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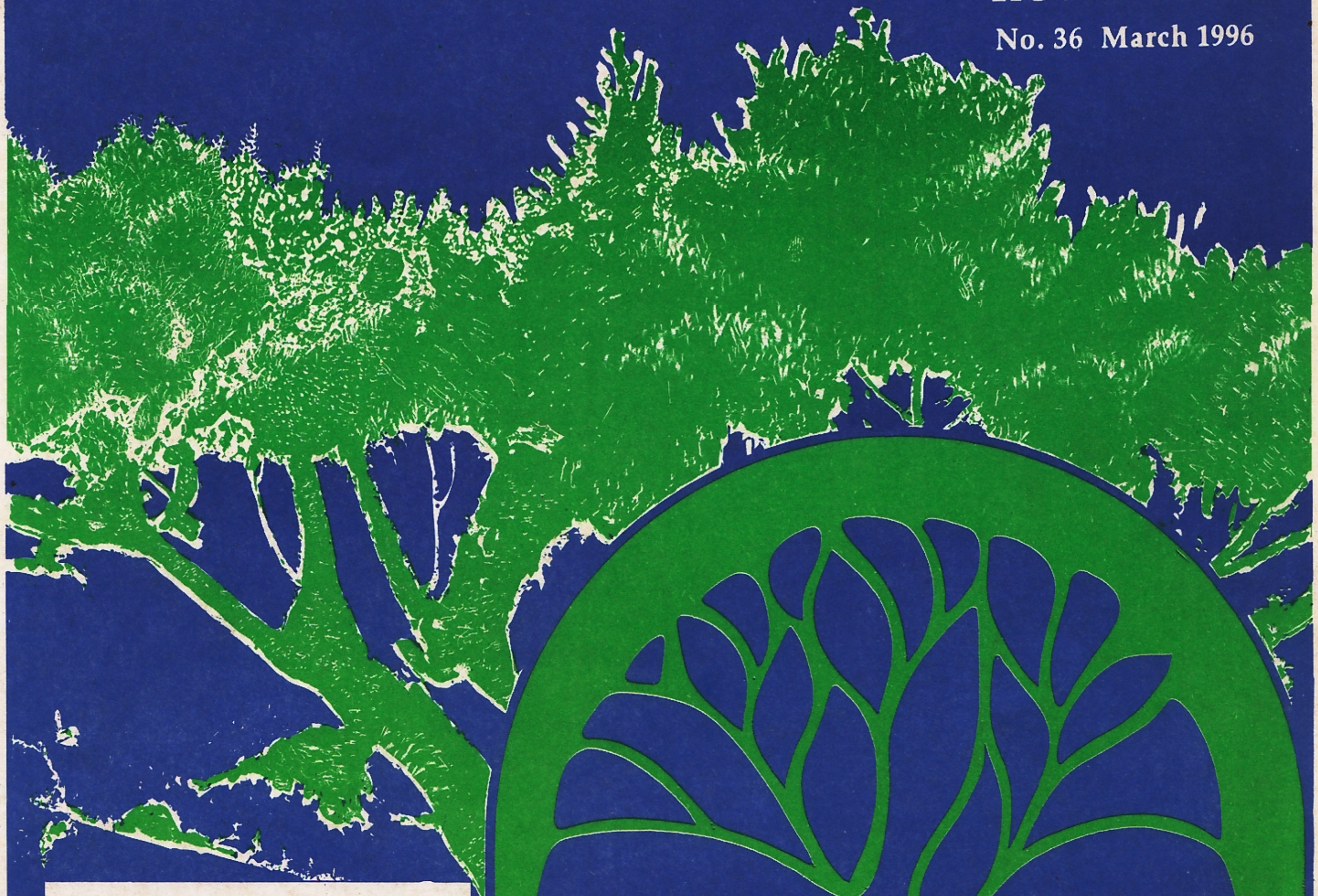
newsletter

No. 36 March 1996



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kerala forest research institute

Peechi, Trichur - 680 653, Kerala, India

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newsletter of
kerala forest research institute

Peechi, Trichur 680 653
Kerala State, India.

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Newsletter Committee (1995-1996)

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Mr. Subash Kuriakose

evergreen, the KFRI Newsletter is currently brought out in March and September each year and is intended for free private distribution within the Institute and the Kerala Forest Department. Free copies will also be sent upon request to other persons or institutions connected with forestry activities. The views expressed in the Newsletter are those of the authors and do not necessarily reflect views of the Institute. All interested persons are invited to send comments and opinions. The Newsletter Committee reserves the right to choose among contributions and edit wherever necessary.

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KFRI Completes 20 Years in Forestry Research

Kerala Forest Research Institute (KFRI) has completed 20 years in forestry research since its establishment on 3rd July 1975. KFRI was established as an Autonomous Institution under the Science and Technology umbrella of the State Government to undertake research in forestry which is important for the economic development of the State as well as for scientific management of the forest resources. Little more than a concept, with a handful of people, the Institute functioned initially in a rented building at Patturaikkal, Thrissur and in 1976, shifted to Chiyyaram, Thrissur. The inauguration of the KFRI main campus at Peechi took place on 19 February 1978, a memorable day in the history of forestry research in the State. The main campus at Peechi situated 19 Km east of Thrissur town is spread over an area of 28 ha which forms part of the reserve forest under Peechi Forest Range. Over the years, the Institute has built up good infrastructure facilities and man power. A sub-centre was established at Nilambur in about 45 ha of forest land. A Field Research Station at Palappilly was inaugurated in April 1994. Recently, with the help of the Kerala Forest Department, a Teak Museum was also opened in the sub-centre campus at Nilambur. The Institute is organized into various Divisions. At present, there are 14 Research Divisions, viz., Silviculture, Wood Science, Soil Science, Economics, Statistics, Agroforestry cum Publicity, Botany, Physiology, Genetics, Non-wood Forest Products, Wildlife Biology, Ecology, Pathology, and Entomology. In addition, Administration and Library Divisions, and an Engineering Wing are also functioning in the main campus. As on 31 March 1996, there are 153 regular employees in the Institute - 45 scientific, 20 technical and 88 administrative and supporting staff. In addition, about 62 research/project Fellows are also working at the Institute in various time bound research projects.

Most of the research undertaken by the Institute have been directly related to the priorities of the forestry sector of the State. Research is carried out on all aspects of forestry, including plantation forestry, management of natural forests, biotechnology, forest environment, biodiversity, man-forest interaction, wildlife biology, wood science and technology, etc. So far, about 252 Research Projects were carried out in different disciplines with financial support from National and International funding agencies as well as from State Forest Department. More than 600 research papers were published in professional journals and 110 Research Reports were brought out as KFRI publications. At present there are 56 ongoing research projects. Although KFRI's mandate is to find solutions for forestry related problems of the State through meaningful research, it has grown to a level greater than a research institution of the State. The multidisciplinary forestry research being carried out in KFRI will have an impact on, and relevance to the forestry practice not only in the country but in other tropical areas as well.

C. Mohanan
Editor

Plant Diversity in Sacred Groves of Kerala

The tropical forests - the miracle of biological ingenuity - are fast disappearing from the earth due to various developmental activities. Different governments and various international bodies have been appealing to the mankind to alter this course of destruction and they also evolved several methods to conserve different biomes by declaring areas as Reserved Forests, Sanctuaries, National Parks, Biosphere Reserves, etc. But such areas are complex, difficult to manage and expensive from the administrative point of view and the local inhabitants have no involvement in them as they seem to be something set aside and kept remote from their day to day life and even their mere entry is often restricted.

When ecological degradation and deforestation have been going on at an alarming rate, as a global phenomenon, in India, there exist thousands of pockets where religion has offered protection to the landscape. Such pockets are called as "Sacred Groves" and are known under different names in different parts of the country as 'Kavu' (in Malayalam and Tamil), 'Sindhravana' or 'Devarkadu' or 'Pavithravana' (in Kannada), 'Deorais' or 'Deoban' (in Marathi), 'Orans' (in Rajasthani), etc. Extentwise they vary from one square metre to about a million square metre. They provide a countrywide network of protected areas wherein the inherent diversity of flora and fauna are preserved for present and future human use. They also serve as unique examples of *in situ* genetic resource conservation. The manifestations of nature are exhibited in the form of magnificent, ancient, arboreal plants, giant climbers, and rich ground flora. The sacred groves are often described as natural museums of giant living trees, treasure-house of rare, endemic and endangered species, dispensary of medicinal plants, recreation centre for urban life, garden for botanists, gene bank of economic species, paradise for nature lovers, and laboratory for environmentalists.

Sacred groves are invariably associated with certain gods or goddesses. In Kerala, they are normally associated with goddess 'Durga', 'Lord Ayyappa' or 'Nagaraja'. Along with sacred groves certain species are also connected. For example, *Ficus religiosa* commonly called as 'Bodh tree' or 'Bodhi vriksha' is related to Sri Buddha who attained enlightenment under this tree. In general, plants with trifoliate leaves (e.g. *Crataeva religiosa*) are associated with "Thirumurthis" (Brahma, Vishnu and Siva). *Aegle marmelos* also a species with trifoliate leaves and *Couroupita guianensis* are associated with Lord "Siva", *Alstonia scholaris* with Nagaraja. Species like, *Azadirachta indica, Butea monosperma, Elaeocarpus tuberculatus, Mimusops elengi, Nyctanthes arbortristis, Saraca asoca,* etc. are related in one way or other with the temples. *Cedrus deodara* (Devadaru) is considered as a sacred tree in the Himalayas. Fruits of *Syzygium cuminii, Calamus rotang* are offered for Pooja to Lord "Ganesh". Flowers of lotus are connected with lord 'Vishnu' and goddess 'Saraswathi'. *Santalum album, Ocimum sanctum, Butea monosperma, Cynodon dactylon* are inevitable for all religious rites. Thus, nature conservation is seen to be closely linked with religion. Our culture has provided protection to the landscape in different pockets of the country where relic vegetation is preserved intact free from human interference. Thus, the sacred groves serve as unique examples of *in situ* genetic resource conservation through the involvement of local people in the most economic and efficient manner. They safeguard representative examples of the main ecosystems by conserving the plant and animal resources and are complimentary to the already existing conservation sites.

According to a pioneer study conducted by the second author, Kerala has 761 sacred groves, scattered throughout the State. Of these, 361 are found to be more than 200 m^2 in extent. Among these 74 are found to be above 0.5 ha in size.

Regarding the floral wealth, 722 species belonging to 129 families and 474 genera are encountered. They are spread over 108 Dicot families, 19 Monocotyledons and 2 Gymnosperms. Sacred groves are also a treasure-house for endemics. Among the 722 species recorded 153 are endemic to peninsular India. Although the total area of 1.4 Km² occupied by the sacred groves in Kerala is negligible when compared with Gamble's 'Flora of the Presidency of Madras', which *inter alia* includes the states of Kerala, Tamil Nadu, Andhra Pradesh and three forth's of Karnataka, the flora in sacred groves is quite rich.

The diversity value obtained for the groves correspond to a good value obtained for some well protected evergreen formations in South India. For example, 90 Km² of Silent Valley encompasses 960 species of angiosperms in relation to 722 species in 1.4 Km² of the area occupied by the groves. The sacred groves are also an important abode for medicinal plants (413 spp.), non-wood forest products (278 spp.) and wild relatives of cultivars (58 spp.). The presence of a few rare, threatened and vulnerable taxa like, *Blepharistemma membranifolia* (vulnerable), *Impatiens acaulis* and *I. lucida* (threatened), *Cryptocoryne spiralis, Drypetes confertiflorus, Syzygium travancoricum* (all rare) indicate that *sacred groves are viable 'hot spots' for* conservation.

Some of the sacred groves have shrunk considerably or are getting degraded due to the following reasons: (a) decreasing religious beliefs, (b) religious beliefs are intact but the deity is shifted due to limited land resources, (c) increasing tourism without adequate environmental awareness, (d) indiscriminate collection of Minor Forest Products (e) developmental activities both within and outside the groves, and (f) shortage of manpower to offer adequate protection.

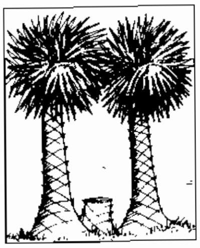
In the light of what has been stated above the following points are worth consideration:

- Values of far reaching importance such as ecological, economic, social, aesthetic and spiritual which are implicit in the groves should be made explicit by awareness campaign.
- Wherever the vegetation is degraded in the sacred groves, natural regeneration should be augmented by desired, indigenous species by providing technical and financial help to the temple authorities.
- Reforestation through community involvement should be implemented in completely deforested groves with sufficient land.
- As they are 'hot spots' for conservation, special care should be taken to offer total protection to the groves harbouring rare, endemic and endangered species to serve as gene banks.
- *Ex situ* conservation of such species *should be encouraged and* propagation through tissue culture should be initiated.
- Individuals of privately owned groves should be honoured in awareness campaign meetings through suitable awards.
- Land tax exemptions or concessions should be given to the sacred groves.
- The presence of 241 tree species in various sacred groves reveal their adaptability to various agroclimatic zones of the State indicating their potentialities for agroforestry and social forestry programmes.

In fine, the Kerala Forest Department should be complimented for having taken the initiative to provide protection to the existing groves through barbed wire fencing. Wisdom has dawned a little late but it is better late than never.

K. Balasubramanyan
Division of Ecology
and
N.C. Induchoodan
Kerala Forest Department

A sacred grove in Kayamkulam, Kerala



Utilization Potential of Palm Wood

Palms are an important group of monocots comprising useful plants such as coconut, oil palm, palmyra, sago, date palm, etc. Besides oil, edible fruits, sugar, starch, fibre and other products, a number of palms yield substantial quantity of woody material which is being used on a smaller scale for constructional and agricultural purposes in rural areas. At present the timber from palms has not gained popularity for extensive use although the material has greater potential for improved use particularly in the present context of timber shortage.

The woody material from palm trunks differs from common commercial woods in its structure and origin. It consists of discrete longitudinal fibrous strands (fibro-vascular bundles) held together by softer ground tissue. The fibro-vascular strands provide mechanical rigidity to the stems and conduct water and food materials to various parts. The ground tissue, on the other hand, serves mainly as a storage tissue. As the stems grow in height with age, the increasing requirement of self support is met by reinforcement of fibrous strands by further sclerification which starts from the stem and progresses upwards. As such, there is no secondary thickening growth in palm stems.

The distribution of fibrous strands is not uniform across the radius of a palm stem. In the peripheral portion of the stem cross section, the strands are more numerous and overcrowded. As a result, this part is generally heavier and harder. Towards the stem centre, the fibrous tissue gradually decreases with consequent increase in the proportion of ground tissue. This type of distribution of sclerified tissue in the stem is common to majority of palms. However, there are reports of a few exceptions.

The thickness or relative proportion of harder material in the stemwood is an important factor influencing the utility of palm wood. The softer portion in many species is weak and spongy and is prone to biological deterioration or drying defects. Hence, it is not much useful as such for most solid wood applications. On the other hand, the peripheral wood of some species of palms like palmyra, coconut or arecanut has better strength properties than some commercial woods.

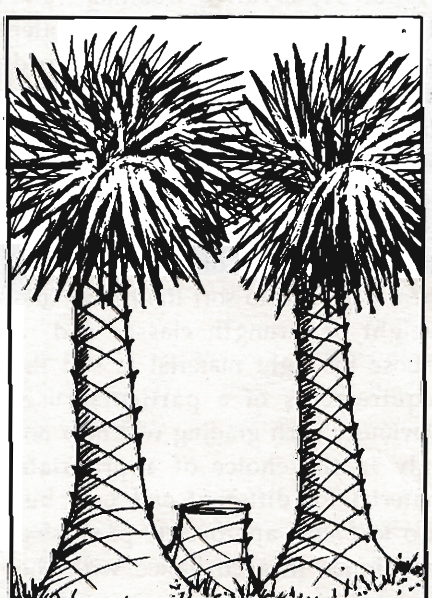
Since the degree of sclerification at different height levels of a stem is highly variable, there is a wide variation in mechanical properties of the stemwood from the butt end to the top. It is generally the lower parts of the trunk which yield timber having optimum strength quality. From base to top there is considerable decrease in weight, hardiness and strength of wood. Therefore, the timber from palm trunks cannot be used indiscriminately if it has to satisfy the constructional requirements.

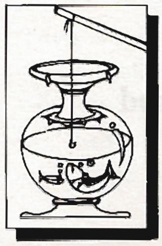
Although palm wood has certain advantages over conventional timbers like straight, cylindrical bole and absence of branches or knots, it has certain limitations. The major problem with the material is the difficulty in processing it by conventional methods. Palmwood is often hard and silicious which causes quick dulling of cutting tools. To overcome this, use of wear resistant carbide tools has been recommended for satisfactory processing. Chipped or torn grain is more common while working with hand tools which can be minimized by the use of power tools or machines. Experimental trials on coconut wood have shown that it is ideal to do major part of processing including sawing and machining in green condition and final finishing by sanding after drying.

Proper preservative treatment and drying of palm wood material offer some difficulty. The softer corewood is generally easier to treat but rather difficult to season satisfactorily. The reverse is true for the peripheral harder part. Since the difference in technical properties is remarkably high in different parts of the trunkwood there is a need to sort the timber into weight or strength classes and to choose the right material to suit the requirements of a particular use. Obviously such grading will help not only in the choice of appropriate material for different end uses but also to follow appropriate processing techniques in accordance with the intended use.

Besides structural applications, palm woods are suitable for a variety of other uses. Promising among them are furniture and joinery, decorative uses, utility items and curios, flooring and paneling. Palmwood is satisfactory for turnery and carving if complicated patterns and finer details are avoided. Among other important uses of this timber, production of glued laminated timber appears promising since it is a means to utilize the softer wood also. Here softer wood layers are sandwiched between alternate layers of harder wood and glued to produce timbers of required shape and dimension. Such products are highly promising from the point of view of complete utilization of the material. With rapid developments in wood technology it is possible that new products and possibilities may emerge in future years to enhance the exploitation of this nonconventional source of wood for more diverse end uses.

K.V. Bhat
Wood Science Division

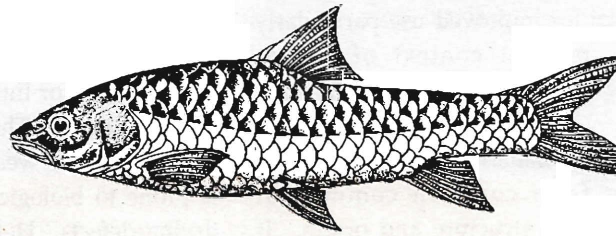




Mahseer - a Threatened Fish of Kerala

The unique and diverse freshwater fish fauna of Kerala is supported by 44 rivers, their lakes/reservoirs and innumerable ponds. Vulnerability to extinction, rarity, and endemism make many of the freshwater fishes of Kerala threatened. Habitat alteration, pollution, over exploitation, and invasion by exotic species are the major threats posing the existence of the fishes.

Mahseer, a highly threatened fish thrives in upland cold waters of Western Ghats. The Mahseer that usually found in Western Ghats is commonly known as Deccan/Yellow Mahseer (*Tor khudree*). Apart from its highly endangered status, it is one of the most favoured game fishes by anglers in sport fishery. Besides, the high palatability of the flesh makes it the most sought after item by fishermen. It is reported to grow up to 50 Kg in weight and more than two metre in length and hence the name (Maha = great; seer = lion). Live Mahseers have a silvery background colour with dark bluish upper part and pale golden yellow lower half. Eyes are normally red. Fins are bluish grey, often tipped with yellowish pink.



Mahseer is very specific in habitat requirements. It prefers low water temperature (around 25°C), clear water and coarse substrates. This fish faces a serious threat due to stock depletion all over India. Major reasons for stock depletion are (i) ingenious destruction of brood stock (ii) onslaught of the upstream migrating spawners and downstream migrating youngones (iii) deterioration of spawning grounds due to deforestation and consequent siltation and (iv) lesser number of eggs, longer hatching periods and high specificity on temperature and substrate requirements for spawning.

Mahseer spawns in cool, clear waters of highland forests where substrates like gravel, pebble and sand are available and temperature span around 22-26°C. Mahseer is an omnivore generally feeding on plant as well as animal matter such as insect larvae and other benthos. It is commonly called 'Kuyil' in Malayalam and the probable last stocks of them exist in the streams, lakes and reservoirs of Periyar and Parambikulam in high ranges of Kerala, where they face reasonably lesser threats and risks.

L.K. Arun
Wildlife Biology Division

Some Rare Butterflies of Kerala

Butterflies are well represented in most of the geographical regions that support plants. Because of their diversified habits, they occur in every imaginable habitat. However, the rapid destruction of the dense, humid and sub-tropical forests, which is perhaps today's greatest environmental *faux pas* has adversely affected the survival of many species of butterflies.

Of about 1500 species of butterflies known to occur in India, 300 are reported from southern India. Most of these are found in Kerala. Because of the typical ecoclimatic conditions in southern India, the butterflies found in this region are quite distinct from those of the other parts of the country. The true affinities of some of these are with species found in the Indo-Malayan subregion. Because of years of isolation in ecoclimatic conditions peculiar to this area, many species have also acquired several characters not found in their counterparts elsewhere. The extent of endemism in certain groups of South Indian butterflies is also very high. As a result of fragmentation of natural habitat, many species have now restricted to the forest belts.

Butterflies have great aesthetic quality in their wing patterns and this gives them a commercial value. In many parts of the world, they are collected in large numbers from the wild for sale as well as for making souvenir articles. Although the common species can withstand moderate harvesting of this kind, excessive collection may affect the survival of the rare and vulnerable species. Therefore, it is necessary to regulate the commercial collection of rare species by legislation. In India, several species are being protected under the Wildlife Act and attempts are being made to conserve them. Information on the butterfly fauna and their status is essential for the success of such programme. Some rare butterflies belonging to the family Papilionidae found in Kerala are described.

1. ***Chilasa clytia clytia* Lin.** (The Common Mime)

Status: Protected Schedule I Part IV

This butterfly is common in hilly regions usually at low elevations. Wing span 90-100 mm. It occurs in two forms. The typical form clytia mimics the common crow, *Euploea core*. Wings of both male and female are dark brown with cream coloured markings. Forewings have several spots at the margin and between the veins. A series of large yellow spots are present on the ventral side of the hindwings. In the form *dissimils*, which mimics the Blue Tiger, *Danaus limniace*, the wings are black with creamy coloured stripes;tail is not present.

The Common Mime

2. ***Troides minos* Cramer** (The Southern Birdwing)

Status: Protected Schedule I Part IV

The Southern Birdwing is one of the largest Indian butterflies. It is endemic

The Southern Birdwing

to southern India and the Western Ghats. The main habitat is lowland evergreen forest, but the species also prefers mixed deciduous and subtropical evergreen forests. Wing span 140-190 mm. The male is with glossy black forewing and golden hindwing with black borders and veins. The female differs from the male in the upper hindwing having a discal raw of large triangular black spots. Larvae feed on the leaves of *Aristolochia indica* and *Bragantia wallichii*.

3. ***Papilio liomedon*** Moore (The Malabar Banded Swallowtail)

Status : Protected Schedule I Part IV

This butterfly is the rarest of the South Indian Papilios and is endemic to the Western Ghats. It is confined to the wettest part of the lowland evergreen forests, where it flies mainly during the monsoon months. Wing span 90-100 mm. Both male and female are tailed and are brownish black. A creamy yellow band runs from the apex of the forewing to the middle of the hindwing. The band on the forewing is composed of separate spots which passes through the cell of the hindwings. Larvae develop on the leaves of *Acronychia laurifolia*; adults feed at flowers of *Lantâna*, *Clerodendron* and *Mussaenda*.

The Malabar Banded Swallowtail

4. ***Papilio buddha*** Westwood (The Malabar Banded Peacock)

The Buddha Peacock is probably the finest butterfly in South India. The species is limited to wet lowland evergreen forest. Usually it is not found where rainfall is much less than 4000 mm per annum and it seems unable to survive in severely disturbed forest. Buddha peacock appears from May to late September and is commonest among the low hills, close to the sea. Although it is never found away from the forest, it has been recorded from suburbs of cities. It usually prefers to remain under the canopy. The immature stages survive on leaves of *Xanthoxylon rhetsa*. Wing span 90-100 mm. In both male and female, the wings have broad bluish green discal band. Basal areas of the wings are dusted with green scales. The outer areas and tail are black.

The Malabar Banded Peacock

5. ***Papilio dravidarum*** Wood-Mason (The Malabar Raven)

The Malabar Raven is another endemic of the Western Ghats, confined to dense forests. It resembles the common mime. Larvae develop on foliage of *Glycosmis pentaphylla*. Wing span 80-100 mm. The wings of both male and female are blackish brown with marginal series of conical white spots; tail is not present.

George Mathew and
M. Mahesh Kumar
Entomology Division

The Malabar Raven

Weather Data for Peechi (1995)

The rainfall at Peechi was about 591 mm lesser than previous year. The total rainfall including the summer showers amounted to 2578.4 mm during the whole year. Of this, the South West monsoon contributed to about 2421 mm while that of North East monsoon to about 157 mm. The number of rainy days, when rainfall was greater than 10 mm, was 74 days which is about 16 days less than that of the previous year. Summer showers were rare and months of January and February did not receive any rain at all. On 10th March the first summer shower of 1.6 mm was obtained. In April, small showers contributed to about 45 mm and from 5th June onwards, continuous rain began. The month of July was blessed with maximum rainfall, raining almost all days amounting to 837.6 mm. During the month of December there was no rain. The monthly averages of the various weather parameters measured at the KFRI Weather Station are presented in Table 1. The annual rainfall from 1988 onwards,the monthly rainfall for 1995, and an ombrotherm showing wet and dry periods for the year are presented graphically in Fig.1 a,b and c respectively.

The mean maximum temperature recorded in various months during the reporting year varied between 29.5 (Jun) to 39.2°C (Mar., Apr.), while the mean minimum temperatures varied between 19.9 (Dec.) to 23.7°C (Apr.). Averages of maximum monthly relative humidities varied between 78% (Dec.) and 85% (Sept.) whereas the mean monthly minimum r.h. ranged between 36% (Mar.) and 70% (Jul.) during the year. Mean bright sunshine was high in December (8.2 h) and was low in July (1.4 h) due to monsoon clouds. Details of monthly averages of weather parameters, cumulative rainfall, etc. recorded at KFRI Weather Station are highlighted.

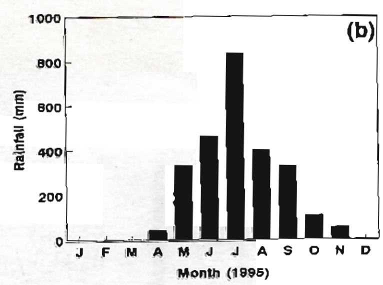


Fig.1.b. Cumulated monthly rainfall for 1995 at Peechi

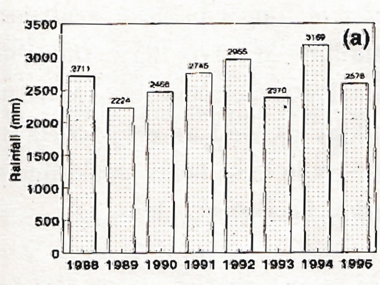


Fig.1.a. Cumulated annual rainfall from 1988 to 1995 at Peechi

Highlights

Days with highest maximum	:	24 March and 4th April temperature (41°C)
Days with lowest minimum temperature	:	19th January, 2-3, 15-17 December (18°C)
Day with highest maximum r.h.	:	30th October (95%)
Day with least minimum r.h.	:	19th November (21%)
Total rainfall for the year	:	2578.4 mm
Day with maximum rainfall	:	17th July (142 mm)
Month with maximum rainy days	:	July (22 days)
Total number of rainy days	:	74 days
Day with maximum bright sunshine	:	30th November (10.2 h)
Month with maximum bright sunshine	:	December (8.2 h)
Month with minimum bright sunshine	:	July (1.4 h)

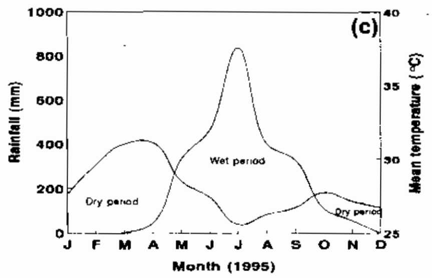


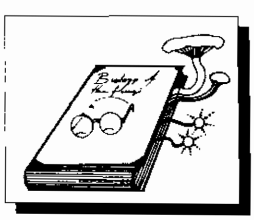
Fig.1.c.Ombrotherm showing wet and dry periods for the year 1995 at Peechi

Table 1. Monthly averages of weather data for 1995 at Peechi (Latitude: 10°32'N, Longitude: 76°20'E Altitude 100 m)

Month	Mean Temp (°C)		Mean r.h. (%)		Rainfall (mm)	Daily mean Wind velocity(km/hr)	Daily mean Bright Sunshine (h)
	Max.	Min.	Max.	Min.			
January	34.70	20.50	79.00	47.00	0.00 (0)	2.2	7.40
February	37.10	22.10	81.00	44.00	0.00 (0)	1.6	8.10
March	39.20	22.80	82.00	36.00	1.60 (0)	1.10	7.80
April	38.50	23.70	81.00	46.00	45.40 (1)	1.10	7.50
May	34.10	22.90	82.00	58.00	333.00 (10)	0.80	5.50
June	31.90	22.90	83.00	66.00	463.00 (15)	0.70	2.80
July	29.50	21.70	84.00	70.00	837.60 (22)	0.70	1.40
August	30.40	22.10	84.00	67.00	401.20 (9)	0.60	3.80
September	31.30	22.20	85.00	69.00	329.60 (11)	1.10	3.90
October	33.50	22.00	84.30	63.50	111.00 (3)	0.69	5.30
November	32.70	21.60	84.00	58.00	56.00 (3)	0.40	5.30
December	33.60	19.90	78.00	43.00	0.00 (0)	1.80	8.20

Note: r.h.: Relative humidity; the figures in parenthesis indicate the number of rainy days when rainfall was > = 10 mm.

Jose Kallarackal **and** ***C.K. Somen***
Plant Physiology Division



Book Review

Biology of the Living Organisms - Series 1
Biology of the Fungi
By J.G. Vaidya
Satyajit Prakashan, Pune, India (700 pages)ISBN 810900 565-06

The book is divided into two main parts: Fundamentals of Mycology and Fungi in Action with six chapters in each part. Biological features of fungi, Heterotrophy and its consequences, Vegetative growth, Reproduction, Incompatibility, and Ultrastructures are the chapters included in the first part. Nutrition and metabolism, Ecology, Biodeterioration and biodegradation, Phytosociology, Metabolites, and Biotechnology are covered in the second part. The book is by and large a very readable and up to date treatment of biology of the fungi. The multidisciplinary approach followed by the author for making the subject more comprehensible to the reader is appreciable. The author has tried to provide more details on the fundamental characteristics as well as on fungi in action and interaction with the environment, and exploitation in the industry. One of its greatest strengths lies in the numerous references (more than 2,500) to more recent studies. Chapters on Fungal ultrastructure, Nutrition and metabolism, Biodeterioration and biodegradation, and Biotechnology are exceptionally outstanding in their contents. A few minor flaws detract from the presentation, including occasional misspellings. Despite these quibbles, the book contains an impressive synthesis of information on different aspects of fungal biology. Advanced students of Mycology and Plant Pathology, Biotechnology, Molecular Biology as well as researchers and teachers in these fields would find the book to be of great value.

C. Mohanan
Pathology Division

Recent Publications

Research Papers

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Research Reports

Silviculture, management and utilization of bamboo resources of southern India (Phase II). Final Technical Report of Project No. KFRI 135/91.

Project Leaders: Dr.S. Chand Basha (May 1991-December 1994), Dr. K.S.S. Nair (January to April 1995); Project Co-ordinator: Dr.R. Gnanaharan; Investigators: Dr.M.S. Muktesh Kumar, Dr.A.R.R. Menon, Dr.P. Vijayakumaran Nair, Mr.U.N. Nandakumar, Dr.R.C. Pandalai, Dr.K.K. Seethalakshmy, Mr. Thomas P Thomas, Dr.C. Mohanan, Dr.R. Gnanaharan, Dr. K.V. Bhat, 1996.

Executive summary

The importance of bamboo in the economy of Kerala State is well recognized. Millions of people in the rural sector depend on bamboo for their livelihood. The gap between availability and demand is ever widening. To find ways to bridge this gap, the Kerala Forest Research Institute (KFRI) undertook a multi-disciplinary project funded by the International Development Research Centre, Canada (IDRC). The first phase of the project (April 1987 - April 1991) achieved the set objectives and generated basic and useful information. To consolidate the results and also to continue observations in the component involving growth study, a second phase of the project with the widened scope was proposed. The major findings of the study conducted during May 1991-April 1995 are given below.

Taxonomical study; Distribution map

From southern India, 32 species under 10 genera have been recorded including the cultivated species. Twentytwo species under seven genera are naturally occurring. The study helped greatly in contributing to the preparation of a Compendium of Bamboos of India under BIC-India Project giving taxonomic description of 131 species with illustration of 117 species. The following species of bamboos were collected in flower:

Ochlandra sivagiriana (Gamble) Camus - flowering reported for the first time; *Ochlandra talboti* Brandis - flowering reported after a gap of 98 years; *Pseudoxytenanthera stocksii* (Munro) Naithani - new record to Kerala; *Dinochloa nicobariana* Majumdar - flowers described for the first time.

Illustrations and taxonomic description have been prepared for these specimens where flowers were hitherto undescribed. A bamboo herbarium has been established as part of KFRI herbarium and all specimens have been deposited there.

A taxonomic revision of the genus *Ochlandra* Thw. has been published. A tentative key based on vegetative characters for easy identification of 32 species of bamboos in the field, occurring in southern India, with illustrated diagrams and also a distribution map have been prepared.

Growing stock estimation

The study confirmed that mapping and resource evaluation of bamboos in natural forests can be effectively and efficiently done using large scale aerial photographs. The stock mapping accuracy was worked out and was found to be 90% in the case of visual interpretation of large scale aerial photographs (1:15,000) and 70% in the case of visual interpretation of IRS IA and Landsat TM False Colour Composites. Due to more clear textural variation in aerial photographs with respect to crown density status of bamboo, the feature can be efficiently used in stock mapping of bamboos. Broad classification of forest types alone can be done using satellite data by visual and digital interpretation techniques and for subsequent stock mapping procedure use of large scale aerial photographs is the most appropriate technique, coupled with area estimation using electronic planimeter and collection of stock parameters using standard sampling and quadrat techniques.

Geographical Information System (GIS)

An attempt was made to develop a GIS database for bamboo resources of Kerala. Data on distribution, taxonomy, altitude, rainfall, temperature, soil, vegetation types, drainages, roads, important locations, etc. were gathered from multiple data sources and organized into a GIS database by adopting a top down approach with the help of a low cost PC. The potential of GIS database for integrated processing of various data layers through GIS analysis functions like overlay, buffering and digital terrain modeling has been demonstrated. Also, the use of GIS for planning different resource management activities and for diverse ecosystem studies has been demonstrated.

Species/variety trials; Germplasm establishment

The germplasm located at the Field Research Centre campus, Kerala Forest Research Institute, has diverse bamboo species cultivated for research and extension. Though the total collection is around 47 species including few varieties of *Bambusa bambos* and some unidentified species, 38 species belonging to 11 genera have been botanically identified. The genus *Bambusa* is represented by 12 species, *Dendrocalamus* by eight, *Ochlandra* and *Pseudoxytenanthera* by four each. *Thyrsostachys*, *Phyllostachys* and *Gigantochloa* have two species while *Pseudosassa*, *Schizostachyum*, *Arundinaria* and *Melocanna* are represented by one species.

The study started during Phase I on growing plantation showed that *Bambusa bambos* can be successfully grown as an undercrop in teak plantations or sparsely wooded moist deciduous forests provided sufficient protection is given from biotic interferences at least during the initial 3 to 4 years of establishment. There was no marked effect of pit size (0.3 x 0.3 x 0.3 m and 0.45 x 0.45 x 0.45 m) and spacing (10 x 10 m and 12 x 12 m) on the survival, growth and productivity of bamboo clumps of different age groups (6, 12, 18 and 24-month-old seedlings at the time of planting). Clumps raised from older seedlings always showed better survival, quicker field establishment, faster growth, and higher culm production. On the other hand clumps raised from young seedlings were more susceptible to biotic interferences and once damaged, either fails to recover or establishes as very week bushy clumps. Marketable culms (culms having a length of 3 m or more or culms with a basal girth of 110 mm or more) were available in larger quantities from older clumps much earlier thus ensuring higher yield in shorter periods.

Seed storage; Propagation of branch cuttings

Fruits of four species of *Ochlandra* viz. *O. ebracteata* Raizada & Chatterjee, *O. scriptoria* (Dennst.) Fisch., *O. travancorica* Benth., *O. travancorica* var. *hirsuta* Gamble were collected from different places. Fruits of *O. travancorica* var. *hirsuta* were collected for the first time. *O. ebracteata* flowered gregariously in 1992 after an interval of 30 years. The fruits contain high moisture and during storage moisture content comes down rapidly resulting in loss of viability which varies from one to four months depending on the species. Storage of seeds in low temperature and high humidity to retain high moisture in the seeds was not promising as the seeds germinated in the storage bags.

The rooting percentage of branch cuttings was enhanced by 50 by using the suitable rooting media (sand) and the right concentration of growth regulating substance NAA (3000 ppm), with proper misting conditions.

Soil properties

Bambusa bambos grows well along the hills and in the valleys of Kerala on lateritic soils. Soil depth, texture, bulk density, and nutrient contents do influence its growth to some extent but the plant is found to be capable of thriving well in almost all soils of the State. It can be considered an important species for afforestation in similar areas.

Control of diseases

Web blight caused by *Rhizoctonia solani* is the most important nursery disease of bamboos. Occurrence of different strains of the pathogen poses practical challenge in successful management of the disease in bamboo nursery. Characterization of *R. solani* isolates from bamboo nurseries revealed different anastomosis groups, viz. AG1-IA, AG IC, and AG2 - 2IV. This is the first record of anastomosis grouping of *R. solani* from forest nurseries. *R. solani* belonging to different anastomosis groups exhibits varying degree of virulence, resistance to fungicide, reaction to antagonistic organisms and also difference in utilizing the carbon and nitrogen sources in laboratory and green house assays.

In bamboo nursery; types of shade over the seedbeds, water regimes and seed rates (seeding density) influenced the incidence and severity of the disease as well as the growth of the seedlings. Of the various treatment combinations tried, low seed rate (165 g / m^2), low water regime (10 L / m^2/ day) and no shade was effective in minimizing the disease incidence and severity as well as in producing vigorous, well developed seedlings.

Among the biocontrol measures, soil solarization was not much effective against web blight. However, it controlled the damping-off. *Trichoderma harzianum* (TH_4) and *T. viride* (TV_3) strains, applied as soil amendment and seed-coating were effective in reducing the incidence of web blight. Application of fungicide (Carboxin 0.2% a.i) in soil as a prophylactic measure after 7 and 21 days of seedling emergence is desirable to control the disease.

Rot of emerging culm of bamboos caused by *Fusarium moniliforme* var. *intermedium* is widespread in the State. The disease incidence varied from 35-37% during 1991-'94. Cultural measures like proper culm tending and cleaning the debris around the clump before the onset of monsoon reduced the disease incidence and mortality of the shoots.

Both ecto- and endo-mycorrhizal association were recorded in 19 different species of bamboos in the State. Very high percent infection (80-99) was observed in *B. bambos* but no correlation was obtained for incidence of rot of emerging culms and the mycorrhizal status of the clumps.

Furniture

The study showed that locally available bamboos, *Bambusa bambos*, *B. bambos* var. *gigantea*, *Dendrocalamus longispathus*, *D. strictus*, *Pseudoxytenanthera ritcheyi* and *Thyrsostachys oliveri* can be made use of for making bamboo furniture. Bamboos with straight culms, like *Bambusa bambos* var. *gigantea* and *Dendrocalamus longispathus* can be used in round form. Bamboos which are poor in form and with short internodes can be split and used over a wooden framework.

Anatomical study

In view of the practical importance of anatomical structure of bamboos for their identification and utilization, study was undertaken to investigate the culm structure of some common bamboos presently grown in Kerala. The 21 taxa examined in the study are: *Bambusa balcooa, B. bambos, B. polymorpha, B. vulgaris, B. wamin, Dendrocalamus brandisii, D. longispathus, D. strictus, Melocanna bambusoides, Ochlandra ebracteata, O. scriptoria, O. setigera, O. sivagiriana, O. travancorica, O. travancorica* var. *hirsuta, O. wightii, Psedoxytenanthera bourdillonii, P. monadelpha, P. stocksii, Schizostachyum beddomei* and *Thyrsostachys oliveri*. A comparison was made in terms of the structure of cortex, ground tissue, fibro-vascular bundles and the lining layers of the culm cavity. Considerable variation was found between different genera and species with a high degree of overlapping of characters. No well-defined characteristics useful for delineating different genera or species were identified. However, from anatomical point of view, the genus *Ochlandra* appears to be a more homogeneous group among the different taxa studied.

Management and utilization of rattan resources of India (Phase II). Final Technical Report of the Project No. KFRI 136/91.

Project Leaders: Dr. S. Chand Basha (May 1991-December 1994), Dr. K.S.S. Nair (January - April 1995); Project Coordinator: Dr. K.M. Bhat; Investigators: Dr. C. Renuka, Mrs. M.P. Sujatha, Dr. P.C. Pandalai, Mr. U.N. Nandakumar, Dr. K.K. Seethalakshmy, Mr. T.K. Dhamodharan, Dr. C. Mohanan, Dr. P.K. Muraleedharan, 1996

Executive Summary

Research carried out during the Phase II period (May 1991-April 1995) falls under different areas such as taxonomy and live collection, resource characterization, reproductive biology, seed stand and soil studies, propagation and seed storage, silviculture, continuous inventory, harvesting, processing and preservation techniques, fungal staining and biodeterioration, and harvesting and processing techniques. The major findings of the study are given below.

Resource characterization

Taxonomy: Extensive taxonomic survey was conducted in Andaman & Nicobar islands as well as the northeastern region of the country. Both island groups are relatively rich in rattan resource with 3 genera and about 12 species. *Calamus andamanicus, C. pseudorivalis* and *Korthalsia laciniosa* are widely distributed in both islands, while *C. palustris* and *C. viminalis* restricted to Andaman islands; *C. unifarius* is endemic to Great Nicobar island. The study reports six new species from this region. Three genera, viz. *Calamus, Daemonorops* and *Plectocomia* with 16 species and two varieties were explored from northeastern States.

Live collection: Twenty five species were assembled in KFRI campus; the collection includes species from China, Malaysia and Thailand. Chinese species are performing well; *C. tetradactylus* and *D. margaritae* show better growth than native species. The Malaysian species, *C. caesius* and *C. manan* perished after an initial growth for 2 years. Only *C. perigrinus* exists which shows good growth. Six species are from Andaman & Nicobar Islands of which *C. andamanicus* and *Korthalsia laciniosa* are much preferred by rodents resulting in heavy losses of seedlings.

Properties: Majority of the rattan species of Andaman & Nicobar islands comprise large and medium diameter rattans which are strong to very strong or moderately strong. This implies that they are suitable for high-value products such as furniture frames, walking sticks, and a variety of novelty items of export potential. *Calamus andamanicus* deserves special mention as it is the most desired and widely used rattan in Indian subcontinent due to its aesthetic value, large stem diameter, and superior mechanical properties. This rattan, comparable to Indian rattans of strength Class I and *Calamus manan* of the South-east Asia, deserves greater research attention as priority species in the Asian region.

Reproductive biology and seed orchards

Calamus thwaitesii, C. hookerianus and *C. pseudotenuis* were selected for studying the reproductive biology. The plant is dioceous and flowering is annual. The flowers open at the early hours of the day, around 4 a.m. in all the species studied. The male and female flowers open almost at the same time. In *C. hookerianus* another set of flowers open around 4 p.m. also. Anthesis takes place immediately after the opening of the flower. Within 2 to 4 hours all the pollan are shed from the flowers. All the three species are mainly anemophilous. The pollen viability and stigma receptivity of the three species decrease from 12 hours after the anthesis.

There is a linear decrease in the number of fruits as they get matured. In *C. pseudotenuis* there is a gradual reduction in the number of fruits from November to March when the fruits mature. After March there is a sudden increase in the rate. In *C. hookerianus* most of the fruits are fallen at a very early stage. From January onwards a reduction in the rate of fall occurs till the fruits mature in February. In *C. thwaitesii* the rate of fall is comparatively less. Birds, small animals like squirrels, monkeys, etc. and human beings are the dispersal agents. Seed stands of the ten commercially important species were established.

Soil studies: Even though the nutrient response study in pot and field did not yield statistically significant results, maximum growth response in *C. thwaitesii* and *C. pseudotenuis*, in the pots, indicates that *Calamus* prefers the nutrients N, P and K in equal proportions. Higher level of M resulted in higher growth response in *C. hookerianus* while in *C. pseudotenuis*, it did not show such effect except in height increment. In the field trial, maximum growth response varied from 92.1% to 193.3% in *C. hookerianus* while the increase in *C. pseudotenuis* varied from 33.7% to 107.5% over control. The results demonstrate the positive effect of nutrient inputs in the growth of *Calamus* seedlings. Further, this study envisages the need for more in-depth studies in cane nutrition for establishing the practice of nutrient application to get economically attractive increase in growth.

Propagation and seed storage

Species of *Calamus* produce seeds annually in large quantity but the seeds loose their viability within two months after collection. Study was undertaken to find out the natural longevity of seeds of various species and storage methods to prolong the viability. Seeds of *Calamus metzianus*, *C. thwaitesii*, *C. pseudotenuis* and *C. hookerianus* collected from different locations in Kerala were employed. Seeds of other rattan species available in small quantity were also collected and observation on seed weight, germination and longevity was made. The effect of stratification was studied on some of the seed lots of *C. hookerianus and C. thwaitesii*, which showed a poor germination at the time of collection and could not be used for storage.

The results showed that there was considerable variation in the initial germination of the seed lots of the sample species collected from different locations. Although seeds of most of the species had a moisture content of 30%, the viability was lost within two months. Storage experiments with control of temperature showed that viability can be prolonged to about six months. But in some of the seed lots germination occurred under storage since the humidity used for storage was high. But the germinated seeds remained in plumule stage and they could be successfully planted out up to a period of six months.

Observations on survival and growth of seedlings and suckers from the experimental plots established in 1988 clearly showed that it was easy to establish rattan plantations by underplanting. Poly potted seedlings were the best planting stock and *C. rotang* was the fastest among the four species which started suckering within three years and flowered during fourth year; the percentage of seedlings flowering increased every year. Growth of *C. thwaitesii* showed that the plants were still in rosette stage. The plants that started suckering was less than 10%. There was no indication of flowering and fruiting till the end of 1994. Two seedlings of *C. pseudotenuis* flowered during 1994 indicating that the first flowering can occur at the age of six years. Suckering has started in seedlings. Growth of *C. hookerianus* was slow when compared to that of *C. pseudotenuis* which was planted in the same area.

Rattan silviculture

In majority of rattan species, plenty of good quality seeds are available every year; hence artificial regeneration through seeds is found simple and successful. Proper seed extraction, providing adequate moisture content in the germination medium, and over head shade in nurseries are prerequisites for quicker germination and faster seedling growth. One-year-old polypotted seedlings are best suited for field transplantation. Though rattans are shade loving plants, initial growth in a partially open area helps faster growth. Periodic climber cutting and leaf mulching ensure better establishment and growth in the field. With the up dated knowledge of silviculture of the species in the current project, large-scale plantation programme can be initiated in ever green/moist deciduous forest of Kerala so as to meet the ever increasing demand from rural industries.

Continuous inventory

Spatial information on rattan, its habitats and their dynamics over time are important for scientific management and utilization. This component was taken up to explore the possibilities of developing a continuous inventory system capable of providing these information in a cost-effective manner.

Studies conducted in rattan habitats in Kerala have highlighted the difficulties involved in the preparation of distribution maps as well as in the establishment of sample plots for generating the information required. While the heterogeneous habitat conditions warranted very high sampling intensities to arrive at meaningful estimates, the difficult terrain conditions made field survey highly uneconomical. Attempt to use Remote Sensing, Geographic Information Systems and Global Position System techniques to minimize ground survey was found quite successful. A new method was devised to prepare distribution maps using these tools. This method was found to be more easy, quicker, cost-effective and efficient than conventional surveys. Use of these tools was found to be effective in the preparation of inventory design as it provided new opportunities for stratification and use of various sampling techniques taking into consideration the factors influencing growth of rattan.

Determination of remeasurement interval was another vexing problem. At present, there is no non-destructive method practically viable to measure rattan height accurately. The possible accuracy that can be achieved by ocular estimates was found to be 2 to 3 metres necessitating a remeasurement interval sufficient enough to offset the measurement errors, so as to develop growth models. The growth data suggest a remeasurement interval of five years. Use of measuring instruments using laser technology, could be helpful in making more accurate measurements, but this needs further studies. As rattans occur interspersed with other forest resources, to be cost-effective, rattan inventory need to be integrated with multi-resource inventory. Further research efforts are needed in this direction.

Harvesting and processing techniques

Due to the non-availability of justifiable quantity of mature stock in northeastern and southern India, there is limited scope in the near future for employing low-cost machines including the trifor developed in South East Asia for cane harvesting. If the principle of sustained yield is adopted, there exists opportunities for such semi-mechanized harvesting techniques in densely growing locations of Andaman & Nicobar Islands. Although there is a need for further research on the treatment of canes of standard size available in the market, the techniques standardized for curing, bleaching, fumigation and preservation in the present study indicate the ample scope for technology transfer to rural communities involved in the rattan-based industries.

The State Forest Departments in Karnataka, Kerala, and Andamans and several rattan manufacturers were convinced with the results of oil-curing to make it mandatory soon after extraction, before the rational supply to manufacturers. Several NGOs and Government organizations in different States of India including Kerala, Gujarat and Karnataka have initiated the work for establishment of modern rattan furniture manufacturing units after consultation of the results achieved in the current research project.

Fungal staining and biodeterioration

To test the efficacy of promising chemicals viz., sodium azide and copper sulphate obtained in the laboratory trials against fungal staining and biodeterioration of post-harvest rattans and to work out the economic feasibility of the chemical treatment under various field and processing conditions, trials were carried out employing low cost, temporary treatment tanks dug in rattan extraction sites. Results of field trials revealed that fungal staining was less in canes treated with copper sulphate (4and 8%) and sodium azide (0.1 and 0.2%) than the control (without chemicals). Horizontal dipping treatment with Cuso4 (8%) was more effective in checking the fungal staining, however, the effectiveness of the treatments depended on the period of post-harvest exposure of the canes in the forest floor before the treatment. End dipping with sodium azide (0.2%) was equally effective in protecting the canes from staining fungal attack and the treatment was very handy especially in difficult terrain. General guidelines for the protection of post-harvest rattans against fungal staining and biodeterioration were prepared.

Harvesting and processing economics

The study has worked out the productivity of the workers involved in harvesting operation. It is estimated that an unskilled worker would collect about 10 numbers of first class, 26 numbers of second class, 40 numbers of third class and 60 numbers of fourth class, rattan per day. His work involves locating the plant, collection, dressing, cutting into 12' pieces and transporting to lorry sites. On an average, a cane harvesting worker earns about Rs.30 to 45 per day and gets employment about 100 to 150 days per season.

The contractors and Societies are the main beneficiaries of the harvesting operation. For instance, the Societies get a large amount from the Federation for harvesting operation with free of interest, in addition to the 10% commission for undertaking the work. The contractor gets Rs.1 to 3 per cane as profit.

The price of raw material and the cost of production have increased significantly during the last seven years. Consequently, the price of finished products has increased, which has affected marketing of the products. Although there has been an increase of wage, the socio-economic condition of the cane workers has not improved much, due to a variety of reasons such as inflation, shortage of raw material, exploitation by the owners, etc. The Government should adopt a price policy for non-wood forest products in general and cane in particular for the development of this industry.

Consultancy Reports

Indigenous tools, equipments and technology for processing bamboo and rattan. Final Report of the Project No. KFRI Cons.6/94. Dr. R. Gnanaharan, 1996, Final Report was submitted to the sponsor, INBAR, New Delhi.

Properties and quality of teak timber with special reference to juvenile wood. Final Report of the Project No. KFRI/ Cons.8/95. Dr. K.M. Bhat, 1996. Final Report was submitted to the sponsor, Amazon Teak Foundation, the Netherlands.

Investigation on outbreak of pink disease in HNL 1994 *Eucalyptus grandis* plantations in Munnar, Kerala, India. KFRI Consultancy Report.
Dr. C. Mohanan, 1995. Report was submitted to the Hindustan Newsprint Ltd., Velloore, Kerala.

Large-scale mortality of *Eucalyptus grandis* in 1994 and 1995 HNL plantations in grasslands at Pamba. KFRI Consultancy Report.
Dr. C. Mohanan, 1995. Report was submitted to the Hindustan Newsprint Ltd., Velloore, Kerala.

New Research Project

KFRI 247/96: Development of spike disease resistant sandal seedlings through biotechnology involving ELISA technique and tissue culture.
Investigators: Dr. M. Balasundaran (Pathology Division), Dr. E.M. Muralidharan (Genetics Division).

Objectives: i.Development of ELISA techniques for detection of Mycoplasma like organism in tissues/sap of spike diseased sandal and host plants. ii. Identification of disease resistant trees among disease evading trees utilizing ELISA techniques. iii. Development of a protocol for micropropagation of sandal through enhanced bud proliferation using shoot tip or axillary bud explants or through somatic embryogenesis. iv. Micropropagation of disease resistant/ superior genotypes through enhanced proliferation of meristem followed by rooting. v. Development and standardization of technology for production of easy to handle ELISA kits for detection of spike disease of sandal.
Duration: 3 years
Funded by : Department of Biotechnology, Government of India

Participation in Seminars, Symposia, and Workshops

Dr. P.K. Muraleedharan attended the Indo British Workshop on Biodiversity: Conservation and Evaluation at TBGRI, Trivandrum during February 15-17, 1994.

Dr. Jose Kallarackal attended the Montpellier Symposium held at the University of Montpellier, Montpellier, France during September 7-14, 1995 and presented a paper on *'Water use of selected forest trees in the tropics'* written jointly with C.K. Somen.

Dr. R. Gnanaharan attended the Rubber Wood Task Force Meeting held at Kottayam on October 20, 1995.

Dr. M. Balasundaran participated in the National Workshop on Molecular Biology of the Gene organized by the Centre for Plant Molecular Biology (CPMB), Osmania University, Hyderabad and sponsored by Department of Biotechnology Govt. of India during November 11-26, 1995. Also attended the International Symposium on Plant Molecular Biology at CPMB, Osmania University during November 28-30, 1995.

Dr. N. Sasidharan attended Workshop on *'Teaching about Plants'* held at Trivandrum on November 17, 1995.

Dr. U.N. Chandrashekara participated in the Fifth Swadeshi Science Congress held at Kozhikode during 3-5 November 1995 and presented a paper on *'Mulayude Adivilayayi Bhukaanda Sasyangal'* written by U.M. Chandrashekara and P.K. Shajahan.

Dr. Jose Kallarackal participated in the Annual Project Review Workshop of the Ministry of Environment and Forests held at the University of Osmania, Hyderabad during November 21-24, 1995 and presented the details of the project on eucalypts.

Dr. N. Sasidharan participated in the Workshop on *'Package Programme on Botanical Research and Herbarium Management Systems (BRAHMS)'* held at IFGTB, Coimbatore during December 4-8, 1995.

Dr. U.M. Chandrashekara attended the Second Congress on Traditional Sciences and Technologies of India held at Anna University, Madras during December 27-31 1995 and presented a paper titled *'Indigenous ecological knowledge about cultivation, management and use of bamboos in Kerala'* by U.M. Chandrashekara and P.K. Shajahan.

Mrs. E.P. Indira attended the *'Seminar on Crop Breeding in Kerala'* organized by Department of Botany, University of Kerala on January 25, 1996.

Dr. E.M. Muralidharan, Dr. M. Balagopalan, and Mr. K.V. Mohammed Kunhi attended the 8th Kerala Science Congress held at Cochin during January 27-29, 1996. Dr. Balagopalan presented a paper entitled *'Cluster analysis of soil properties as influenced by elevation'* written by P. Rugmini and M. Balagopalan.

Dr. Jose Kallarackal attended the National Seminar on Drought Management in Plantation Crops held at Kottayam, Kerala during February 7-8, 1996 and presented a paper on *'Atmospheric drought and its physiological effects on oil palm plantations in peninsular India'* written by Jose Kallarackal and P. Jeyakumar.

Training

International

Dr. N. Sasidharan attended the International Diploma Course on Herbarium Techniques at Royal Botanic Gardens, Kew, U.K. during June 2 to July 30, 1995.

National

Dr. E.M. Muralidharan attended a short-term training course on 'Enzyme Purification, Yeast Genetic Transformation and Application of Molecular Markers' organized by the DBT, MS. Swaminathan Research Foundation and the SPIC Research Foundation at Madras during November 27 to December 11, 1995.

Guest lectures

Dr. R. Gnanaharan gave guest lectures to the participants of Refresher Course at SFS College, Coimbatore on September 20, 1995, January 16 and February 15,1996.

Mr. K.C. Chacko delivered a guest lecture on *"Improved plantation and nursery techniques including seed collection and storage in forestry"* on September 21, 1995 for a batch of State Forest Service officers who were attending the XII Refresher Course at the State Forest Service College, Coimbatore.

Resource persons

Dr. R. Gnanaharan was a Resource Person at the Technology clinic on Rubber wood Processing organized by the Science and Technology Enterpreneurship Development Project, Calicut at Kottayam on 7th December and at Thiruvalla on 8th December 1995. He took classes on *'Quality control and standards of processed rubber wood.'*

Dr. K.V. Bhat, Dr. C. Mohanan and Dr. K.M. Bhat were Resource Persons of the Refresher Course on Wood Science and Technology at the Bharathidasan University, Thiruchirappally, Tamil Nadu. Dr. K.V. Bhat took classes on *'Monocot woods their structure, properties and utilization'* on 30th and 31st January 1996. Dr. C. Mohanan took classes on *'Biodegradation of wood and seasoning of timber'* on 6th and 7th January 1996. Dr. K.M. Bhat took classes on *'Application of wood anatomy in forensic science and silvicultural and genetic improvement of wood quality'* on January 13, 1996.

Consultancy

Dr. K.M. Bhat was on deputation to the British ODA, New Delhi during December 1995 to February 1996 to carry out a consultancy work.

Dr. R. Gnanaharan was on deputation to M/s. Forest Industries (Travancore) Limited, Aluva, Kerala during January 1996 to carry out a consultancy work.

Campus News

Dr. K. Jayaraman took up an assignment at the Ontario Forest Research Institute, Sault Ste. Marie, Ontario, Canada during July to December 1995. He has worked on the following topics: i. Regression with autocorrelated errors: Applications in stem profile models, ii. Calibration of height diameter relation for natural maple stands of Ontario through random parameters models.

Dr. M. Balsundaran visited FAO Regional Office, Bangkok, Thailand during October 1-20, 1995 on invitation from FORSPA, for preparing a consolidated report of FORSPA-funded research projects on Biofertilizers.

Trainning Imparted

Mr. Mohan Babu Gurung, Forest Range Officer from Nepal has successfully completed a 4-months training in Agroforestry (November 8, 1995 - February 2, 1996) at KFRI under the Third Country Training Programme of British ODA.

IUFRO Office holders

The following scientists were elected as IUFRO Office holders of different Research Groups (RG) and Working Parties (WP) for 1996-2000.

Dr. K.S.S. Nair - Deputy Coordinator, RG. 7.03.00
Dr.K.M. Bhat - Deputy Coordinator, RG. 5.06.00; RG 5.08.00
Dr. J.K. Sharma, Coordinator, WP. 7.02.07
Dr. K. Balasubramanian, Deputy Coordinator, WP. 1.07.17
Dr. K.K.N. Nair, Deputy Coordinator, WP. 1.17.02
Dr. V.V. Sudheendrakumar, Deputy Coordinator, WP. 7.03.09
Dr. C. Mohanan, Deputy Coordinator, WP. 7.02.03

KFRI Seminars

Dr. George Peterken, Conservation Consultant, Forestry Commission, U.K. gave a talk on *Woodland Conservation* on February 27, 1996. Dr. Brian, N.K. Davis Associate Editor, Biological Conservation, U.K. gave a talk on *An introduction to Monkswood Research Station* on February 27, 1996. Dr. J.J. Shah, Emerites Professor, M.S. University, Baroda gave a talk on *Heartwood formation in forest trees* on November 9, 1995.

Distinguished Visitors

Dr. N.K. Joshi, Director General, ICFRE. Dr. George Peterken, Conservation Consultant, Forestry Commission, U.K. Dr. Brian, N.K. Davis, Associate Editor, Biological Conservation, U.K. Dr. J.J. Shah, Emerites Professor, M.S. University, Baroda. Dr. J.M. Waller, Head, Crop Proteciton, IMI, U.K. Dr. Harry Evans, International Institute of Biological Control, U.K. Dr. Brian Critchley, Entomologist, NRI, U.K. Dr. Lene Lange, Senior Research Scientist, Novo Nordisk, Denmark. Dr. John Fryer, Forestry Research Co-ordinator, ACIAR, Australia. Dr. A.M.O'Connel, Senior Principal Research Scientist, CSIRO, Australia.

Training Programme Organized

A three day Training in cane furniture and handicrafts manufacturing for rural artisans was organized by KFRI in collaboration with District Industries Centre, Pathanamthitta at Kozhencherry during October 16-18, 1995. About 25 rural artisans including women participated in the training programme. The programme covered various aspects of rattan silviculture, taxonomy and post- harvest processing and preservation techniques. Drs. K.M. Bhat, C. Renuka, R.C. Pandalai, C. Mohanan and Mr. T.K. Dhamodaran were the resource persons involved in the programme.

Managing Director, District Industries Centre, Pathanamthitta, inaugurating the programme

Promotion of bamboo cultivation on kole bunds

Kole lands (coastal low lands) of Trichur and Palakkad Districts are well known as rice granary of Kerala. Here the crop is cultivated in the vast area of paddy fields after pumping out excess water into canals. Traditionally canal bunds were temporarily being constructed using bamboo and mud. But recently most of the bunds were replaced with permanent bunds with the financial assistance of the State Government and NABARD. But these bunds are prone to soil erosion during flood period. Thus stabilization of kole bunds and prevention of soil erosion are of immediate requirements. Cultivation of bamboo on bunds not only prevent soil erosion but also provide culms needed by the local people. During the rapid rural appraisal by the scientists of KFRI involved in the Integrated Rural Bamboo Project, President and some members of the Jubilee Kole Society, Cherpu, Thrissur have shown interest to grow bamboo on kole bunds. The farmers prefer to grow bamboo which are having thornless branches.

With this background, KFRI has decided to involve, as part of the research project on Integrated Rural Bamboo, with the Jubilee Kole Society to raise bamboo on an experimental basis on the kole bund at Chenam, Thrissur. A meeting was held at Chenam on 20th December 1995. Sri. Rajeev Sadanandan, IAS, Collector of Thrissur District has inaugurated the programme and Dr. K.S.S. Nair, Director, KFRI presided over the function.

About 425 seedlings and culm cuttings of bamboo and reed bamboo supplied by KFRI were planted by the Jubilee Kole Society on kole bunds of about 5 km length. It is expected that this programme generates interest among farmers of other Kole Societies to grow bamboo and other plants on bunds both for the stabilization of bunds as well as earning extra income.

Planting bamboo on kole bund

Forthcoming Events

20-23 August 1996: International Workshop on Hypsipyla Shoot-Borers in Meliaceae. Kandy, Sri Lanka. Contact: Ms. Manon Griffith, QDPI Forestry, PO Box 631, Indooroopilly, Qld 4068 Australia; Fax 61-7-3896 9628; Email griffith@qfslab.ind.dpi.qld.gov.au

2-6 September 1996. World Heritage Tropical Forests Conference. Cairns, Australia, Contact: Conference Secretariat, PO Box 1280, Milton, Queensland 4064, Australia; Fax 61-7-3369 1512; Emailwhtf96@sunray.im.com.au

8-13 September 1996. International Conference on Integrating Conservation of Biological Diversity with Social and Economic Goals. Victoria, Contact: Connections Victoria Ltd.,P.O. Box 40046, Victoria, BC V8W 3N3, Canada; Fax 1-604-382 2076.

23-27 September 1996. Effects of Environmental Factors on Tree and Stand Growth. Dresden, Germany, IUFRO S4.01-00. Contact: Prof.Dr. Gunter Wenk, Institut fur Waldwachstum und Forstliche Informatik, Postfach 10, D-01735 Tharandt, Germany.

24-27 September 1996. 3rd International Plywood and Tropical Timber Congress. Belem, Brazil. Contact: Ivan Tomaselli, SPCP Engenharia de Projectos Ltda, Rua Sao Pedro, 489-Cabral, 80035-020, Curitiba, Brazil; Fax 55-41-252 5871.

6-12 October 1996. Nursery and Establishment Opeations for Difficult Sties. Solan, IUFRO S3.02.00, S3 02-03, Se.02-01 Contact: Dr. Parvinder Kaushai, Region Centre, NAEB, Dr. Y.S. Parmar University of Horticulture and Forestry, Nauni 173 230, Solan (HP), India, Fax 91-1792-62242.

20-22 October 1996. Workshop on Seed-borne Pathogens of Tree Seeds. Prague, Czech Republic. Contact: Dr. Jack Sutherland, Pacific Forestry Centre, 506 W Burnside, Victoria BC V8S 2Z1, Canada, Fax:1-604-363 0775; Email jsutherland@al.pfc.forestry.ca.

27-October- 2 November 1996. Tree Improvement for Sustainable Tropical Forestry. Caloundra, Australia. Post-Conference tour in North queensland 3-7 November. Contact: QFRI-IUFRO Conference, Queensland Forest Research Institute, M5 483, Gympie, Qld 4570, Australia, Fax 61-74-828 755; Email stevew@qfri.fh.dpi.qld.gov.au

4-6 November 1996. International Symposium on Forests and Environment. Nanjing, Contact: Mr.L. Rongsheng Secretariat, ISFE, Nanjing Forestry University, Nanjing 210037, P.R. China; Fax 86-25-541 2500.

12-17- May 1997. Forestry in a Changing Political Environment: Challenges for the 21st Century. Victoria Falls. Zimbabwe, Contact: The Secretary General, the 15th Commonwealth Forestry Conference, Forestry Commission, PO Box HG 139, Highlands, Harare, Zimbabwe; Ph 263-14-49 8430; Fax 263-14-49 7066.

M.Sc. in Tropical Forestry

The Wageningen Agricultural University (WAU) in the Netherlands is offering a 17 months M.Sc. course in Tropical Forestry, starting every year in September. Core of the program: the M.Sc.-thesis research. Two specialization: **Social Forestry** and **Silviculture and Forest Ecology**. Applicants need to have a B.Sc. in Forestry (or equivalent), fluency in English, and preferably working experience. Applications for the 1997-1998 course: before November 15, 1996.

For more information contact:
Department of Forestry,
M.Sc. Course Director Frits J. Staudt
P.O. Box 342, 6700 AH Wageningen,
The Netherlands
Fax: (31) 317 483542

Educational Video (VHS)

The Teak Defoliator

A 20 minute scientific documentary produced by the Kerala Forest Research Institute on the teak defoliator, *Hyblaea puera* (Lepidoptera), the most dangerous forest plantation pest of the Asian tropics.

Depicts the biology and the spectacular drama of the pest population outbreaks and defoliation which no words can fully describe.

Summarises our present knowledge on outbreak causation and suggests management methods.

Priced at US$ 50 per copy. Add US$ 30 for packing and postage. Special rate of Rs. 600 for bonafide users within India.

Bamboo - A Crop

A 22 minute documentary video on Bamboo - A Crop (English) - മുളയും വിളയാണ് (Malayalam) produced by KFRI to use it as a communication medium to promote cultivation and management of bamboo as one of the crops in rural Kerala.

Depicts the traditional knowledge of bamboo clump management for obtaining sustainable yield, on-farm experiments on undercropping of bamboo, cultivation in low rainfall dry agroclimatic zone and on kole bunds, scientific methods of propogation, supply and demand of bamboo, and economics of bamboo cultivation.

Priced at Rs. 500 per copy.

Available from : The Librarian,
Kerala Forest Research Institute,
Peechi - 680 653, Trichur, Kerala, INDIA

Please make the drafts payable to Director, Kerala Forest Research Institute, Peechi.