肴。在云南和海南省少数民族居住区，当地人常在采收藤条时，截取嫩梢部分当作常用蔬菜[9]，或特意采集茎尖作成特色菜肴招待贵客。食用的方法通常有3种：(1)烧吃：将茎尖放在火塘边烤熟后蘸盐巴和辣椒吃。(2)煲汤：将茎尖舂碎后，与舂碎的米一起煮成美味可口的汤，哈尼族称之为"A-neuqiemei"[7]；或将藤笋切成块状与排骨或鸡肉炖煮香气四溢的靓汤。(3)小炒：将茎尖切成丝状或片状，单炒或与其它菜混炒。一些藤种如云南省藤、版纳省藤、小省藤和倒卵果省藤和单叶省藤的果实通常被当作野果食用[7,9]。

长期以来，东南亚棕榈藤资源丰富的国家，藤果不仅见于东南亚国家的农贸市场，亦常见于超级商场的货架。当今国内，一些种类的果实被采集制作为具有地方特色的旅游食品销售。棕榈藤黄藤属藤种的果实、果肉胶质，外被鳞片状果皮，常常分泌出褐色胶状体，人们用小刀刮取凝固在果实表面的胶状体，萃取"麒麟血竭"，即为名贵中药"龙血素"，人们还利用黄藤属的褐色果肉作为染料制品。

2.1.5 兵器

古代战争中使用的战车、将士穿戴和使用的防护性的兵器，如：战袍、盾牌和盔甲等大多选用了藤和皮革作为原料。

2.2 藤与精神文化

棕榈藤不仅为人们提供生活和生产工具及建筑和交通等物质材料，创造丰富的物质文明，而且

还丰富了我们的精神文化。

2.2.1　观赏与娱乐

传统上，云南的少数民族，如傣、哈尼、基诺、阿昌、怒、布朗、崩龙、佤和景颇族等常用藤篾或藤条制作头饰、首饰和腰饰等。傣族用“藤篾缠腰”，哈尼族“男子以红藤缠腰”，妇女出嫁后“以藤丝圈束于膝盖下以为记”，基诺族“男以黑藤篾缠腰及手足”，阿昌族“妇女红藤为腰饰”，怒族“男子编红藤勒首”，布朗族“膝下系黑藤”，崩龙族“女以藤乘虚而入圈腰”，佤族“妇女以黑藤系腰数十圈”，景颇族“男子藤盔藤甲，女子手束红藤为饰”等等[7]。在我国云南边境地区和泰国、缅甸等一些东南亚国家，人们和大象玩藤球的游戏成为当地居民的娱乐活动。迄今，在东南亚许多国家的市场上仍然可见编制精细的藤球出售。

2.2.2　工艺品

藤制工艺品在东方艺术殿堂中独树一帜，源远流长，是中国藤文化的精华。我国早期陶器的起源，是与竹和藤的编织密切相关的。人们以竹藤编织的篮筐作为原模型，再在篮筐的里外涂上泥，从而制得竹藤胎陶坯，再放到火上烧制而成。后来，人们直接用粘土制成陶器物的坯子，就用竹藤编织作为陶器的坯布胎。殷商时代，竹藤的编织纹样更趋丰富。在陶器的印纹上出现了方格纹、米字纹、回纹、波纹等。在著名的西安半坡新石器时代遗址出土的陶器上，就发现了不少编织物的印痕，其中也有藤编织物。这些编织纹样有蓝纹、席纹、格纹、斜纹等。这足以证明，当时我们的先民已掌握了高超的藤编织技艺。

民间艺人用藤编织成栩栩如生的各种动物造型的小件物品，常作为工艺品陈设或装饰，如云南傣家的住舍，常见许多用藤编织而成的器皿陈设。怒江峡谷的怒族女子用竹藤精制而成的手镯和傣家小伙用巧手编成送给自己心爱者的小背篓，是地道的欣赏和实用兼备的工艺美术品。云南少数民族编织工艺品的常见纹饰是篮纹、斜纹、异向斜纹、回纹等，艺人们根据各种编织的实用情况巧妙地进行选择、变化，创造了许多美丽典雅的编织纹样，创制了多种以实用为主的民间工艺品[6]。凡此种种，都体现了云南少数民族民间艺人在藤编上的高超技艺和对生活的洞察力和审美力。

现今，在一些旅游区，某些藤果或种子通常被串在一起制成类似佛珠的工艺品，作为旅游纪念品出售。工艺品在中国南方各地形成了不同特色，呈现出不同的风姿：有细腻，有粗犷；有华贵，有质朴；有浓重，有淡雅；真可谓“淡妆浓抹皆相宜”。人们从不同风格和特色的藤编工艺品中，可领略到不同的艺术风韵。

2.2.3　民俗与宗教

在中国传统文化中，藤既与民风民俗密不可分，又是某种文化精神的象征。勐宋地区，哈尼族每年过“Yeku”节时，都要用几个根藤，做荡秋千的绳子[7]。许多藤种萌蘖性强，藤条坚实耐用，因而海南黎族人在女儿出嫁时，一般要送藤制品，赋“生活美满，早生贵子”之意。被称为“岁贡”珍品的黎锦，整个画面生动活泼，蔚为壮观，藤的图案也名列其中。它将日常生活的景观与大自然的造化交织在色彩斑斓的图案之中，反映了黎族人民高超的工艺技术和民族精神[6]。此外，一些少数民族常佩带藤饰品，以驱魔避邪，去病护身。

3　藤产业与商品贸易的沿革和发展

经过历代先人的实践和耕耘，科学技术发展的促进和推动，我国的藤产业与贸易踏着坚实的脚步，走进了新时代。

3.1　藤产业的发展

早期，我国的藤业主要反映在藤制工艺上。它在父子相承、师徒相授的传统学艺中经历了漫长的历史，其特点就是手工工具和手工操作相结合，沿袭传统手工生产方式，生产落后。早在150年前，广东省的南海县即开始大宗进口“洋藤”和海南藤编织器具和制作家具，并逐渐形成独自特色的地方性产业。全国解放后，尤其是改革开放以来，我国藤类加工工业有很大发展。仅广东省就有数十家大中型藤厂，形成了大规模的制藤工业，其它各省市也都有新开办的中小型藤器厂。随着科学的发展和技术的注入，藤业慢慢由传统生产方式过渡到现代工业生产方式，无论在设备和规模，还是在效率和质量方面，都取得了新进展。制藤工业是劳动密集型产业，可以吸纳大量的劳动力就业。据调查统计，参与藤业生产的从业人员估计超过15万人，在地区经济中起着举足轻重的地位。

中国制藤工业经历了150多年的发展，技术不断革新、工艺水平不断提高，成为世界上独树一帜的传统工业。当前，世界上制藤工业的发展可以溯源于南海藤厂，东南亚各国的藤厂中绝大部分厂家源于南海藤厂。大中型藤业公司的某些生产过程已实现机械化或半机械化，主要设备有：干燥

窑、蒸汽炉、劈藤机、藤芯劈裂机、藤条弯曲机、织藤机。小型藤厂仅具有厂房和藤芯劈裂机。家庭藤家具作坊使用自己制作的劈藤器械。华南尤其是广东省的南海市，制藤业是传统工业，大、中、小型藤厂竞相展示，争奇斗艳，其中著名的有南海、东风、南方等大型藤业公司，成为我国藤工业和商品贸易的主要集散中心。福建安溪后来居上，成为全国最大的竹藤工艺品生产基地之一，特别是1992年后，各种竹藤工艺厂如雨后春笋般崛起，遍布全县18个乡镇。其中安溪藤厂以先进的工艺、多样的产品、一流的质量独领风骚，闻名遐尔。

3.2 藤产品的贸易与种类

3.2.1 藤产品贸易

在古代，藤被视为珍品，寻常百姓很少有能力购得，民间交易较少发生，且产品较单一。藤品一般只进贡到王室或出现在达官贵人府上，做为财富或地位的象征。

尽管如此，藤的交易很早就产生了。公元748年，唐鉴真高僧东渡日本，遇风和受海流的影响，航船漂流到振州，即现今的海南省三亚市，看到当地已经是“一年养蚕八次，收稻两次，十月种田，正月收粟”。当时黎族地区出产的高良姜、五色藤、盘斑布等土特产品不少作为贡品或商品输入中原地区。

随着社会的发展，藤的交换也逐渐频繁起来。到了近代，不仅有了广泛的交易，藤品也更加丰富。例如，在云南勐宋地区，随着外地迁入人口的增加，当地有部分村民特别是田少的穷苦人，经常到森林里去砍藤和藤的茎尖，再用它跟坝区的傣族交换大米[7]。此时，藤不再是富人专用的奢侈品。如今，随着科学技术的突飞猛进，生产力的不断提高，藤产品因物美价廉走进了千家万户，成为人们享受生活的舒适品。

藤的国际贸易始于19世纪中叶，但那时国际贸易还不很发达。到了20世纪初，藤的国际贸易开始兴旺起来。此时，新加坡成为东南亚和太平洋西岸地区藤条的重要转口贸易国，在1922～1927年间，出口量为16 000～27 500 t。1977年，香港进口藤条和藤产品价值为2 600万美元，经加工和生产后，产值提高为6 800万美元[8,10]。

国际上，我国是原藤和藤制品贸易大国，由于原生棕榈藤资源短缺，主要进口原藤，经过精加工再出口。随后改革之风吹遍整个神州大地，中国对外交流空前广泛，国际贸易大大加强。我国的藤编家具、织件、器具和工艺品，以其工艺技术精湛，驰名中外，产品畅销国际市场，成为我国传统的大宗出口创汇商品。据不完全资料估测，20世纪60年代到70年代，我国藤制品外贸总值每年约2 000万～3 000万美元，80年代初达到每年4 000万美元，占当时国际藤制品贸易额的1/4。1985～1986年期间，我国藤贸易额超过5 000万美元，到90年代末，进出口总额突破1.2亿美元[2]。

3.2.2 藤产品的种类

在广大藤编艺人的辛勤劳动下，随着科技的进步和生活水平的提高，产品结构日臻完善，产品花样日渐繁多，但概括起来，可分为两大类，即半制品和制品（编织品）[2,3,8]。

（1）半制品：主要用小径藤加工成藤皮及藤芯，用以生产编织品，本身也作为半制品出售。藤皮（rattan peel）：有多种规格，要求抗拉强度大。广东省的藤厂一般按用途将藤皮分为5类：篦丝、席丝、沙丝、合丝及车皮。由于藤织品长期由个体手工业者加工制作，并常为世代相传，新中国建立后，其中许多人参加集体所有制藤厂或进入地方国营企业，一些行话也带入并沿用至今，故在其它地区藤皮类半制品名称可能与广东有所不同。

藤芯（rattan core）：原藤经刨藤机或手工开出藤皮后的剩余物，有圆芯，扁芯，角芯等，大量用于藤织件，也用于家具的骨织类（用藤芯包缠的藤家具）及装饰。

（2）编织品：主要为藤篦、藤席、藤家具及藤织件。

藤篦（rattan webbing）：多种规格，用于家具、屏风、室内间隔及装饰等。品种有眼篦、稀篦（方形眼孔）及密篦（无眼孔），主要产品为眼篦，共6个品种，高质量印尼藤开出的篦丝方可编织2，2.25及2.66眼3种藤篦，一般原藤只能用于编织1，1.33及1.6眼3种，1眼篦又名大眼篦。

藤席：包括各种规格的床席及枕席。

藤家具：品种及规格很多，并不断创新。藤器业将其归为6类：油藤类，上油漆；磨光类，磨光，上油；藤枝类，用原藤编织；藤皮类，用藤皮包缠，如藤椅；骨织类，用圆芯包缠；花类，着眼于制品的局部装饰，使造型美观。

藤织件（rattan wares）：品种及规格繁多，并不断创新，常具有独特的艺术性。藤器业将其归为5类：动物型，编织成各种动物形状，可放置小件物品，常作为工艺品陈设；餐篮类，有盖及提柄，可