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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 here are the those of the authors and do not necessarily reflect views of the institute. All interested persons are invited to send comments, opinions and short articles for inclusion in the Evergreen. The Newsletter Committee reserves the right to choose among contributions and edit whereever necessary.

DR. S. CHAND BASHA JOINS AS KFRI DIRECTOR

Dr. S. Chand Basha, I.F.S., Chief Conservator of Forests (Social Forestry and Projects), Kerala joined as Director of KFRI on 20th May 1991.

Dr. Chand Basha began his career in the year 1960 as a lecturer in Botany in the St. Thomas College, Kozhencherry, after completing his M.Sc in Botany with a first rank from the University of Kerala. In 1962 he took AIFC from Dehra Dun and joined the Kerala Forest Service. During 1966 he was selected for the Indian Forest Service. In the Kerala Forest Department, Dr. Chand Basha has served in various capacities such as Assistant Conservator of Forests (1964-1966), Divisional Forest Officer (1966-1974), Working Plan Officer (1974-1977), Managing Director, Travancore Plywood Industries Ltd. (1979-1981) and as Conservator of Forests of Central (1978-1979), Northern (1981-1984) and Southern (1984-1987) Forest Circles. He was appointed Chief Conservator of Forests (Social Forestry and Projects) in 1987, a post which he held till joining the KFRI. Dr. Chand Basha earned his Ph.D. degree in Botany from the University of Kerala in 1989. His main interests are in the fields of Botany, Silviculture, Ecology, eco-restoration and conservation.

Dr. Chand Basha has extensive experience in forest management and tribal development. His major achievements include efficient implementation of the World Bank aided Social Forestry Project. He has authored several technical reports and research articles on various aspects of forestry.

KFRI looks forward to a brilliant future under his able leadership.

Artificial seeds are here!

Nature's inexhaustible wonders will never cease to amaze us. Take the tiny SEED - a remarkable example of nature's ingenuity, whichever way one looks at it. Consider these aspects. All by itself the seed has the means to brave the elements - the pests, the heat, the drought or may be a fire, and yet when the time is just ripe it will burst forth into activity and give rise to a seedling and help it along on its way.

The heart of the seed of course is the embryo. Inherent to its structure is the ability to produce a whole new plant. The germ of the future shoot and the root already exists in the embryo. To sustain the developing embryo, nature has thoughtfully provided a little stock of food in the form of cotyledons or an endosperm. There is even an elaborate mechanism designed to make this stored food available in the right form for the seedling to use. As if that was not comfy enough, the embryo is wrapped up and kept snug inside the folds of a seed coat. And knowing very well the vagaries of the environment the seed is not just left to its mercy. Instead, as the embryo develops it is sent into a dormant state - a sleep from which it awakens only when the circumstances are propitious.

In creating the seed nature has apparently put in everything at its disposal. Can man ever hope to improve upon nature in what appears to be as near to perfect as can be imagined? Will man then, be able to create an artificial seed?

Is there a need for artificial seeds? For an answer let's take a look at some of the problems faced by scientists involved in plant improvement. Extensive breeding, spread over many years is required in many crops to obtain desirable combinations of traits. The resulting combination would then be lost or disturbed significantly due to meiotic instability in the subsequent generations if pollination is allowed to take place.

One way to overcome the problem is to resort to vegetative propagation where clones or identical copies of the desired plant can be produced. It is the quickest way to harness the benefits of a superior genotype, obtained either by selection, hybridization or genetic transformation, in the very next generation. However, in many important crops vegetative propagation would be highly labour-intensive and costly and in some others extremely difficult or impossible. Against this scenario the technique of *in vitro* culture assumes significance.

The *in vitro* culture of plants or plant tissue culture as it is commonly known, has emerged as an area with great potential to solve some of the problems of agriculture, horticulture and forestry. Among the many other applications of plant tissue culture, micropropagation has been the most widely applied the world over. There are basically three methods of micropropagation. The first involves shoot cultures obtained by proliferation of cultured axillary or apical buds. In the second method called organogenesis, induction of shoot buds is obtained on cultured tissue.

It is the third method - somatic embryogenesis, that is of particular interest to us here. This involves the development in cultured tissue of somatic embryos - structures that are analogous to zygotic embryos but are derived from somatic (vegetative) cells instead of by fusion of gametes. Not only does the somatic embryo show a striking similarity in appearance to the zygotic embryo but the resemblance is also evident in its developmental stages and in several of its physiological and biochemical characteristics. Any differences, it appears, can be attributed to our lack of understanding of the factors responsible for normal development.

The advantages of somatic embryogenesis over other methods of micropropagation are many. Typically a much higher number of plants can be produced per culture. Methods have been developed by which tens of thousands of embryos can be produced in a litre of liquid medium. Such a culture can then also be grown in large vessels called bio-reactors, similar to those used in industrial fermentation. This amenability to automation is potentially of great advantage in large scale plant production since it can cut down production cost significantly by reducing the labour-intensive stages.

Another important feature of the somatic embryo is that it can germinate to form a plant like the zygotic embryo. But the similarity ends there. Where as the embryo within the seed can be stored for varying periods of time and then put into soil directly, the same cannot be said of the somatic embryo. It

is far too delicate to be sown directly and germinated in the soil. That would mean germinating the somatic embryo in culture and the additional labour of transplanting and hardening of the plants. This inability to deliver the embryo to the soil directly threatens to diminish the benefits that somatic embryogenesis has as a mass clonal propagation system. What is clearly needed is an embryo delivery system that is comparable to the natural seed in its ease of handling and storage.

The concept of artificial seed or synthetic seed originated in the 1970's. By then somatic embryogenesis was obtained in several plant species. Research then was directed to identify those factors that were responsible for normal development and maturation of embryos as in the seed. As a result of our improved knowledge, the efficiency of somatic embryogenesis in several species has improved over the years. The attention then turned to simulating the natural seed in its structure and functions. The idea was to couple the benefits of large scale clonal propagation and other means of plant improvement involving tissue culture with the advantages of the natural seed.

What we expect in an artificial seed then are:

1. The 'embryo' : Any tissue or organ capable of producing a plant with ease, can take the role of the embryo in the seed. For reasons mentioned above somatic embryos are ideal.
2. The seed coat: The most widely adopted method of providing a protective coat to the somatic embryo is encapsulation by suitable polymers. Embryos can be coated with the polymer and desiccated to form wafers that withstand drying out and storage to a great extend. Much more widely used are alginate gels which remain hydrated throughout. The gel that is formed is tough enough to withstand handling without damage to the embryo. It is also non-toxic and allows the embryo to germinate easily. The process of encapsulation can be mechanized to reduce cost of production. Several other synthetic and natural substances can also be used for coating.
3. The artificial endosperm: In the natural seed most of the bulk is the storage material in the form of the cotyledon or the endosperm. In an artificial seed too a synthetic endosperm could be incorporated if a suitable mechanism to make it available for the embryo is devised.

Besides reserve food for the embryo the coat can also be the vehicle for precision application of a variety of plant protection chemicals, slow release fertilizers, mycorrhiza, etc. to avoid the conventional methods of application that are wasteful and environmentally hazardous.

The artificial seed obviously has a tremendous potential. In certain respects it is definitely an improvement over the natural seeds. However, the present state-of-the-art expertise in somatic embryogenesis for most plants is still inadequate to make artificial seed a viable idea. Admittedly the technology is still in its infancy.

E. M. Muralidharan
Division of Genetics

Chenopodium sp. - a grain of ethnobotanical and ecological value.

Chenopodium sp. is known to be grown in the Himalayas by traditional people and also by the Incas of South America. Interestingly, this species is cultivated in forest areas by the tribals of Attappady. This crop, locally known as 'Cheera' (Eng. Amaranth), has very high nutritional quality (Table 1) and hardiness.

At present, 'Cheera' is being recognised as a potentially important underutilised plant resource for marginal third-world areas that are not food self-sufficient. Further, in future, when the environmentally damaging effects of the present day high energy demanding agricultural system become apparent, it may be the neglected crops like 'Cheera' that would help to feed the world.

Table 1. **Nutritional value of *Chenopodium* sp. in comparison with rice and millet**

Nutrient contents	Chenopodium	Rice	Millet
Protein (%)	16	6.8	7.3
Carbohydrates (%)	62	78	72
Lipids (%)	8	0.5	1.3
Minerals (%)	3	0.6	2.7
Energy (k cal/100 g)	376	345	328

S. Sankar
Division of Soil Science

A conceptual model for pricing of non-timber forest products in Kerala

Forest commodities in Kerala can be grouped into timber, non- timber products and wildlife of which the first two are exploited for human consumption. The non-timber forest products, generally known as minor forest produce, include honey, wax, medicinal plants, gums, resins, tanning materials, etc. Consumed by people belonging to different sections in the society, non-timber forest products are in demand not only in home but also in external markets. Although, these commodities have consumptive, medicinal and commercial values, very little attention has been paid for their sustainable use and management. Lack of a proper pricing policy for these products remains to be a major drawback.

The right of collection and removal of the minor forest produce (except bamboos and reeds) is leased out to co-operative societies belonging to Harijans and hill tribes. The price of the products are fixed by the government, with an intent to give fair price to the gatherers and to provide commodities at a cheaper rate to the consumers. The products are bought and sold by co-operative societies at a price fixed by the government. Buying and selling prices are revised periodically.

The criterion adopted by the government in determining the price of non-timber forest products is yet to be spelt out. However, the existing price policy concerning these products has some intrinsic limitations. The non-timber forest products which are available naturally in the forests are treated as 'free goods', especially when the price of each commodity in determined. The value of land on which they are produced and its maintenance cost are never taken into account while estimating the prices. Considering the risk associated with the job, the gatherers receive relatively low wages, and no definite criterion has been followed in determining their remuneration. Since products from the co-operative societies are bought by private traders who in turn sell them at a much higher price, the benefit of a low selling price, maintained by the society is not enjoyed by the real consumer. Thus a fresh look at the pricing of non-timber forest products is a priority.

An attempt is made here to develop a conceptual model for pricing the non-timber forest products. The model is based on the assumption that the products are gathered by the individuals and sold in the market. An outline of the model is given below:

$$P_m = 0_l + M_l + C + P$$

where P_m is the price of non-timber forest products per unit, 0_l is the opportunity cost of land, M_l is the maintenance cost of land, C is the collection charges and P, the profit. The collection charges (C) include remuneration paid to the gatherers, establishment charges of the society and interest on borrowed capital, if any.

The remuneration paid to the gatherers is one of the important components of the price and a fair wage to the gatherers is essential for giving incentive to them to collect large quantities. Then the question is what should be the basis of a fair wage? The options are 1) the gatherers may be paid on the basis of average time expended for collection of one unit of product and 2) as the collection of minor forest produce from interior forests is a highly risky job, their wages can be in par with the wages of those who undertake similar risky jobs outside the forest areas.

The current policy of treating forests as a free gift of nature and setting low prices for forest produce, ignoring their real value, cannot be justified at least economically. It not only incurs enormous loss of revenue to the government but also diverts resources from the forestry sector resulting in the slackening of forestry operations in the state. The mounting costs for management and protection of forests and the need for conserving forest resources for the future call for the implementation of a comprehensive forest price policy in the State.

P. K. Muraleedharan
Division of Economics

Ailanthus triphysa - some information on growth

Ailanthus triphysa, locally known as Matty is a forest tree species popular among farmers of Kerala. It is one of the main raw materials for match wood industries. The latex and leaves of this tree have got many industrial and medicinal uses. Its capacity to adapt to different site conditions, fast growth rate and ready market have attracted lot of attention. The tree is planted widely in homesteads of Kerala as an agroforestry species in combination with many other crops.

Though well known just like many other forestry species, information on silviculture utilization and growth of *A. triphysa* are still very limited. Data on various growth parameters and their allometric relationships are often useful in yield predictions and also in deciding many silvicultural practices. Here, based on a study conducted in a 10 year old Matty plantation at KFRI subcentre campus, Nilambur some information on various growth parameters of the tree are provided.

Four trees each from 3 girth classes viz. less than 30 cm girth at breast height (gbh), 30 - 50 cm gbh and greater than 50 cm gbh, were chosen for measurements and the average value presented in the following table.

Mean tree growth parameters of 10 yr old plantation of *Ailanthus triphysa* grown at Nilambur, Kerala

Growth parameters	Girth classes (gbh)		
	<30 cm	30-50 cm	>50 cm
Girth at breast height (cm)	27.0	41.0	54.0
Diameter at breast height (cm)	8.4	13.0	17.0
Bark thickness (cm)	0.4	0.7	0.8
Height (m)	7.6	9.7	13.1
Bole height - total height ratio	0.6	0.6	0.4
Number of leaves	420	1100	2100
Leaf area (m^2)	20.6	41.8	58.2
Crown diameter (m)	1.5	2.3	4.5
Crown area (m^2)	4.6	7.1	14.2
Stem volume [over bark] (m^3)	0.03	0.07	0.2
Bark volume (m^3)	0.005	0.016	0.031
Bark volume (%)	25.0	21.9	18.6
Artificial form factor	0.47	0.45	0.44
Stem biomass [oven dry] (kg)	5.9	33.5	64.4
Leaf biomass (kg)	1.7	4.4	5.9
Root biomass (kg)	—	—	22.9
Total biomass (kg)	—	—	93.0

P. V. Madhusoodhanan
U. N. Nandakumar
Division of Silviculture

Unusual outbreak of a pentatomid bug in Wyanad

An outbreak of the bug *Udonga montana* (Dist.) (Heteroptera: Pentatomidae), occurred in Wyanad towards the end of May 1991. Massive aggregation of this insect was noticed in the following locations in the Chedalath Forest Range, 1) in a 1988 teak plantation in the Padiri beat and in the adjoining natural forest and 2) in nearby pepper and coffee plantations at Padiri, Kallanikkunnu and Sasimala. In the teak plantation, the aggregation of this insect was noticed on trees and shrubs in an area of about 25 m x 20 m and in the natural forest, in an area of about 0.5 ha. A typical teak tree of about 20 m height harboured about 45,0000 insects. Other trees on which these insects aggregated include *Haldina cordifolia, Garuga pinnata, Mitragyna parvifolia, Dalbergia latifolia, Casearia tomentosa* and *Cassia fistula* besides agricultural crops such as Coconut palms, Guava, Chilly, Ginger, Amaranthus and Cassava.

Pentatomid bugs are generally known to feed on plant sap. Despite large scale aggregation of this insect, no symptoms of damage due to feeding was noticed on the plants except in pepper where slight defoliation and shedding of spikes occurred.

Massive build-up of *U. montana* had been reported in the past from the forests in Chadda (Madhya Pradesh) in 1904 and from coffee plantations in Mysore (Karnataka) in 1917. The outbreak of this insect is suspected to be correlated with gregarious flowering of bamboo as they are reported to feed on developing bamboo seeds (Fletcher, 1919. Report of the Proceedings of the 3rd Entomological Meeting, Pusa, 3-15 Feb. 1919). Although gregarious flowering of bamboo had occurred in the forests at Padiri recently, by the time the bug outbreak was noticed, the major flowering season of bamboo was over and the possible feeding of the bugs on developing bamboo seeds could not be confirmed.

George Mathew
V. V. Sudheendrakumar
Division of Entomology

Workshop organised

As part of the National Science Day Celebrations 1991, a workshop on 'Innovative Uses of Timber in House Construction' was organised by the Kerala Forest Research Institute and the Centre of Science and Technology for Rural Development (COSTFORD) during 1-2 March 1991 at Thrissur. (Late) *Shri C. Achutha Menon*, Chairman, COSTFORD presided the inaugural session and *Shri. R. Ramachandran Nair*, Commissioner and Secretary, Forest Department inaugurated the workshop. *Dr. R. Gnanaharan, Dr. K.M. Bhat* (Wood Science), *Dr. R.V. Varma, Dr. George Mathew* (Entomology) and *Mrs. E.J. Maria Florence* (Pathology) gave lectures on different aspects of wood applications.

Recent publications

Scientific papers

Inflorescence blight and shoot die-back of cashew. Journal of Plantation Crops, 18 (Supplement): 219-223. (Balasundaran, M. and Varma, R.V. 1991).

Wood quality improvement of eucalypts in India: An assessment of property variations. Journal of Indian Academy of Wood Science, 21: 91-97. (Bhat, K.M. 1990).

Effects of slash-burning on soil properties, weed growth, taungya yield and growth of teak. Indian Forester, 117: 237-248. (Chacko, K.C., Sankar, S., Pandalai, R.C. and Nandakumar, U.N. 1991).

Reappearance of common peafowl *Pavo cristatus* L. in Parambikulam Wildlife Sanctuary, Kerala. Journal of Bombay Natural History Society, 87: 292-293. (Easa, P.S. 1990).

Occurrence of pink disease on *Acacia auriculiformis* in Kerala. Indian Forester, 117: 494-496. (Florence, E.J.M. and Balasundaran, M. 1991).

Cylindrocladium collar rot of *Mimusops* seedlings. Indian Journal of Forestry, 14: 150-151. (Florence, E.J.M. and Sankaran, K.V. 1991).

Wood and environment. In: Background papers for the National Workshop on the Future of Wood in the World of Materials. Bangalore, Vol. I(3): 31-28. (Gnanaharan, R. 1991).

Pests and Diseases of Forest Plantations. Proc. IUFRO Workshop, Regional Office for Asia and the Pacific, Bangkok, 283 pp. (Hutacherern, C., Mac Dicken, K.G., Ivory M.H. and Nair K.S.S. (Eds.) 1990).

Pest incidence in natural forests - a study in moist deciduous and evergreen forests of Kerala. In: Proc. IUFRO workshop on Pests and Diseases of Forest Plantations, Bangkok, pp. 129-134. (Mohanadas, K., Mathew, G. and Nair, K.S.S. 1990).

Priorities in forest entomological research in India. Proc. IUFRO World Congr., Canada. Vol.2, pp. 279-284. (Nair, K.S.S. and Mathew, G. 1990).

An action plan for assessing tropical forest pest problems and establishing priorities for research. In: Proc. IUFRO Workshop on Pests and Diseases of Forest Plantations, Bangkok, pp. 9-14. (Nair, K.S.S. 1990).

Social, economic and policy aspects of integrated pest management of forest defoliators in India. Forest Ecology & Management, 39: 283-288. (Nair, K.S.S. 1991).

Phloeospora aethiopica sp. nov. on *Acanthus* spp. from Ethiopia. Mycological Research, 95: 1019-1020. (Sankaran, K.V. and Sutton, B.C. 1991).

Myriellina imperatae sp. nov. on *Imperata* from Papua New Guinea and Australia. Mycological Research, 95: 1021-1022. (Sankaran, K.V. and Sutton, B.C. 1991).

Pseudocercosporella tetradeniae sp. nov. on leaves of *Tetradenia* from Zimbabwe. Mycological Research, 95: 1023- 1024. (Sankaran, K.V. and Sutton, B.C. 1991).

A new species of *Palaquium* Blanco (Sapotaceae) from India. Blumea, 35: 385-387. (Sasidharan, N. and Vink, W. 1991).

In vitro evaluation of fungicides against *Cylindrocladium* spp. causing diseases of *Eucalyptus* in Kerala, India. European Journal of Forest Pathology, 21: 17- 26. (Sharma, J.K. and Mohanan, C. 1991).

Growth response of seedlings of *Acacia, Ailanthus* and *Casuarina* to Triacontanol (Vipul). Indian Journal of Forestry, 14: 46-50. (Somen, C.K. and Seethalakshmi, K.K 1991).

A report on the Ichneumonid parasites of *Hyblaea puera* recorded from Nilambur, Kerala. Journal of Tropical Forestry, 6: 101-103. (Sudheendrakumar, V.V. 1990).

New names for *Chaetospora* and its type species. Mycological Research, 95: 768. (Sutton, B.C. and Sankaran, K.V. 1991).

Rattan processing techniques in India: A case study of oil curing. RIC Bulletin, 9: 15-21. (Yekantappa, K., Bhat, K.M. and Dhamodaran, T.K. 1990).

Research reports

Ex-situ decomposition of leaf litters of *Tectona grandis*, *Ecucalyptus tereticornis* and *Albizia falcataria*. KFRI Research Report No. 71. Final Report of Project Soils 14/84. Division of Soil Science and Plant Pathology. (Mary M.V. (deceased) and Sankaran, K.V. 1991).

Abstract: Decomposition of leaf litters of *Tectona grandis, Euclayptus tereticornis* and *Albizia falcataria* was studied using the mesh bag technique for a perlod of 18 months under field and laboratory conditions. The weight loss of litters under field condition was significantly higher than that under laboratory condition. The decay rate of the three litters also varied significantly under both laboratory and field conditions. There was positive correlation between loss in weight of litters, litter moisture content and rainfall; decomposition of all the litters was rapid during south-west monsoon.

In the field, the dry weight loss of litters after 18 months was 95.7% for teak, 93.9% for *Albizia* and 63.7% for eucalypt. In the laboratory it was 91.9% for teak. 74% for *Albizia* and 59.7% for eucalypt. Teak leaf litter decomposed rapidly as compared to the others; decomposition of eucalypt litter was the slowest.

CO_2 evolution from decomposing litters differed significantly between the three species and it was significantly higher in the field than in the laboratory. CO_2 evolution was highest during south-west monsoon in all the three litters under both the incubation conditions.

In general, the population of various microorganisms associated with the decomposing litters was significantly lower on eucalypt than that on teak and *Albizia*. There were significant differences between number of fungl per g of *Albizia* and eucalypt litters. The number of bacteria per g of *Albizia*, eucalypt and teak litters also differed significantly, irrespective of months or incubation conditions. The population of actinomycetes showed distinct differences between teak and eucalypt.

It is concluded from the results of this study that 1) the leaf litter of eucalypt is relatively resistant to decomposition in comparison with those of teak and *Albizia*. 2) litter moisture content is crucial for the decomposition of leaf litters under tropical warm humid climate. 3) the rate of decomposition of litters and the microbial activity are higher in the field than in the laboratory. 4) the fungal succession on decaying litters reported here is similar to the general scheme of fungal succession on plant litters proposed by Hudson, and 5) the substrate quality is the major factor which determines the rate of leaf litter decomposition, CO_2 evolution, the density of microorganisms associated with the litters and also composition of their fungal floras.

Evaluation of microbial pathogens for biocontrol against important insect pests of *Ailanthus* **and teak.** KFRI Research Report No. 72. Final Report of Project Pathol NF 06/1986. Division of Plant Pathology and Entomology. (Mohamed Ali, M.I., Varma, R.V. and Sudheendrakumr, V.V. 1991).

Abstract: A serious disease of the teak defoliator *Hyblaea puera* caused by a nuclear polyhedral virus was observed in various teak plantations. Bioassay studies revealed that the virus is highly pathogenic to *H. puera*. There was no cross infectivity to three other forest insect pests, viz. *Eutectona machaeralis, Eligma narcissus* and *Atteva fabriciella*. Three species of bacterial pathogens, viz. *Bacillus cereus. B. thuringiensis* var. *thuringiensis* and *Enterobacter aerogenes* were also recorded from *H. puera. B. thuringiensis* was recorded as a stray case of infection and was highly pathogenic and caused 100% mortality in laboratory experiments. Low incidence of *B. cereus* infection was seen in *H. puera* while *E. aerogenes* was consistently isolated from field infected larvae. Except a new species of *Hirsutella* no other fungal pathogens could be observed on *H. puera*. No microbial pathogens were recorded from the teak skeletonizer *Eutectona machaeralis*. The fungal pathogen *Beauveria bassiana* was found to cause larval mortality of the teak sapling borer *Sahyadrassus malabaricus*. Two species of fungal pathogens viz. *Paecilomyces farinosus* and *P. fumosoroseus* were consistently recorded on the pupae of the yellow hairy caterpillar *Eligma narcissus*, an insect pest of *Ailanthus triphysa*. Laboratory trials indicated that *P. farinosus* is more effective in bringing about insect mortality than *P. fumosoroseus*. Sporadic oc-

currence of bacterial pathogens, viz. *Bacillus firmus* and *Serratia marsecens*, were observed on larvae of *Eligma narcissus*; the former was effective only at high concentration. From *Atteva fabriciella*, shoot webber of *A. triphysa* only *B. bassiana* was recorded causing larval mortality. *B. thuringiensis* (teak strain) was found infective against both *E. narcissus* and *A. fabriciella*.

Establishment of a Xylarium. KFRI Research Report No. 73. Final Report of Project Wood 07/1982. Division of Wood Science. (Bhat, K.M. and Bhat, K.V. 1991).

Abstract: The aim of this project was to provide basic information on a variety of timbers, required by wood anatomists/technologists and others to whom wood is a research or study medium. The specific objectives were to a) establish and maintain an identified collection of wood specimens and (b) prepare and maintain authentic microscope slides of the wood specimens collected from Kerala.

The total number of wood specimens collected as on 31 December 1989 is 567, of which 113 are Kerala timbers representing 68 genera with 94 species. The rest were from ten foreign countries. Microscope slides are also maintained for Kerala timbers to serve the purpose of reference in wood structural studies.

A study of the tree legumes endemic to Western Ghats of Kerala. KFRI Research Report No. 74. Final Report of Project Bot. 07/85. Division of Botany. (Nair, N.G. 1991).

Abstract: The report enumerates 12 species and one variety of endemic legumes distributed in the Kerala part of the Western Ghats and adjoining areas. They include *Acacia wightii, Calliandra cynometorides, Cynometra beddomei, C. bourdillonii, C. travancorica, Dialium travancoricum, Humboldtia bourdillonii, H. brunonis, H. decurrens, H. unijuga, H. unijuga var. trijuga, H. vahliana and Ormosia travancorica*.

Distribution of trees in Kerala Forests (Southern Circle). KFRI Research Report No. 75 Final Report of Project Bot. 08/85 Division of Botany. (Nair, N.G. 1991).

Abstract: The work done in this project is a continuation of an earlier study in the same line for Central Circle of Kerala Forests. The report contains an enumeration of 124 species of indigenous species in the Southern Circle of the forests of the State. Apart from the enumeration, brief notes on the distribution and present availability of various tree species are also given. The forest types which abode those taxa in the region are also given as an introduction. The study was mainly confined to the river basins of Southern Kerala namely Karamana, Vamanapuram, Neyyar and Kulathupuzha.

Estimation of quantity of eucalypt seeds for sowing in nurseries. KFRI Research Report No.76. Final Report of Project Silvi.06/1981. Division of Silviculture. (Chacko, K.C., Pandalai, R.C. and Nandakumar, U.N. 1991).

Abstract:A study was conducted at Nilambur to determine the optimum seed rate of *Eucalyptus grandis* and *E. tereticornis* for sowing in nursery beds. Two sowing methods and four seed rates were tried. Line sowing registered higher percentage of seedlings on seed bed and plantable containerised seedlings (PCS) as compared to broadcast sowing. Though higher seed rates produced greater number of seedlings on seed bed, the percentage of seedlings that developed in PCS increased with decrease in seed rate. The quantities of seeds of varying germination capacities required for sowing on a standard nursery bed are presented in a tabular form.

Establishment of a Herbarium in the Institute. KFRI Research No. 77. Final Report of Project Bot. 04/82. Division of Botany. (Sasidharan, N. and Nambiar, V.P.K. 1991).

Abstract: Kerala is endowed with a luxuriant vegetation, due to the varied climatic conditions. Nevertheless there is no established herbaria in the State. Since the establishment of the Institute, collections were made from the forests with a view to establish a reference herbarium of forest plants. In 1982, the work has been formulated into a project with the duration of 5 years. The Institute herbarium which now holds over 6000 specimens is recognised by the International Association of Plant Taxonomists (IAPT), and is known by the acronym KFRI.

So far we have collected about 1,400 species from the forests of Kerala, which forms about 58% of the forest flora. Among the collections, there are 430 tree species which represents about 2/3 of the estimated 600 arborescent species. Besides the general collections the herbarium has a complete collection of medicinal plants of the forests and rattans of South India. The species in the herbarium are indexed in alphabetical order with collection numbers under respective plant families.

Spatial and temporal distribution of *Ailanthus* pests, *Eligma narcissus* and *Atteva fabriciella*. KFRI Research Report No.78. Final Report Project KFRI 103/87. Division of Entomology. (Varma, R.V. 1991).

Abstract: The spatial and temporal distribution of the two major pests of *Ailanthus triphysa*, viz., *Atteva fabriciella* and *Eligma narcissus* have been studied in a 10 ha plantation over a period of three years at Thattekkad in Kothamangalam Range, Kerala. *A. fabriciella* was present almost throughout the study period at varying intensities whereas incidence of *E. narcissus* was erratic. The two insects followed a clustered pattern of distribution, both over space and time, which was also influenced by both biotic and abiotic factors of the locality. Incidence of *A. fabriciella* was negatively correlated with rainfall, but incidence of *E. narcissus*, had no such correlation. At Thattekkad, 5 species of bird predators of both pests and the chalcid, *Brachymeria hime attevae*, which parasitise pupae of *A. fabriciella* were prevalent. At Chathamattom, a reduviid bug, *Panthous bimaculatus* reported here for the first time as a predator of both the pests occurred in good numbers.

There was no difference in the intensity of infestation by either of the two pests between monoculture plantations and plantations raised under teak. A search for other insects feeding on *A. triphysa* resulted in 12 new records of insects associated with the species. Field experiments to study the cause of stunted growth in *A. triphysa* plantation at Erumeli showed that stunting is mainly due to the damage caused by the insect, *A. fabriciella*.

Vegetation analysis and mapping of Parambikulam Wildlife Sanctuary. KFRI Research Report No. 79. Final Report of Project Ecol.07/1986. Division of Ecology. (Menon, A.R.R. 1991).

Abstract: Vegetation mapping of Parambikulam Wildlife Sanctuary was done in 1:50,000 scale, by the conventional field survey methods. Aerial photographs (black & white) in the scale 1:50,000 were used for pre-final map correction. A set of supplementary maps viz. physical, drainage, vegetation density, plantations etc. were also prepared in 1:50,000 scale. Fifty representative localities were selected and structural information of vegetation of the area were collected using census quadrat methods and included in the report as supplementary information for reference.

Studies on selected indigenous species for future plantation programmes in Kerala. Final Report of Research Project No. KFRI 114/87. Project sponsored by the Ministry of Environment and Forests, Govt. of India. (Nair, K.K.N., Chacko, K.C., Menon, A.R.R., Bhat, K.V., George Mathew, Mohamed Ali, M.I. and Pandalai, R.C. 1991).

Abstract: The study involved the establishment of an experimental plantation of six species indigenous to Kerala, namely *Albizia odoratissima* (L.f.) Benth., *Grewia tiliifolia* Vahl, *Haldina cordifolia* (Roxb.) Ridsd., *Lagerstroemia microcarpa* Wt., *Pterocarpus marsupium* Roxb. and *Xylia xylocarpa* (Roxb.) Taub. both as pure and in mixtures among them (25% and 50%) to record the survival and growth performance of each of the species. Survey of the disease and pest problems of each of the species in natural stands, nurseries and trial plantations, and control measures for those potential pests and diseases in nurseries and plantation trial experiment were also undertaken as part of the study. To supplement the data generated on the plantation aspects, details on the botany, natural distribution, within species variation, ecology and wood anatomical and utilization aspects of each of the species were also investigated and reported.

Results of the nursery and plantation trial experiment had shown that *Albizia odoratissima* can be grown on a plantation scale in mixtures, especially with *Grewia* and *Grewia tiliifolia* is a potential plantation species both in pure and mixtures. In the case of *Haldina cordifolia*, it is a very potential plantation

New research projects

KFRI 135/'91

Silviculture, Management and Utilization of Bamboo Resources of Southern India (Phase II).

Investigators: M.S. Muktesh Kumar, A.R.R. Menon, P. Vijayakumaran Nair, K.C. Chacko, R.C. Pandalai, K.K. Seethalakshmi, Thomas P. Thomas, C. Mohanan and R. Gnanaharan (Project Co-ordinator)

Objectives: The general objective of the project will be to assess and evaluate the bamboo resources and develop methods for enhancing production and improving utilization potential. The specific objectives are 1) to carry out an intensive taxonomical study of bamboos and prepare distribution maps, 2) to estimate the growing stock of bamboos using remote sensing techniques, 3) to create a geographical information system for bamboos, 4) to collect and establish a germplasm collection and conduct species/variety trials of promising bamboos, 5) to develop methods for storage of bamboo seeds and propagation using branch cuttings, 6) to determine the influence of soil properties on the growth of bamboo stands, 7) to develop methods for the control of important diseases of bamboo, and 8) to adapt and develop jointing and other techniques for manufacturing bamboo furniture.

KFRI 136/91

Management and utilisation of rattan resources in India (Phase II).

Investigators: C. Renuka, M. P. Sujatha, U. N. Nandakumar, K. K. Seethalakshmi, R. C. Pandalai, K. M. Bhat (Co-ordinator), C. Mohanan, T. K. Dhamodaran and P. K. Muraleedharan.

Objectives: The general objective of the project will be to determine the means of enhancing production and improving utilisation of rattan resources for generating rural income. The specific objectives are 1) to extend the taxonomic survey of resources to the Andaman and Nicobar islands and North-eastern states and expand the live-collections of indigenous and exotic species, 2) to study the reproductive biology and phenology of rattans, and to establish seed orchards of selected commercial species, 3) to carry out continuous inventory of rattans in permanent sample plots, 4) to develop seed storage methods and standardise propagation techniques, 5) to determine silvicultural requirements in both natural stands and rattan plantations for maximum yields, 6) to extend the studies on anatomical, physical and mechanical properties of rattans to those growing in different parts of India including the Andamans, 7) to improve rattan harvesting and processing techniques including protective measures against biological degradation, and 8) to evaluate the socio-and techno-economic aspects of rattan industry and rattan market potential in different parts of India.

Both the projects are financed by International Development Research Centre, Canada.

NATIONAL SEMINAR ON SOCIO-ECONOMIC RESEARCH IN FORESTRY

Kerala Forest Research Institute proposes to organise a national seminar on socio-economic research in forestry at Thrissur in May 1992. The seminar is sponsored by Ford Foundation, USA. The theme of the seminar will be:

- Socio-economic appraisal of production forestry
- Economics of forest conservation
- Socio-economic analysis of social/agro-forestry
- Changing man-forest interaction

Participants who intend to present papers are requested to send abstracts of papers, not exceeding 300 words, before 30th November, 1991 and full papers by 1st March 1992.

Contact address:

The Convener, National Seminar on Socio-economic Research in Forestry, Kerala Forest Research Institute, Peechi - 680 653, Thrissur, Kerala.

Participation in seminars, symposia and workshops

Mr. T. Surendran (Plant Physiology) participated in the seminar on 'Vegetative Propagation/Biotechnologies for Tree Improvement' organised by the Research and Development Wing of Andhra Pradesh Forest Department at Tirupathi during 25-26 March 1991.

Dr. R. Gnanaharan and *Dr. K. M. Bhat* (Wood Science) attended the National Workshop on 'The Future of Wood in the World of Materials' organised by the National Materials Policy Project of the Department of Science and Technology (Govt. of India) and the Institute of Wood Science and Technology, Bangalore at Bangalore on 12 July 1991.

Dr. Gnanaharan presented an invited paper entitled 'Wood and environment: Impacts, pollution, biodiversity and sustainability'.

Dr. S. Chand Basha (Director), *Dr. K. Balasubramanyan, Dr. A. R. R. Menon, Dr. K. Swarupanandan* (Ecology), *Dr. K. K. N. Nair, Mr. N. Sasidharan* and *Dr. C. Renuka* (Botany) attended the symposium on 'Rare, Endangered and Endemic Plants of the Western Ghats' organized by the Kerala Forest Department at Thiruvananthapuram on 30-31 August 1991. The following papers were presented.

Endemic angiosperms of the Western Ghats of India with special reference to Kerala; A review (*S. Chand Basha* and *K.K.N. Nair*).

Sacred groves: Saviour of endemics (*N. C. Induchoodan* and *K. Balasubramanyan*).

Change detection study of Idukki region and endemism (*A. R. R. Menon* and *P. K. Chandrasekhara Pillai*).

An analysis of physical basis and causes of rarity in the Asclepiadaceae R. Br. (*K. Swarupanandan*).

Rare and endemic trees in the forests of Trichur (*N. Sasidharan*).

Conservation of rare and threatened medicinal plants in the forests of Kerala (*N. Sasidharan*).

Rare and endangered rattans of the Western Ghats and their conservation (*C. Renuka*).

Training programmes

Dr. M. S. Mukteshkumar (Botany) attended a training programme on Bamboo taxonomy under the guidance of *Dr. Elizabeth A. Widjaja* at Herbarium Bogoriense, Research and Development Centre for Biology, Bogor, Indonesia from 22 April-4 May 1991 (sponsored by IDRC, Canada).

Dr. K.S.S. Nair (Entomology), *Dr. R. Gnanaharan* and *Dr. K. M. Bhat* (Wood Science) attended the Forestry Research Management Course conducted at the Indian Plywood Industrial Research Institute, Bangalore during 8-20 July 1991 (course sponsored by IDRC, Canada).

Study visits

Mr. T. K. Dhamodaran (Wood Science) visited various rattan processing industries in Indonesia and Malaysia during 17 February-8 March 1991 (visit sponsored by IDRC, Canada).

Dr. R. Gnanaharan (Wood Science) visited the different institutions of the Chinese Academy of Forestry and also various bamboo processing industries in China during 14-22 March 1991 (visit sponsored by IDRC, Canada).

Others

Dr. P. S. Easa (Wildlife Biology) participated in the elephant radio collaring programme of Bombay Natural History at Mudumalai Wildlife Sanctuary, Tamil Nadu during 18-20 June and 16-20 July 1991.

Dr. P. S. Easa (Wildlife Biology) gave a guest lecture for the Panchayath Executive Officers at the Kerala Institute of Local Administration on 2 August 1990.

Forthcoming events

2-4 December 1991

International Teak Symposium, Trivandrum, Kerala, India.

Contact: The Chief Conservator of Forests, Trivandrum - 695 014, Kerala, India.

6-10 January 1992

Workshop on Integrating Forest Information Over Space and Time, Canberra, Australia.

Contact: Dr. Brian Turner, Dept. of Forestry, Australian National University, GPO Box 4, Canberra, ACT 2601, Australia.

13-17 January 1992

Workshop on Remote Sensing and World Forest Monitoring, Bangkok, Thalland.

Contact: Dr. Songkaram Thammincha, Faculty of Forestry, Kasetsart University, Bangkok 10900, Thalland.

January 1992

Workshop on Sustainable and Effective Management Systems for Community Forestry, Bangkok, Thailand.

Contact: Somsak Sukwong, Director, Regional Community Forestry Training Centre, Faculty of Forestry, Kasetsart University, Bangkok 10900, Thailand.

4-6 March 1992

International Scientific Seminar: Results of Earth Observation through Space Remote Sensing, Havana, Cuba.

Contact: Academy of Sciences of Cuba, La Habana 2, Cuba.

March 1992

International Symposium on Non-Wood Forest Products, Taipei, China.

Contact: H.H. Chung, Division of Forest Management, Taiwan Forestry Research Institute, 53 Nan-Hai Road, Taipei 10728, China.

Campus news

Joined KFRI

Dr. E. M. Muralidharan joined the Institute as Scientist D in the Division of Genetics on 27 May 1991.

Left KFRI

Mr. K. Ravindran, Librarian resigned from the service of the Institute on 31 July 1991.

Mr. M. A. Padmanabhan Nair, Internal auditor, who was on deputation from the Kerala Government service left the Institute on 15 July 1991 to join the University of Calicut.

Returned after higher studies

Mr. K. Sankara Pillai, Assistant Librarian rejoined duty on 20 May 1991 after successful completion of M.L.I.Sc. Course in the Madurai Kamaraj University, Tamil Nadu.

Elected as fellow of IAWS

Dr. K. M. Bhat, Division of Wood Science has been elected as a Fellow of the International Academy of Wood Science.

Exhibition

The Institute participated in the All India Exhibition organised in connection with Valliyoorkavu festival at Mananthavady, Wyanad. Panels illustrating the importance and uses of forests and wildlife and the major achievements of KFRI in forestry research were the major exhibits. The participation helped to convey the message of conservation among the public.