ISSN 0254-6426

evergreen

newsletter

No. 39 September 1997

Contents

kerala forest research institute

Peechi, Trichur - 680 653, Kerala, India

evergreen

newsletter of
kerala forest research institute

Peechi, Trichur 680 653
Kerala State, India.

ISSN 0254-6426
No. 39 September 1997

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Silent Valley and the Cicadas

The chirping of cicadas, the shrill whistling of birds, humming of monkeys and trumpets of elephants are the sounds that add to the solitude of tropical forests. But can such forests remain noiseless ? The answer used to be in the affirmative at least in the case of the famous forests of Silent Valley.

Silent Valley has been acclaimed for its lush wet evergreen forests. Many a person who happened to be at Silent Valley seemed to have been impressed not only by the thick forests but also by the deep spell of silence that adds to the ambience of these forests. Many persons have attributed this silence to the absence of cicadas which usually make the forests 'noisy'.

But is the Silent Valley devoid of cicadas? We made a survey in various habitats in the Silent Valley and we could locate the cicadas - not just one species, but at least four species in fairly moderate numbers.

Cicadas belong to the insect order Homoptera under the family Cicadidae. Members of this family are sap sucking in habits and are characterised by the presence of sound producing organs (tymbals) consisting of two flaps of the metasternum on the ventral side of the thorax. The shape and size of these flaps may vary. These organs are present only in the males and hence only the male members are able to produce sound. This has given rise to a common saying happy the cicadas' lives, for having voiceless wives.

The sound produced by the cicadas has been compared to a knife grinder, scissor-grinder and even a railway whistle. In the temperate forest tracts of the Himalayas, the noise produced by the cicadas has been reported to be deafening and extremely monotonous.

Fauna

About one thousand species of cicadas have been described from various parts of the world, of which most are from tropical forests. In temperate countries it is a rare insect. For instance in Britain there is only one species of cicada. In India around 150 species of cicadas are known to occur of which 25 species are from Southern India.

The four species recorded from Silent Valley have been identified as *Platypleura polita* Walk., *Platylomia amicta* Dist., *Platylomia* sp. and *Gaeana atkinsoni* Dist. Of these the last one is the most colourful species. Its head, pronotum and mesonotum are black. Abdomen above and beneath is ochraceous. The fore wings are bright carmine-red and have a leathery appearance. Hind wings are bright red with a black spot.

The other two species are dull grey coloured. In *Platypleura polita*, the head, pronotum and mesonotum are brownish ochraceous. Some spots are present on the front of head and there is a black, broken transverse fascia between eyes. The abdomen is black; the sternum, legs and opercula are ochraceous. Tegmina and wings are hyaline. *Platylomia amicta* is brownish ochraceous; head with striae and pronotum with two central longitudinal lines. Body beneath and legs brownish ochraceous; tegmina and wings are hyaline, with the venation fuscous.

Life history

Very little is known about the biology of cicadas. The females are provided with a

strongly developed ovipositor, by which they pierce the branches of trees for depositing their eggs. The nymphs that hatch out from the eggs are subterranean in habits and are provided with highly modified fossorial front legs with which they penetrate into the soil. It is reported that the nymphs require 13 to 17 years for attaining maturity.

Natural enemies

The cicadas are apparently defenceless creatures and are victims to many enemies. Among their main persecutors, mention must be made of species of preying mantis, dragon-flies, hornets, wasps, robber flies, spiders and many birds. Their worst enemy however appears to be *Calotes versicolor*, a lizard, which takes a heavy toll of the cicadas.

Fig.1. Platylomia amicta

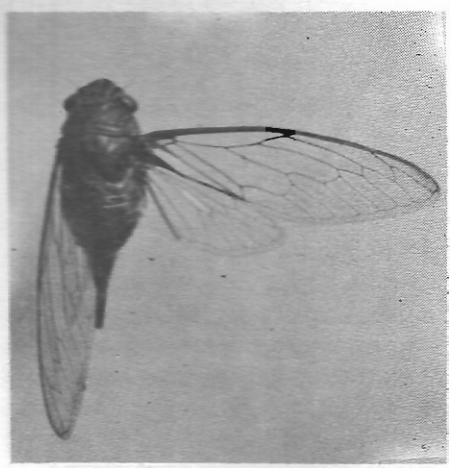

Fig.2. Platylomia sp.

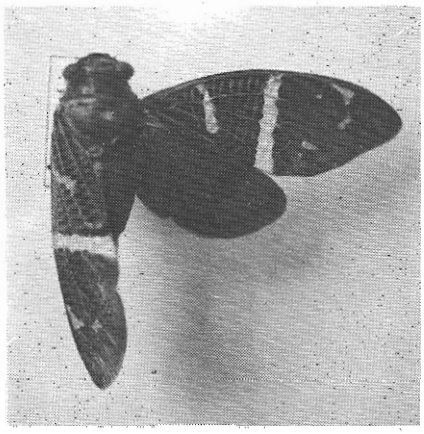

Fig.3. Gaeana atkinsoni

Other sound producing insects

The cicadas are not the only insects that produce sound. Grass hoppers, crickets, beetles and bugs are all reported to produce sound of different kinds and intensities. Production of sound is supposed to be for attracting the opposite sex and in some instances for expressing sexual rivalry between males, for indicating danger and so on.

How the insects produce sound

The methods of sound production may be by any of the following:

- By tapping some part of the body against an external object. The best example of this type of sound production is the death-watch beetle, *Xestobium rufovillosum*, where the insect tap the head against the walls of the burrow. Some Psocoptera and male Plecoptera are also reported to make sound in this way. The pupae of some Hesperiidae and Lycaenidae produce a defensive sound by knocking the body against the substrate.

- By friction of one part of the body against another part. By far the greater number and variety of the sounds emitted by insects are produced by this method in which specialised parts called stridulating organs are involved in sound production. Stridulating organs are present in several groups of insects like grass hoppers, beetles and bugs. In the acridid grass hoppers sound is produced by a row of pegs on the inner side of each hind femur being worked against the outer surface of each tegmen. In the Hymenoptera stridulating organs are common among certain ants in which these organs are located at the base of the first gastric segment where the preceding segment overlaps.

  Certain species of Lepidoptera are also known to be capable of stridulation. They usually produce a hissing or rustling sound e.g. males of *Cidaria dotata* and females of *Parnassius mnemosyne*.

- By the vibration of the wings many insects make a humming or buzzing sound during flight. Mention must be made of many dipterans for this kind of sound production.

- By the vibration of a special membrane excited by muscular action. Sound producing organs of this type are characteristic of the insect order Homoptera (eg. Cicadidae) and is one of the most complex kinds of sound producing organs known.

- Vibrations of uncertain origin. In certain insects, particularly Diptera, sounds are produced in a manner different from those already referred to. The actual method of sound production in these cases has given rise to much discussion, and the evidence that is available is of a conflicting nature. In some species of Syrphidae (Diptera), a high pitched singing note is emitted both when hovering and when at rest. It is reported that the sound is produced by the vibration of a series of lamellae or a tongue like fold, projecting into the trachea by the forcible passage of air through the spiracles. The sound produced by the flapping of wingbases against the minute sclerites closely associated with them has also been reported.

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Entomology Division

Mahogany

Timber from trees belonging to the genera, *Swietenia* L., *Khaya* Juss and *Entandrophragma* C. Dc. in the family Meliaceae, is traded as mahogany. *Swietenia* is called true or Spanish mahogany, while species belonging to Dipterocapraceae are often traded as Philippine mahogany. *Swietenia* comprises three species, *S. mahagoni* L. Jac., *S. macrophylla* King and *S. humilis* Zacc. Mahogany, presumably, *S. mahagoni* and *S. macrophylla* was well known in Europe, during 18th and 19th centuries and the species were probably, distinguished by the place of origin. *S. mahagoni* was used for ships built by the Spanish at Havana in the 18th century. As early as 1597, Walter Raleigh repaired his ships in the West Indies with this timber. *S. macrophylla* became popular for furniture in Europe in the 18th century. This was at time when supplies of Walnut were declining in Europe. By the middle of the 19th century, supplies from accessible sources in Central America were declining. and mahogany was sought in West Africa.

Swietenia mahagoni is native to Southern Florida (USA) and the Greater Antilles, although it was subsequently introduced throughout the Caribbean. It does not naturally occur sympatrically with either of the other two species. *S. humilis* is distributed along the Pacific coast in the dry forest typical of that region and *S. macrophylla* is the most widespread species occupying principally the Atlantic reigons of south eastern Mexico and Central America and South America. Recently, *S. macrophylla*, the big-leaved mahogany, is at the centre of worldwide attention. Conflicting reports suggest that the species is either on the verge of extinction or that it is being sustianably grown and harvested. The reason for this global interest on *S. macrophylla* is that its wood is in great demand especially for domestic artefacts. However, the continued presence of this species as a component of the tropical forests of Central and South America is quite uncertain. Debate over the listing of mahogany in Appendix II of the Convention on International Trade in Endangered Species (CITES) and a number of high-profile environmental campaigns have led to increasing concern over consideration of the species in its natural habitat.

Mahogany trees are emergents, attaining height up to 50 m and diameter up to 2 m. The crowns of the largest trees are up to 20 m in radius. But this formation begins at a size of 10 to 12 cm dbh, and its height increases with tree size above this point reaching up to 3 m on the largest trees. Heavy buttresses provide strong support, and reduced branching and sparse foliage of the crowns, increases wind resistance and consequently helps to survive hurricanes with less damage than the other species.

Mahogany trees are monoecious. The flowers are pollinated by insects. The fruits are woody capsules and take 10 to 11 months to mature. As the capsule dry, the valves drop off, leaving the seeds exposed but still attached to the columella. They are released when a strong wind breaks the columella. Strong wind may also knock mature capsule off the tree before they have shattered and dispersed their seeds. Mahogany is considered to be a light demanding climax species. Seedlings and saplings are shade intolerant, exhibiting fastest growth with overhead light and lateral shading, but can survive in a suppressed state for years in partial shade. The trees allocate their photosynthates to growth until they reach about 80 cm dbh, at which stage, they increase allocation to reproduction. Unfortunately, this coincides with the minimum cutting diameter.

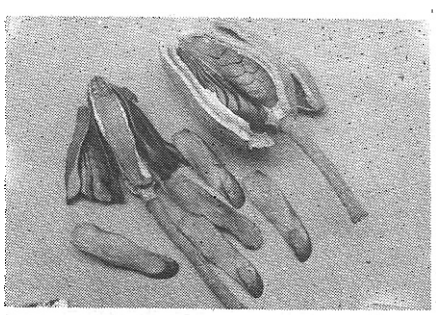

Fig.1. Seeds of S. macrophylla

If a mahogany grown at the maximum rate, throughout its life, it will take about 52 years to reach commercial size, while growing at the medium growth rate it will take more than one hundred years. The actual time to achieve commercial size should fall within this range. The growth rate of mahogany appears remarkably consistant across its range and an average growth rate of 3.6 to 9.1 mm per year has been reported. Mean annual increment (MAI) varies with the planting density. MAI for nearly pure plantations ranges from 10 to 30 m^3. per hectare per year.

Mahogany plantaitons have been established in over 40 countries around the world. The principal mahogany growing countries include Indonesia with ca. 116000 ha, Fiji (42000 ha), The Philippines (25000 ha), Sri Lanka (4500 ha), Guadeloupe (4200 ha), Solomon Islands (3100 ha), Western Samoa (2300 ha) and Martinique (1500 ha).

Cultivation of the true mahogany was first attempted in India in 1795, when plants from the West Indies were introduced into the Royal Botanic Gardens, Calcutta. It was propagated subsequently by layers, until from 1865 arrangements were made for consignment of seeds from West Indies, and the trees have since been planted with varying success in many parts of India. Seed lot labelled mahogany believed to be obtained from Honduras was first intorudced into In-

dia through the India office in 1872. The emerging seedlings were soon noticed to be different from those of the true mahogany, and when the trees flowered and fruited in their twelth year, the material available was examined by Dr. King, who described it as a new species, *Swietenia macrophylla* King. *S. macrophylla* grows more rapidly and thrives better than *S. mahagoni*. In Kerala, planting experiments with mahogany, both *S. macrophylla* and *S. mahagoni* were initiated in 1872 and have been continued in different localities subsequently. A plantation of both *S. macrophylla* and *S. mahagoni* was raised as early in 1893 at Edakode, Nilambur. *S. macrophylla* recorded comparatively good growth than *S. mahagoni*. Earlier planting of *S. mahagoni* under teak at Nilambur was a failure as the trees cannot tolerate much shade.

Fig.2. Containerised seedlings of S. macrophylla

The shoot borer, *Hypsipyla* sp. which attacks the leading shoot leaving the tree with a low fork or multiple leaders is the important limiting factor for raising successful plantations. Though teak is the much preferred timber species, in recent years, many small holders have shown interest to plant mahogany on marginal land. There is a high demand for the planting stock of this exotic species and KFRI Subcentre at Nilambur supplies the containerised seedlings and encourages the planters by extending necessary helps in raising this promising timber species.

C. Mohanan
KFRI Subcentre, Nilambur

Flowering and Seeding in Reed Bamboos

The genus *Ochlandra* generally known as reed bamboo, encompasses nine species and one variety of which, eight species and one variety are endemic to the Western Ghats and one species (*O. stridula*) endemic to Sri Lanka. Among these, five species -*Ochlandra beddomei, O. ebracteata, O. setigera, O sivagiriana* and *O. talbolti* occurring in the Western Ghats are considered rare and endangered. Due to the unique nature of flowering and seeding in reed bamboos, seeds are not available regularly which limits the production of planting stock. Information on flowering and seeding of reed bamboos is scanty except for *O. travancorica*, the widely distributed and commercillay exploited reed bamboo.

Of the nine species of reed bamboos mentioned above, seeding was observed for all except *O. sivagiriana*. Fruits of *Ochlandra* belongs to the bacca type where pericarp is fleshy and has a characteristic long beak which comes to about the same length of fruit. *O. travancorica* var. *hirsuta* has the largest fruit(31 to 41 fruits/kg), while *O. scriptoria* has the smallest (625 to 640 fruits/kg). Fruits of reed bamboos show high moisture content (60 to 70%) at the time of collection which reduce rapidly to below 30 per cent. The seed longevity varies from one to four months depending on the species; seeds of *O. travancorica* var. *hirsuta* exhibit shortest viability (1 month) followed by *O. travancorica* (1.5 months), *O. scriptoria* (2 months) and *O. ebracteata* (4 months). The seeds of reed bamboos are recalcitrant and hence common storage methods are not effective. To raise the planting stock seeds are sown immediately after the collection on seedbeds provided with coir mesh shade. The seeds of *O. ebracteata* and *O. travancorica* var. *hirsuta* usually give high percent germination (90 to 95) while that of *O. travancorica* give low percent (50). As the seedlings reach a height of 60 to 75 cm the shade over the seedbeds can be removed. One-year-old seedlings can be utilised for planting. The planting stock can also be multiplied by macro-proliferation. In this method the top portion of the seedlings is cut and the rhizome is split into small bits based on the number of tillers. Each rhizome bit with a part of the tiller is containerized and maintained in the nursery for one year. The macro-proliferation process can be repeated further to provide a steady supply of planting stock.

K.K. Seethalakshmi
Division of Plant Physiology

Flowering of various species of *Ochlandra* in the Western Ghats

Species	Years of previous flowering	Years of recent flowering	Localities
O. beddomei	1875 1876	1986 1988 1992	Wayanad, KFRI Campus
O. ebracteata	1961 1963	1987 1988 1992	Achenkoil,Edapalayam
O. scriptoria	Annual	1988 1989	KFRI campus
		1992 1995	Pervannamuzhy ,Vazhachal
O. setigera	Nil	1988 1994	Nilambur
O. sivagiriana	Nil	1993	Vazhachal
O. talbolti	1896	1994	Virajpet
O. travancorica	1868 1875	1988 1992	Vamanakulam
	1882 1905	1993 1996	Shangily,
	1976 1982		Pamba
O. travancorica var. hirsuta	Nil	1992 1993	Shangily
O. wightii	1835 1882	1992	Achenkoil

Rainfall Data for Nilambur

The total rainfall at Nilambur Subcentre during the year 1996 was 2353.6 mm and number of rainy days was 166. The South West Monsoon contributed to 1547 mm and North East Monsoon to about 603 mm. Summer showers were rare and months of January and February did not receive any rain. On 28th March, the first summer shower of 32 mm was obtained followed by 92 mm in April and 79 mm in May which contributed to a total of 203 mm. From 1st June onwards, the monsoon began and June had the maximum rianfall of 544 mm (15 rainy days) followed by 470 mm and 291 mm in the month of July (21 rainy days) and August (21 rainy days) respectively. The month of September received 240 mm with 13 rainy days and 473 mm in October (20 rainy days). November and December received comparatively less rainfall of 30 mm (6 rainy days) and 99 mm (7 rainy days) respectively. Rainfall data collected from the KFRI Subcentre campus from 1976 onwards are given in Table 1. The 21 years rainfall data show that the area received more than 2000 mm of rainfall in most of the years. Maximum rainfall was received in the year 1980 (3313 mm) while minimum rainfall (1385 mm) was in 1982.

C. Mohanan
KFRI Subcentre, Nilambur

Table 1. Rainfall data for the years 1976-1996

Year	Rainfall (mm)												Total (mm)
	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sep.	Oct.	Nov.	Dec.	
1976	0.0	0.0	3.0	77.0	20.0	214.9	748.4	529.0	121.4	123.2	212.1	61.2	2115.2
1977	0.0	0.0	0.0	44.5	295.2	541.0	568.7	179.9	222.8	476.5	279.7	0.0	2608.3
1978	0.0	0.0	0.0	24.0	102.4	635.0	821.0	723.8	54.1	151.0	243.2	8.0	2762.5
1979	0.0	0.0	0.0	3.5	180.0	317.6	694.7	637.5	106.7	144.7	193.2	80.0	2391.0
1980	0.0	0.0	0.0	59.1	82.7	1146.1	1093.8	434.5	159.0	210.0	128.0	1.0	3313.2
1981	0.0	0.0	0.0	45.0	108.0	711.0	639.0	851.0	354.5	218.5	64.7	9.0	3002.2
1982	0.0	0.0	0.0	4.0	52.7	339.1	527.1	284.4	58.9	15.7	104.8	0.0	1385.8
1983	0.0	0.0	0.0	0.0	58.6	975.8	593.8	603.7	357.9	162.6	39.4	67.0	2808.8
1984	13.8	15.8	26.8	31.6	69.4	1008.4	657.8	230.4	127.6	412.2	26.6	25.8	2648.2
1985	19.0	8.0	9.6	50.0	45.0	761.8	453.4	297.9	115.0	114.8	108.6	4.6	1980.5
1986	33.6	0.0	19.2	84.6	63.6	526.6	254.8	408.8	367.1	160.6	209.8	53.0	2151.7
1987	0.0	0.0	6.0	3.0	131.8	279.1	202.0	185.8	190.0	299.3	152.6	67.8	1512.0
1988	0.0	18.0	37.2	126.4	80.8	503.8	707.2	421.4	285.0	53.4	26.7	31.4	2291.3
1989	0.0	0.0	0.6	66.2	67.4	500.2	480.0	245.8	249.4	79.6	128.9	0.0	1818.1
1990	10.8	0.0	0.0	2.8	278.2	559.4	465.8	387.0	43.8	355.2	81.8	0.0	2184.8
1991	1.6	0.0	0.0	45.2	33.3	866.9	1038.8	259.4	44.4	197.6	113.2	0.0	2598.4
1992	0.0	0.0	0.0	54.8	147.4	690.2	782.0	496.8	251.4	199.4	155.8	0.0	2777.8
1993	0.0	18.4	0.0	13.6	61.6	427.0	603.5	329.2	44.6	364.6	77.4	9.4	1949.3
1994	40.2	0.0	21.8	97.6	144.6	734.4	1244.0	349.3	110.8	392.8	136.9	1.2	3271.6
1995	0.0	15.0	0.0	72.6	151.5	380.2	591.1	221.2	193.7	164.8	183.7	0.0	1973.8
1996	0.0	0.0	32.0	92.0	78.8	544.6	470.8	291.0	240.7	473.4	30.8	99.5	2353.6

Recent Publications

Research Papers

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Research Reports

KFRI Research Report 114

Studies on growth and prevention of sapstain fungus *Botryodiplodia theobromae* in rubber wood and its effect on strength properties. Investigators: Smt. E.J. Maria Florence, Dr. R. Gnanaharan, and Dr. J.K. Sharma, December, 1996.

Abstract

Microorganisms cause various types of damages to timber such as decay, soft rot, mould, stain and bacterial degradation. Of these, moulds and stains are common on rubber wood. The predominant fungus causing sapstain in rubber wood is *Botryodiplodia theobromae*. Due to the environmental conditions favourable to fungal growth, sapstain is a serious problem to the utilization of rubber wood in Kerala. A detailed study on the factors affecting the growth and colonization of *B. theobromae* was carried out. The study revealed that no growth of *B. theobromae* occurred at and below 23.8 per cent moisture content of rubber wood. Moisture content of 29.0 per cent and above was most favourable for heavy growth of the fungus. Temperature tolerance of the *B. theobromae* was studied and it was found that 30 °C was the ideal temperature for the growth of the fungus on Potato Dextrose Agar medium. The results indicated that once *B. theobromae* was established in the wood, the mycelium was not killed on the surface as well as inside the wood at 50 °C even after 7 days of incubation. The weight loss of rubber wood due to the infection by *B. theobromae* was studied and it was found that the weight loss in the first month was 8.0 per cent which increased to 12.2 per cent at the end of fourth month. But in *Alstonia scholaris*, the weight loss accounted was 4.5 per cent at the end of fourth month. Density of stained rubber wood was determined and it was seen that there was a reduction in the density at the end of fourth month. No reduction in the compressive strength of stained wood was noted whereas the bending strength was reduced when compared to unstained wood. In the field evaluation of different chemicals/fungicides for the control of sapstain and decay, Captafol even at 3 per cent did not prevent mould and sapstain completely on rubber wood. When open and close stacking were compared, better control was achieved by open stacking. Busan 1009 in combination with boric acid was effective in controlling fungal growth. Hylite extra and chlorothalonil were found to be equally good in controlling sapstain. Chlorothalonil at 1 per cent was found to be effective in controlling sapstain. During rainy season, the concentration of the fungicide has to be increased for better control of fungal growth.

KFRI Research Report 119

Micropropagation of teak, rosewood and sandal .Investigator: Dr. E.M. Muralidharan, March 1997.

Abstract

Micropropagation of three important tree species, teak, rosewood and sandal was attempted. In teak shoot tip and axillary bud collected from seedlings and from mature trees were used to initiate shoot cultures. High levels of contamination presumably from endogenous bacteria and fungi, was observed in tissues collected from mature trees during the period from May to November. This is attributed to the high humidity during these months. The best period for collection of buds was January to April. Exudation of phenolic compounds and browning of media was also high in tissues of mature trees.

In teak, sprouting of shoot tip and axillary bud was better in seedling, than in mature trees. Shoots obtained from mature trees were however thicker and with larger leaves. The effect of cytokinins on shoot multiplication was tested in mature tree cultures and higher levels of benzyl aminopurine and kinetin were found to favour shoot multiplication whereas at lower levels shoot elongated. Excised shoots could also be rooted by transfer to a medium containing 1 mg/l of indole butyric acid for 42 hrs., followed by transfer to a hormone free liquid medium. Plantlets of teak were transferred to a mixture of soil and vermiculite (1:1) and hardened in a green house under intermittent mist; 60 % survival was obtained when plants were shifted to soil after 10 weeks.

In rosewood axillary bud explants taken from mature trees of *D. latifolia* and *D. sissoides* gave high rates of contamination when collected during the period from June to November. Axillary buds sprouted to form shoots but failed to elongate. No multiple shoot formation was obtained on cytokinin containing media.

Leaf explants cultured on media containing auxins and cytokinins gave rise to profuse callusing. Callus could be maintained by subculture, but no morphogenesis was obtained on a wide range of media.

Shoot tips, nodes and internodes of mature sandal trees were cultured for induction of multiple shoot and callus. High rates of contamination was obtained as in teak and rosewood, but was mostly caused by bacteria. Axillary buds sprouted to form shoots and few multiple shoots but failed to elongate further. No plantlets could be regenerated.

Internode and leaves were cultured on auxin containing medium to induce callus. Callus formation occurred on cut edges of tissues but was slow growing. Callus could not be maintained for longer periods and did not show morphogenesis.

KFRI Research Report 121

Private sector involvement in forestry research in India. Investigators: Dr.K.S.S. Nair, Mr. Mammen Chundamannil, Mr. K.C. Chacko, Dr. P.M. Ganapathy, Dr. S. Chidambara Iyer, November 1996

Abstract

Forestry Research in India was started with the establishment of the Forest Research Institute, Dehra, Dun in 1906. Since mid 70s, several Forest Research Institutes were established both within the public sector and the private sector. The area of research and specialisations have diversified. Some institutions have attracted substantial donor assistance from international sources while some others function as in-house units of forest products companies. Detailed case studies were carried out in six private sector forestry research organisations. The WIMCO Seedlings, Uttar Pradesh, ITC Bhadrachalam Paper Boards Ltd., Andhra Pradesh, Western Indian Plywoods Ltd., Kerala, BAIF Development Research Foundation, Maharashtra, Tata Energy Research Institute, Delhi and Indian Plywood Industries Research and Training Institute, Karnataka (in the private sector up to 1990).

The impact of private sector in forestry research in India is not significant in quantitative terms. If quality of output is considered, the contributions of a few are outstanding although that of many is of little significance. The former has not only produced results, but also transferred them to the field, farm or products and demonstrated the feasibility and value of the same. Problems addressed by them are not terminated with R&D. Equal emphasis is given to extension and application. Nevertheless, only a narrow spectrum of forestry research needs are addressed by the private sector.

Among the success factors in private sector organisations, the leadership qualities of the chief functionaries and a mission oriented dedicated approach have created a culture and climate which drive the organisations to excellence. The absence of a bureaucratic approach enable personnel to take total responsibility and enjoy freedom of action. Among the inadequacies of private sector organisations, the lack of a long term mission, except in in-house units, lack of co-ordination among private sector institutions and dependence on public sector organisations and Universities for basic research is evident.

There should be a networking of institutions doing research in forestry and their interaction should be encouraged. Collaborative research involving Universities, government institutions and private institutions should also be encouraged. A best private documentation and dissemination scheme may also be set up by FORSPA to link forestry practices in the

region and take best advantage of applicable research results generated elsewhere.

KFRI Research Report 122

Management of the bark caterpillar *Indarbela quadrinotata* in forest plantations of *Paraserianthes falcataria*, Investigator: Dr.George Mathew, July 1997

Abstract

The bark caterpillar *Indarbela quadrinotata* is a polyphagus wood boring insect, attacking a variety of tree species in India. Although generally considered as a pest of minor importance in forestry, this insect is a serious pest in horticultural plantations of guava, apple, pomegranate, jujube, etc. in several parts of India.

I. quadrinotata is widely distributed in Kerala attacking a variety of tree species like *Peltophorum pterocarpum, Delonix regia, Terminalia catappa, Casuarina equisetifolia, Swietenia macrophylla, Macaranga peltata, Anacardium occidentale* and *Ceiba pentandra.*

Recently, large scale build up of this insect was noticed in some plantations of *Paraserianthes falcataria* in the southern Forest Circle, mainly at Punalur. Studies were made on the factors leading to the build up of this insect in plantations and its possible control.

Among the factors favouring establishment of this insect, availability of appropriate alternative host plants which will enable survival of a residual pest population was found to be important. Age of the plants was also found to have direct relation with borer attack as saplings were found to be more susceptible. At Punalur, the avenue trees of *P pterocarpum, S. macrophylla* and *D. regia* were found to be the major host plants of this insect.

In plantations, infestation generally starts with the onset of premonsoon rains in late May. The signs of infestation become apparent from July onwards when the sleeve-like structure made of frass and excreta extending from the borer holes are seen on the trunk of affected trees. The rate of feeding was found to be faster during the summer months. Larval stage lasts for about 8 months. Pupation occurs within the tunnel, with the cephalic end of the pupa slightly protruding from the tunnel mouth. In the field, pupation was noticed to commence from late February onwards. Pupal period lasts for about 9 days.

Control trials have indicated that plantations of *P. falcataria* can be protected from this insect by spot application of insecticides. Of the various insecticides screened against this insect, monocrotophos (0.1%), quinalphos (0.1%) and fenvalerate (0.08%) gave best results.

KFRI Research Report 123

Micropropagation of selected medicinal plants. Investigator : Dr. E.M. Muralidharan, March 1997.

Abstract

Micropropagation of selected important medicinal plants, *Alpinia calcarata, Kaempferia galanga, K. rotundanda* and *Malaxis rheedei*, was carried out successfully. Plantlet regeneration was achieved in all the species through enhanced axillary bud development and multiple shoot formation.

In *Kaempferia galanga, K. rotunda* and *Alpinia calcarata* the mode of regeneration was similar. On media containing a wide range of cytokinins, Benzylaminopurine (BAP) and Kinetin (Kin), multiple shoots were induced. Rooting also occurred on all the shoots in the multiplication medium. Liquid medium was found to be better than solid medium for multiplication and plantlet formation. Inexpensive polypropylene bags were used as culture containers for micropropagation. Natural light was found to be sufficient for illumination of cultures.

Plantlets of all three species were transferred to soil and more than 80% survival recorded. The micropropagated plants in all the three species showed morphological variations. The leaves of micropropagated plants had a higher length to breadth ratio than control plants in the first year. Although higher number of rhizome buds were produced in micropropagated plants than in controls the total biomass of rhizomes was reduced. Near-normal morphology was restored and the yield of rhizomes increased in the second generation plants, in both pot cultures as well as in the field.

In *M. rheedei*, explants containing axillary buds taken from pseudobulbs were cultured on media containing cytokinins. Sprouting of the buds occurred on a wide range of cytokinins. Multiple bud formation at high frequency was observed on media containing higher levels of cytokinins when the explants were longitudinally split. Highest multiplication was obtained on 2 μM BAP. Elongation of buds occurred on lower levels of cytokinins. Rooting of the shoots was obtained on 3 μM Naphthalene acetic acid (NAA).

KFRI Research Report 124

Flora of Kerala Forest Research Institute campuses at Peechi, Nilambur and Velupadam in Trichur and Malappuram Districts, Kerala State. Investigators: Dr. K.K.N. Nair, Dr. K. Yesodharan and Sri. K.K. Unni, August 1997.

Abstract

The three campuses of Kerala Forest Re-

search Institute at Peechi (Headquarters), Nilambur (Subcentre) and Velupadam (Field Research Station) cover an area of 118.96 hectares in Trichur (Thrissur) and Malappuram districts, Kerala State. Even though the three campuses are still dominated by the natural vegetation, there are also several plants introduced or grown for experimental and other purposes. In total, the flora of the three campuses is composed of 565 taxa of angiosperms (flowering plants) and 3 species of gymnosperms. Among the angiosperms, 404 species are dicotyledons and the remaining 161 species are monocotyledons.

The flora enumerates both natural and introduced plants growing in the three campuses, arranged according to the classification system of Bentham and Hooker (1862-83). For each of the natural elements of the flora, up to date nomenclature, diagnostic description, flowering and fruiting period, brief note on its occurrence in the campus(es) and local names, whether available, are given. For introduced or cultivated species appended towards the end of each of the families, up to date name and details of their distribution in the campus(es) are provided. Among the total 568 taxa enumerated in the Flora, about 150 species are trees, excluding several bamboos which are also arborescent in habit.

A campuswise analysis of the Flora had shown that in Peechi campus (28.17 ha) there are 438 taxa of flowering plants and 3 species of gynmnosperms. Out of the total 441 taxas 356 are natural elements and the remaining 65 taxa are introduced or cultivated. From Nilambur campus (43.36 ha) a total of 268 taxa were recorded of which 202 are natural elements of the flora whereas 66 species are introductions. At Velupadam (47.43 ha) the flora comprises of 202 species of which 157 taxa are natural elements and the remaining 45 taxa are either introduced, cultivated or grown as part of the bamboo germplasm bank. The KFRI campus at Peechi and Nilambur form part of the moist deciduous forests and Velupadam campus is a clear felled teak plantations area with profuse coppicing of *Tectona grandis* and the area is mostly converted into germplasm and experimental plots.

KFRI Research Report 125

Socio-economic and ecological aspects of developing bamboo resources in homesteads of Kerala, Part-I: Ecological and social aspects, Investigators: Dr. U.M. Chandrashekara, Dr. S. Sankar, Dr. R.Gnanaharan, July 1997

Abstract

Bamboo is an important component of the rural landscapes in Kerala. In spite of the great demand for bamboo and significant benefits to farmers and different social groups, the bamboo wealth of rural Kerala is declining drastically. In order to understand the reasons for negative attitude towards bamboo by farmers, and also assess the possibilities of promotion of bamboo cultivation, participatory rural appraisal (PRA) technique were employed. Though PRA exercises a wealth of traditional knowedge about bamboo cultivation and management was brought to light. At the same time, PRA provided an opportunity for some of the farmers to involve in small-scale bamboo cultivation in their homesteads whcih in turn helped scientists to understand socio-economic and ecological factors influencing in bamboo cultivation and management.

On-farm experiments indicated that the traditional practice of growing some rhizomatous crops as undercrop of bamboo is an acceptable one. Number of farmers who realised that something can be grown under bamboo is increased from 8% to 100%. Farmers prefer short duration plants as undercrops. This is because the crops can be harvested well before cutting bamboo branches for fencing and the loss of undercrops could be avoided. Selection of crops is determined by the socio-economic status of the farmers. Participant farmers also realised that more than the influence of bamboos, factors such as the level of management, quality of soil and planting material used and shade of other trees determine the crop yields.

A study on the thickness of fibre wall of bamboo branches, an indicator of branch maturity, revealed that the fibre wall thickness increased with age till branches are of 8-9 (February-March) months old and no change was observed later. Therefore, a common notion prevailing among the farmers in the low rainfall Dry agroclimatic zone and medium rainfall Humid agroclimatic zone of Kerala that branches are mature at 5-6 months old is incorrect. The study also disapprove the notion that farmers of the Humid and Dry zone are free only during December-January and those of the Kole zone during May-June. Majority of the farmers have free time in the month of March-April. Therefore, ideal time for fencing acitivity here is February-April. Advance the fencing activity to March-April in the Kole zone (coastal zone), also avoid the situation where the delay in thorn cutting damages new culms.

As on-farm expeirment conducted indicated that the traditional practice of detopping bamboo culms is acceptable and is of practical importance. No damage to the remaining part of the culm was recorded. Instead the length of the branches increased due to detopping and this may be due to the cessation of apical dominance.

Bamboo branches, though widely used for fencing homegardens and other lands, are increasingly expensive due to the high labour involved in cutting bamboo branches and making the fences. Therefore, a need for increasing the life of fence was felt by farmers. Considering this

need, an experiment was designed to study the effectiveness of chemical preservation technique using boric acid and copper sulphate solution. The activity did not provide conclusive results.

An attempt has been made to promote bamboo cultivation in a village in the low rainfall Dry agroclimatic zone of Kerala in order to determine vairous factors responsible for the success or failure of such attempt. The case studies demonstrated that the farmers of the village wanted bamboo mainly for thorny branches for fencing. During the first year after planting, 15% of the farmers managed the plants at a very good level and another 30% of the farmers at a moderate level, while in the second year, the number has increased to 30% and 43% respectively. Considering the usefulness and success of the programme farmers show readiness to involve themselves in the cultivation of bamboo at the community level. Farmers recognised PRA techniques adopted during the study as useful tools to prepare local landuse plans.

Case studies conducted to understand the relevance of traditional knowledge and practices about bamboo clump management indicated that most of them have scientific base. On the other hand, some of the traditional practices are not practical and do not possess scientific base but only were relevant for the past socio-economic conditions of the village ecosystems. The study recommends certain strategies for the promotion of cultivation and sustainable utilisation of bamboo in farming systems.

New Research Projects

KFRI/271/97 : Ecophysiology of host parasite relationship in teak

Investigators : Dr. Jose Kallarackal, Sri. C.K.Somen

Objectives : i. to understand water relations, transpiration and gas exchange characteristics of *Dendrophthoe falcata* in relation to its host, the teak tree ii. to examine the interaction of the water relations of the hemiparasite with the nitrogen and mineral nutrition of teak. iii. to study the ecophysiological factors that promote the growth of the parasite on teak.
Funding Source : Department of Science and Technology
Duration : 3 years

KFRI 273/97: Lichen (Macrolichen) flora of southern part of Western Ghats

Investigator : Dr. M.S. Muktesh Kumar

Objectives : i. Inventory of the macrolichens of the Western Ghats (ii) population structure, species composition, ecology and (iii) development of lichen herbarium and preparation of laboratory guide for lichen taxonomy.
Funding Source : ICFRE, Dehra Dun
Duration : 3 Years (April 1997 to March 2000)

KFRI 274/97: Conservation and genetic improvement of reed bamboos (Ochlandra spp.)

Investigator: Dr. K.K. Seethalakshmi

Objectives: i. To establish a live collection of all the species of *Ochlandra*, ii. To select phenotypically superior clump of *O. travancorica* and *O. scriptoria* from natural stands and multiply vegetatively, iii. Using molecular markers screen the different species to see whether it is feasible to use this technique to see the genetic variation within and between species.
Funding Source: ICFRE, Dehra Dun
Duration : 3 years.

KFRI 275/97: Biological control of damping-off in forest nurseries in Kerala

Investigator : Dr. C. Mohanan

Objectives : i. To conduct a disease survey in forest nurseries in the State and to isolate and identify various fungi associated with damping-off disease. ii. To select and evaluate the efficacy of microbial candidates against principal damping-off fungi. iii. To study the effect of soil solarization as a tool to control the disease, and to develop mass culture techniques for potential antagonistic microbes.

Funding Source : ICFRE, Dehra Dun
Duration : 3 years (June 1997 - May 2000)

KFRI 278/97: Germplasm collection and growth studies of selected bamboo species suitable for the region (Western Ghats)

Principal Investigator : Dr. R.C. Pandalai
Co-Investigators : Dr. M.S. Muktesh Kumar, Dr. K.V. Bhat
Funding source : ICFRE, Dehra Dun
Duration : 3 years (April 1997 to March 2000)

KFRI 279/97: Development of technology for collection, processing and testing seeds of five important tree species of Kerala

Principal Investigator : Sri. K.C. Chacko
Co-Investigator : Dr. C. Mohanan
Objectives : To investigate various factors which affect the seeds of *Acacia nilotica, Anthocephalus cadamba, Albizia lebbek, Dalbergia sissoides, Tectona grandis*
Funding source : ICFRE, Dehra Dun
Duration : 3 years (April 1997 to March 2000)

Participation in Seminars, Symposia and Workshops

International

Dr. K.M. Bhat attended Internaitonal Academy of Wood Science Meeting held at Vancouver, Canada during June 20 to July 2, 1997 and presented a paper on Properties and behaviour of juvenile teak wood (K.M. Bhat).

Dr. K.M. Bhat attended IUFRO Div. 5 Conference held at Pullman, Washington State University, USA during 6-12, 1997 July, and presented the following papers:

- Tree ring responses of ring porous tropical hardwood (teak) to changes in environmental factors (K.M. Bhat and P.B. Priya).
- Characterisation of juvenile wood in tropical hardwood teak (K.M. Bhat).

National

Dr. M.S. Muktesh Kumar participated in the Naitonal Workshop on Impact Assessment of Working of Western Ghats Forests (IAWWGF) held at Madkeri, during 3-5 March 1997. He presented a paper on Diversity and systematics distribution of epiphytic flora of Western Ghats (Muktesh Kumar and Stephen Sequiera).

Mr. Thomas P. Thomas attended the Seminar on Coir Geo Textiles organised by Coir Board at Coimbatore on 12 March 1997.

Dr. K.K. Seethalakshmi attended National Congress on Medicinal Plants organised by Oushadhi, Trichur on 12 June 1997.

Dr. U.M. Chandrashekara attended a Conference on Ecological History and Traditional Science held at the Centre for Science and Environment, New Delhi during 28-30 March 1997. He presented a paper on "How culture influences the uses and management of bamboo in India".

Mr. U.N. Nandakumar attended the Workshop on "Biodiversity Conservation Planning and Research Strategy Formulation" organised by Kerala Forest Department at Thiruvananthapuram during 3-5 March 1997. Contributed to the Workshop as member for Working Groups for 1. Developing protocols for establishment of GIS for landscape planning". 2. Assessing information needs of Kerala Forest Department for implementing biodiversity conservation programmes".

Dr. M. Balagopalan participated in the Symposium on The Ecology of Moist Forests of South India held at Madurai Kamraj University, Madurai during 23-26 April 1997. He presented a paper on "Effect of plant communities in the wet evergreen forests of the Western Ghats, Kerala, India (Balagopalan, M.)

Dr. R.C. Pandalai attended a Seminar on "Environment, People and Development" held at Agali, Attappady by Attappady Hills Area Development Society and presented a paper (in Malayalam) on "Afforestation in Attappady - Problems and Prospects" on 6 May 1997.

Dr. P.S. Easa, Dr. K.K. Ramachandran, Dr. E.A. Jayson and Sri. Padmanabhan participated in the Conservation Assessment and Management Plan Workshop for Indian Mammals at Indian Institute of Science, Bangalore from 25-29 August 1997.

Training

International

Smt. E.J. Maria Florence underwent a training in biological control of sapstain at Molecular Life Science Dept. of University of Abertay Dundee, Scotland, under Colombo Plan from January to July 1997.

Dr. M. Balagopalan attended a training programme in Soil and plant analysis using sophisticated instrument and soil stand management studies in eucalypt plantations at the CSIRO Forestry and Forest Products Laboratory, W. Australia, during 22 July to 17 October 1997.

National

Mr. Thomas P Thomas attended the training on Environmental Impact Assessment of Water Resources Projects conducted at CWRDM, Kozhikode from 18 to 23 August 1997.

Training Imparted

Dr. M.S. Muktesh Kumar served as resource person in the Bamboo Taxonomy Training Course, organised by INBAR at Vientiane, Laos, PDR, during 8 to 22 May 1997.

Dr. C. Renuka served as resource person in the Rattan Taxonomy Training

Programme, organised by INBAR at Vientiane, Laos,PDR during 21 April to 5 May 1997.

Division of Pathology organised a training in Forest Pathology for 1996-98 batch of ACF trainees (20 participants) from State Forest Service College (SFSC), Coimbatore during 15-23 May 1997. Dr. J.K. Sharma, Dr. M. Balasundaran, Dr. C. Mohanan and Dr. K.V. Sankaran handled the theory and practical classes.

Resource Person

Dr. C. Mohanan and Dr. V.V. Sudheendrakumar served as resource persons for the Workshop on 'Treatment Technology' organized by the Kerala Forest Department during 26-28 May 1997 at Thiruvananthapuram.

Dr. R.V. Varma, Dr. K.K. Seethalakshmi, Dr. M.S. Muktesh Kumar, Dr. C. Mohanan and Dr. R.C. Pandalai served as resource persons in the *Training on bamboos* organised by Institute of Management in Government (IMG), Cochin, during 21-26 March 1997 for the staff of Bamboo Corporation.

Dr. R.V. Varma served as a resource person for the All India Workshop on Biological Control held at TNAU in March 1997.

Guest Lectures

Dr. C. Renuka gave a lecture on 'Nursery practices of important medicinal plants' in the NGO's Training Programme organised by the Forest Department at Peechi on 11 March, 1997.

Sri. K.C. Chacko delivered a lecture on "General silviculture and silviculture systems" for 15 M.Sc. (Final Year Environmental Science Students of M.G. University, Kottayam) on 26 June 1997.

Dr. R.V. Varma took a class on applied entomology in a refresher course for College teachers organized by the Kerala University in June 1997.

Dr. U.M. Chandrashekara delivered a lecture on 'Trees for urban surroundings on Short Term Course for Engineers on Landscape Architecture organised by the Department of Architecture, College of engineering, Thiruvananthapuram on 29th April 1997.

Campus News

Ph.D. Degree

Mr. T.R. Manoharan was awarded Ph.D. Degree in Economics from the Deemed University, FRI, Dehra Dun for a thesis entitled "Economics of Protected Areas: A Case Study of Periyar Tiger Reserve" under the research guidance of Dr. P.K. Muraleedharan.

Mrs. V. Anitha was awarded Ph.D. Degree in Economics from the Deemed University, FRI, Dehra Dun for a thesis entitled "Land use Changes and its Impact on the Socio-economic Conditions of the tribals: A Case Study of Wayanad District in Kerala" under the research guidance of Dr. P.K. Muraleedharan

Distinguished Visitors

H. E. Sri. S.S. Kang, Governor of Kerala visited KFRI Subcentre and Teak Museum on 18 August 1997.
Mr. Yves Crouzet, General Manager, La Bambousarale Anduze, visited the Institute on 15 April 1997.

Fellowships

Dr. K.M. Bhat was awarded JSPS (Japan Society for Promotion of Science) Invitation Fellowship for giving lectures and collaborative research on teakwood in Japan during 21 April - 27 June, 1997. He gave lectures on 'Sustainability of tropical forest resources' in Nagya University, Wood Research Institute Kyoto and Forest Products Res. Institute, Tsukuba, Japan. He was also awarded an ITTO Fellowship to attend International Academy of Wood Science Meeting at Vancouver, Canada during 30 June - 2 July 1997 and IUFRO Div. 5 Conference at Pullman, Washington State University, USA during 6-12 July 1997.

Meeting/Symposium

The 23rd Annual Meeting of the Mycological Society of India and a Symposium on 'Fungi in Forest Ecosystem' was held at KFRI during 9-11 May 1997. Dr.P.K.K. Nair, (Director, ERRC, Trivandrum) inaugurated the meeting and symposium. Dr. Indira Kalyanasundaram (University of Madras) presided over the inaugural function. A total of 50 participants from all over India attended the meeting and symposium.

H. E. Sri. S.S. Kang Visits Teak Museum

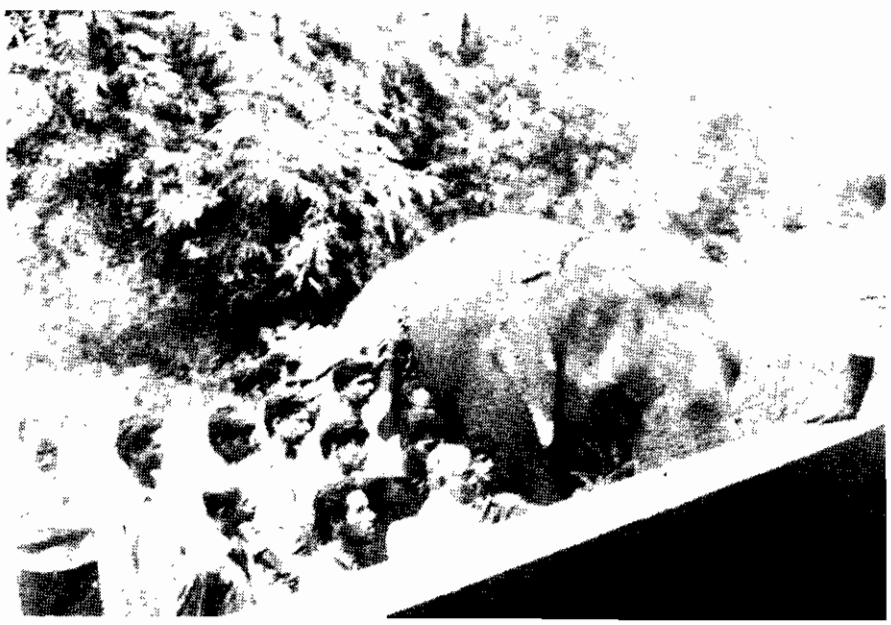
Training Programme/Workshop Organized

A Refresher Course for mahouts was organized jointly by Elephant Welfare Association, 'Elephant Owners' Association, Kerala Forest Department and Kerala Forest Research Insitute. The programme of five days duration was held at the Information Centre of Thrissur Wildlife Division at Peechi. Training programme for the first batch was from 28 July to 1 August and the second batch from 4 to 8 August 1997. Forty mahouts participated in two batches.

The programme was inaugurated by Dr. K.S.S. Nair, Director, KFRI in a function presided over by Dr. Radhakrishna Kaimal, Vice President of Elephant Welfare Association.

Dr. K.C. Panicker, Dr. Jacob V Cheeran, Dr. Radhakrishna Kaimal, Dr. P. Girinathan Nair, Sri. P.M. Neelakantan Namboodiripad, Sri. Avanapparambu Maheswaran Namboodiripad, Sri.Babu Namboodiri, Sri. Ponnappan (Mahout from Kodanad), Sri. Krishnankutty Nair (Mahout from Guruvayur) and Dr.P.S. Easa dealt with different topics for the trainees.

The Certificates for the second batch was distributed by Sri.S. Ayyappan Nair, Administrator, Guruvayur Devaswom . The function was presided over by Dr.K.S.S. Nair, Director, KFRI. Adv. Arun Kumar (Elephant Owners' Association) felicitated. Dr.K.C. Panicker of Elephant Welfare Association welcomed the gathering and Dr.P.S. Easa proposed vote of thanks.



Gregarious Flowering of Bamboos in Kerala

This year was special for bamboos in the districts of Thrissur, Palakkad and Malappuram in Central Kerala. We were witness to the gregarious flowering in *Bambusa bambos, (B. arundinacea)*. In a small pocket of Chittoor (Attappady) in Palakkad district, the giant variety - *B. bambos var. gigantea* also flowered greariously perhaps for the first time on recrod. Surprisingly, in both the bamboos several non-flowering clumps too were observed. This raises several questions. a. Are the flowering clumps, in either species,of the same origin as the ones that did not flower this year? Or was there some sort of physiological control which did not operate in the non-flowering plants? b. Does the simultaneous flowering phenomenon in *B. bambos* as well as in the giant variety point to any kind of affinity between the two, over and above what their taxonomic status suggests? But for the tremendous disparity in the height and diameter of the culms, the two bamboos show no differences at all.

No worthwhile effort appears to have been taken by any agency, government or private, to collect the seeds that must have been produced in such huge quantities. Almost the entire population of the bamboos in the three districts is in private land. The local people especially the tribals did gather the seeds from the ground (swept clean of leaf litter). Most of it however was immediately dehusked by pounding since they seem to relish the fare prepared out of the bamboos seeds, cooked like some of the local rice preparations. Some even attribute curative properties to the seeds. The immense potential for producing the planting material for the bamboo crop for the years to come appeared to have been lost. Although they were aware that the bamboos would die out *en masse* in a few months, this apparently did not worry the people to any great extent. The price of bamboo culms should go up since the culms and thorns of this species are used extensively in this part of Kerala for building, fencing and as props for banana. With hardly any other suitable bamboo species available in the region, a scarcity in the next few years will almost be a certainity.

E.M. Muralidharan
Division of Genetics

Forthcoming Forestry/ Environment Events

22-25 November 97. Innovations in Forest Tree Seed science and Nursery Technology. Raipur, India. IUFRO Div II.209.00. Contact:S C Naithani, Organising Secretary, SOS in Life Sciences, Pt Ravisankar Shukla University, Raipur-492010, India; Fax 91-0771-534283; Email rsinf@shakti.ncst.ernet.in

2-5 December 97.Overcoming Impediments to Reforestation. 6th International Workshop of Biotechnology-assisted Reforestation Project.Brisbane & Gympic, Australia.Contact: Centre for Conservation Biology,University of Queensland, Brisbane 4072, Australia. Fax 61-7-3365 4828; Email ccbinfo@ccb.uq.edu.au

9-12 December 97. 2nd Symposium on the Asian Tropical Rainforest Management. Samarinda, Indonesia. Contact. The Organising Committee, c/o PUSREHUT-UNMUL, PO Box 1165, Samarinda 75123, Kalimantan Timur, Indonesia; Fax 62-541 39894.

16-19 February 98. Value added Processing and Utilisation of Lesser Used Timber Species. Kumasi, Ghana. Contact: Dr. A Addae-Mensah, Conference Secretariat, VAPU_LUS, University Box 63, Kumasi, Ghana: Fax 233-51-60121; Email USTLIB @ ust.gn.apc.org

16-20 February 98. Medicinal Plants Conservation, Utilisation, Trade and Cultural Traditions. Bangalore, India. Contact: National Institute of Advanced Studies, Indian Institute of Science Campus, Bangalore 560 012, India.

9-16 August 98. 7th International Congress on Plant Pathology. Edinburgh, UK. Contact: ICPP98 Congress Secretariat, c/o Meeting Makers, 50 George Street, Glasgow GI IQE, UK; Fax: 44-141-552 0511;
Email: icpp98@meetingmakers.co.uk

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