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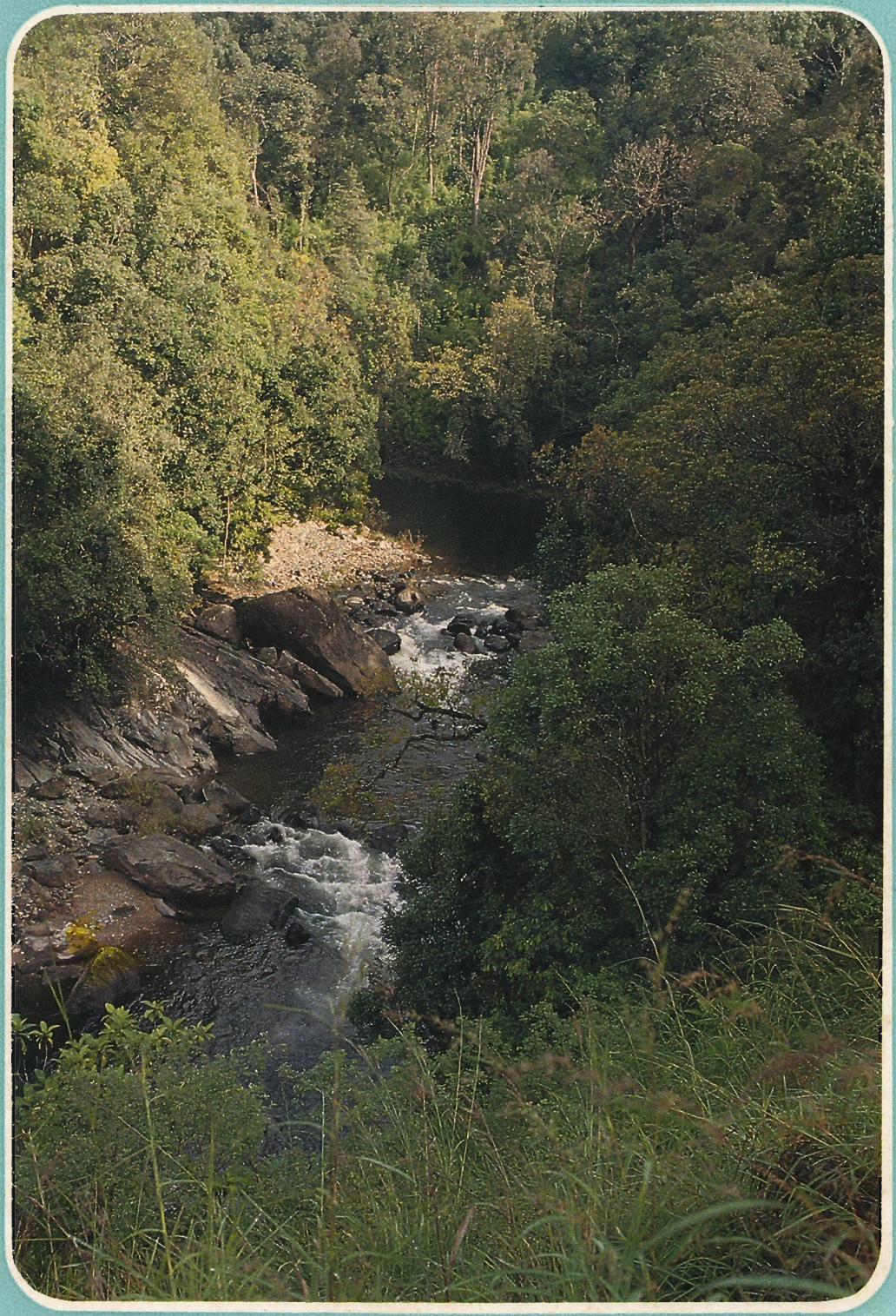

Newsletter of
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Cover - Silent Valley Printed at Lumiere Photo - Subhash Kuriakose

Editor's Column

Conservation of Forest Genetic Resources

The term genetic resources encompasses all living resources that are genetically based, and it denotes the richness of genetic diversity. Forest genetic resources in a broader sense includes all genetic resources of forest origin including trees, shrubs, wild relatives of crop plants, animals and even microbes.

For the past few decades man's activities have been highly devastating to the forest vegetations, with the result many of the wild relatives of useful species have disappeared from the surface of the earth and some are on their way to extinction. As a matter of fact conservation of our genetic resources has become inevitable. The concept of conservation of genetic resources envisages preservation of existing genetic stock and their diversity so as to make them available for posterity and to ensure continued evolution.

Among the forest genetic resources we are mostly concerned with trees and shrubs, especially the ones that are economically important. Preservation of wild varieties of crop plants are taken care of by several international agencies by *ex situ* conservation. Consequently wild genetic resources have done much to improve crop varieties. On the contrary, conservation of tropical tree resources has received very little attention.

Considering the ecosystem concept, the most ideal method is to preserve the genetic diversity of forest ecosystems, *per se*. Establishment of large natural areas in the form of biosphere reserves, national parks and sanctuaries is the viable means for *in situ* conservation. Though several programmes have been initiated in India in this direction, much more is desired. What we need urgently is to impress upon the government / decision makers on the necessity of conserving remaining genetic resources. It is also desirable to have a national level information network on forest genetic resources, especially on tree species

Preparation of inventories, mapping the pattern of distribution of species, assessing genetic variability within and between populations etc., are preparatory in deciding the size and number of areas to be conserved as protected areas. Once the inventories are made, a thorough understanding of the biology including phenology, pollination, mating systems, effective population size and gene flow between populations for each species and interaction between other components of the ecosystem is required. This is essential to formulate suitable management strategies.

The topic 'Conservation of woody genetic resources' is discussed in many national and international forums, but it has not received the desired follow up action. It is time to act so that whatever genetic wealth is left with us will survive.

Divisional Highlights-11

Wood Science

Wood is one of the most valuable natural resources. Though it is a renewable resource, the resource is being depleted rapidly. Effective utilization of this resource calls for understanding the anatomical, physical and chemical characteristics of the uniquely complex material, the wood. The Division of Wood Science was established in 1979 with the objective of unlocking the untapped potentials of the available resources of wood in Kerala. The Division has undertaken a number of problem-oriented projects.

Database

Available information on the well-known as well as lesser-known indigenous and some exotic timber species growing in Kerala was compiled and brought out as a handbook. Information is provided on botanical names along with local and trade names; physical and anatomical features; strength properties, drying characteristics, natural durability and common uses. The Division is also maintaining a Xylarium. Wood specimens of about 100 species are available in the collection.

Raw material

The Division has generated basic data on raw materials required by the rural, small-scale and large-scale industrial sectors.

Rural/Cottage sector : Cane resources play an important role in the rural economy and a large number of tribal people earn their livelihood. Anatomical and physical properties of ten cane species growing in Kerala were investigated to develop identification key and raw material classification system.

Small-scale sector : Kerala has about 225,000 ha area under rubber plantations. Though rubber trees are raised primarily for latex production, they become an useful source of wood. Rubber wood is highly susceptible to insect and fungal attack. The Division has developed a simple technique to treat rubber wood with cost-effective boron preservative chemicals. Treated rubber wood is suitable for furniture items.

Another non-conventional timber source is coconut wood. Kerala has about 700,000 ha area under coconut production. Root-wilt is a major disease of coconut palm. Large number of palms which are dead because of wilt-disease and senile palms are being felled. The Division has generated basic information on the physical and mechanical properties, sawn timber output, calorific value and quantity and quality of charcoal of wilt-diseased palms of different age groups and of non-diseased over-mature palms to be able to ascertain their utilization potential It has been found that stem wood from mature palms compare quite well with other locally available structural timbers.

Large-scale sector : Eucalyptus grandis is one of the most promising pulpwood species in Kerala. Effect of age and locality on the pulp-wood quality was studied. Factors like density, fibre length, bark content and heartwood content were investigated. The study suggests that any intensive silvicultural practice for faster growth of *E. grandis* should be encouraged.

There was another study conducted in the Division which evaluated the utilization potential of branch wood of 11 species which at present constitutes major fraction of logging residues. The study suggests that branch wood can be used to supplement the raw material resource for pulp, paper and reconstituted board industry.

The Division has developed a simple method to screen the species suitable for wood-wool board manufacture. The study showed that a knowledge of the amount of extractives and the pH of the extract of cold water, hot water and mild alkali will help in not only screening the suitable species but also in choosing the suitable method of extraction of the

extractives which are present in the tropical hardwoods which pose problems in the cement-bonded wood-wool board manufacture.

Raw material protection : The available resources, for effective utilization, should be protected from organisms that cause deterioration. For this purpose inter-disciplinary projects were carried out with Divisions of Entomology and Pathology.

Sapstaining fungi : Sapstain is a major problem in rubber wood. Different fungicides have been evaluated in the Division for the protection of rubber wood, especially during diffusion storage.

Decay fungi : Natural resistance of wood against decay fungi is being determined by employing an accelerated laboratory test for those species for which information is not available. One lesser-known species, *Vepris bilocularis*, was found to be moderately resistant to decay fungi.

Borers : Insect causing damages to rubber wood were identified. Boron-treated rubber wood was tested against *Sinoxylon anale* which causes heavy damage to untreated rubber wood and it was found that the suggested boron-treatment gives protection against this borer.

Field study : Insect and fungal problems of raw materials like reed and cashew wood, which are stored outdoors by the pulp industry, were studied. Efficacy of prophylactic treatment with different chemicals was examined.

Techno-economic study

The Division collaborated with the Division of Management to carry out a techno-economic study of sawmilling industry. Information on log characteristics, storage of logs, log handling, types of machines used and their maintenance, sawing techniques and grading systems was collected. The study indicated the following: productivity is as low as about 50 manhours per cubic metre of wood processed; poor condition and maintenance of machinery cause problems in sawn timber recovery and grade of timber; kerf width, sawing variation and sawing pattern play significant role in sawn timber recovery.

Extension

Also the Division caters to the needs of the wood industry through extension activities. Queries on alternative species for specific end uses, wood drying, wood preservation techniques, strength of wood, etc. are attended to. Services like timber identification, determination of moisture content, density, preservative retention etc. are also carried out.

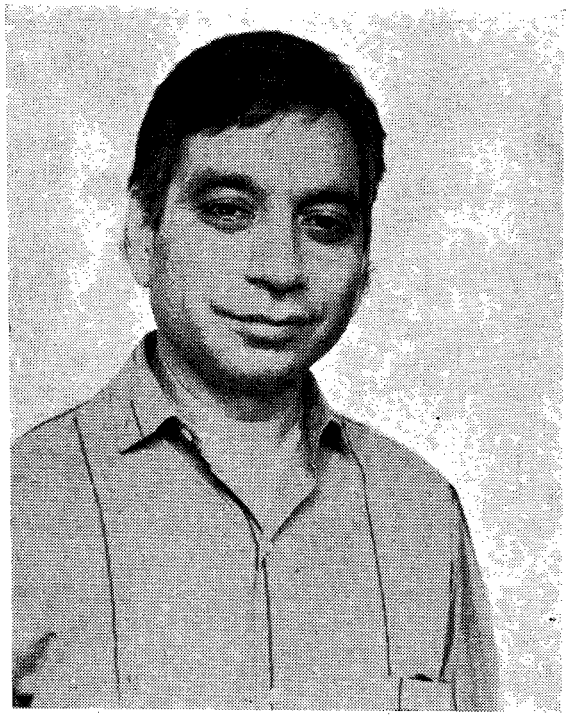
The Division is actively involved in the multidisciplinary projects on rattan and bamboo. Another ongoing project is on the wood properties of lesser-known species of Kerala.

The Division endeavours to unlock the potentials of lesser-known tree species and non-conventional sources of wood to maximise the benefits for the welfare of the state and the nation.

"Restoring to the community the sense of responsibility that was originally its own may be our only hope for the future protection of our soil, water, fisheries, pastures, forests and wildlife."

— M. S. SWAMINATHAN

Conservation and Management of Forest Genetic Resources



Dr. K. S. Bawa, Professor of Biology in the Massachusetts University, USA visited KFRI during March 1988. Excerpts from his talk delivered in the Institute are presented here.

Though the term forest genetic resources in a broad sense can also be used to include all the forest organisms like microbes and forest animals, usually the term is used with particular reference to forest tree resources primarily. By conserving the genetic resources, we mean conservation of all the heritable variations of a given species.

.....The main question now is that what should be our policy on the conservation of the forest genetic resources? Are we going to preserve these natural resources in national parks? Or are we going to preserve them in wildlife sanctuaries? ..... There are three primary types of conservation areas in the country and eventually we will probably be left with this intact vegetation. Where are our genetic resources to be conserved? ..... We do not know whether our genetic resources can be preserved *in situ* i.e., in the wild population in the natural ecosystem or *ex situ* i.e., to collect live plant materials and plant them in gardens or arboreta. But here again we do not have any clear idea as to how many species are to be conserved *in situ* and how many *ex situ*.

The next question would be on the biological information that we require to formulate a policy on the conservation and management of our forest genetic resources? In the tropics, there are thousands of species which are being used in one way or the other. Hence, the problem of conservation and management of resources become a complex problem as compared to the temperate regions, where there are only a few forest tree species that are being used.

.....So, under tropical situation we cannot study the biology of each species to determine how we are going to conserve each one of them. For this purpose it might be useful to distinguish two groups of species—species which are of limited or of potential use and the group of species which are being intensively used such as teak, shorea etc.

.....Now what we need is to have an inventory of the species of limited and potential use. The state of inventories of biological resources in general and forest genetic resources in particular is very poor in the tropics and subtropics. For example, in U. K., areas have been inventored at 10 km^2 whereas in the tropics it is on an average of 100 km^2. As a result many forest tree species remain undescribed. A notable example can be cited from South America, where a tree genus when monographed, 25 out of 150 were new species. Likewise, the flora of the Colorado Islands covering an area of only 1400 ha was published eight years ago. But seven years after the flora was written, 15 new species have been described from that locality. This just illustrates how little we know as to what is contained in many of these forests.....

The situation may be different in a place like Kerala, where the flora in general is better known than the Central and South American countries. But at the same time we should not be surprised if taxonomists continue to discover new species. Unfortunately the pace at which we are conducting inventories does not commensurate with the rate of deforestation. In Western Equador, for example, 100 new species are described during the last two or three decades.

.....So, an inventory of the species is the first step to be taken up and then to find out the distribution of their populations. Here what we need is to have good maps showing the distribution of some of our most important forestry resources, also try to assess the status of those areas where some of the most important populations are located. Once the inventories are prepared, we will come to the conclusion that it is inevitable to preserve some of these populations *in situ* in biological reserves.

.....Then comes the question, what should be the size of the population to be conserved and also the minimum number of individuals that are required to be effectively conserved? The estimates range from 50. If our interest is only short term conservation i. e., for 100 years and if we are willing to tolerate one per cent inbreeding and if the generation time is 10 years then we can conserve a population of 50 individuals without much loss in genetic variablity. Nevertheless on a long term basis, to retain the evolutionary potential of a population and to avoid loss of genetic variability, the number mentioned is 500 individuals that can breed with each other. But if we have to have effective breeding size of 500, we have to have 1500 to 2000 individuals.....

Now the question is what is the size of area we need to conserve 1500 to 2000 individuals? Approximately 1/3 to 1/2 of the tropical tree populations have a density of one adult per ha and if 1500 to 2000 individuals will have to be conserved one would need 2000 ha or 20 km^2 area. From data collected by Peter Ashton, it has been found that in South East Asia there are about 200 individuals of rare tree species in 20 km^2. Then for the conservation of 2000 individuals of the rare species one would require an area of 200 km^2, which is a fairly large area and going to be impossible in many cases..... The next question is how many areas and populations do we require?..... There is no definite answer to this question. To get a theoretical answer, it has been found that in many of the outcrossing species, if we conserve three populations, we are likely to conserve 90% of all the genetic variability... ..... From a genetic point of view it is better to have multiple populations, multiple areas of somewhat relatively small sizes than to have a very large area.

..... It is not just sufficient to declare an area as a reserve. One has to manage that area. The question is what type of research is needed for the management of that area, so that those genetic resources do remain in that particular area and perpetuate. For this we have to have some knowledge of the ecosystem dynamics; we also should have some idea about the symbiotic relationships of at least some of the important species including their pollinators, seed dispersal agents, mycorrhizal associations etc..... We have to make sure that the system is preserved as a system and not as a collection of different species. It was pointed out to me that in Silent Valley, *Cullenia* and lion-tailed monkeys occur together and the latter help in the seed dispersal of *Cullenia*. This has to be investigated in detail and if there exists a strong obligatory relationship then we have to conserve the system as a whole.

...Now coming to the intensively used resources, what type of biological information we have to have for their conservation.....It is really very sad to say that we do not have a good idea of the distribution of genetic diversity within and between populations, say for two of our most important tree species i. e., teak and sal.....Incidentaly it has been shown

Soil Technology Packages for Enhancing Productivity in Teak Plantations of Kerala

Soil condition and requirements of agri-horticultural crops in the State have been identified from decades of experience and research. In contrast, those for the forest trees have had scant attention. Through various projects and associated studies by the Institute, around 600 point observations are available; however, most of these soil observations are not related to teak growth and productivity.

Soil requirements of teak may have to be seen against its indigenous habit and the fairly long rotation of 50 years or more. Studies along this line will lead to soil suitability for teak, which is a component of the land-site-soil suitability spectrum. Land comprises several resources and being heterogenous, it can be parcelled into sites which are less heterogeneous. Soil is but an element of the site and very often an important one in that success or failure of a tree stand may depend on the soil conditions. Having chosen a site for teak plantation based on climatic, physiographic, biotic and management parameters, soil suitability takes on different hues. Quite often in a site, soil heterogeneity will be a problem to reckon with. Attempts to homogenize soil conditions, as in agri-horticultural systems, may not be practical and if at all resorted to are costly.

Soil suitability for teak leads to questions like adequacy or sufficiency of soil to yield productive tree stand. Having established the qualitative and quantitative attributes of soils, the manager may opt for adding soil inputs or modification of soil surface to make the site a better one for teak.

This project will touch issues connected with soil suitability for teak and not land or site suitability, which are broader ones. The objective is to assay soil suitability in teak plantations of various Forest Divisions of Kerala as well as formulate technology packages for different soil conditions and types of teak plantations.

T. G. Alexander
Division of Soil Science

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that trees on an average have twice the level of genetic variability between populations. But there are species like *Eucalyptus caesia* which shows 61% variability between populations. In those species just by conserving one population we are losing a lot of genetic variability. So genetic diversity is perhaps the most important area in terms of conservation of forest genetic resources. .....Unless we know level of genetic variability and how that variability is distributed in space, we really cannot design very effective conservation strategies.

Another area of critical importance is on the reproductive system, i. e., mode of reproduction. It is the mode of reproduction that determines the level of genetic diversity in a population. But we have a poor knowledge of the reproductive systems of many of our commercially important tree species. We should have knowledge of phenology, pollination, mating system and some idea of gene flow..... Suppose we are establishing a seed orchard and if we don't know how far the pollinators are flying around, we won't know whether our seed orchard is going to give us the seeds from the seed orchards or from pollens coming from outside. These questions of breeding structure of population is becoming very important in establishing seed orchards.....

Most of the things that I have talked about is part of a report we prepared for the National Academy of Sciences, when we were given the task of looking at the whole question of global management of forest genetic resources. One of the conclusions collectively arrived at by three or four of us is that importance of studies on forest genetic resources is not very well recognised. Though in India, we have very good means of conservation of crop genetic resources, in terms of forest trees, we have not given much importance and so there is a rapid erosion of forest genetic resources.

The Wattle and Gum Story

For someone who scans through the daily news papers and weeklies, it is not uncommon to find several articles written on wattles and gums. In olden days it used to be the habit of only poets to describe the plants in a flowery language and the birth right of scientists to describe them in a technical and ununderstandable jargon. Today it looks that even the common man is interested in writing about plants. Unfortunately, the language is not all that flowery as one would expect. This recent interest in plants and the environment is not a phenomenon in India alone, but the world over. As a matter of fact in West Germany these naturalists have organised a strong political party called "Die Grunen" (translated as "The Greens") and occupy several seats in their parliament. In Australia the so called "Greenies" were able to reverse a decision by the federal government to build a dam in Tasmania, thereby saving a beautiful piece of evergreen forest. In India, the "Chipko" movement has done commendable work in the protection of our environment.

Recently, the introduction of *Acacia* (wattle) and *Eucalyptus* (gum) into India has met with fierce criticism from many environmentalists groups. Most wattles and gums are natives of Australia, and they have been introduced here for various purposes. Anyone travelling on our highways recently would have noticed the greenary on either sides which appeared very barren previously. Wattles, some species of which are not browsed by cattle have no doubt transformed many of our barren countryside into lush green territories. The potentials for using the wattles as firewood and pulp are substantial. Although wattles have been introduced as a social forestry crop in Kerala, the gums have been occupying a major place in plantation forestry. The gums are mainly planted for satisfying the newsprint needs. Initially, the gums were planted after clear-felling some of the virgin forests in Kerala. However, very soon the authorities realised the mistake and put an end to this practice. Now in Kerala, the area under gum cultivation is less than 40,000 ha and as such there are no plans to expand this area.

What is wrong with the wattles and gums? In general, the environmentalists have been against the introduction of these alien species into India. Their argument is why do we introduce them when we have natives like the bamboos for paper pulp. Moreover, wattles and especially gums have earned a bad name for their high water consumption. The wattles have additionally become notorious for their alleged allergic pollen. Apart from these major problems, scores of other minor problems like the slowness in their litter decomposition, their inability to check the soil erosion, their inefficiency to support any wildlife have surfaced up recently.

Is there any truth in all these allegations against these two plants? Here, some aspects of their water use have been discussed.

A plant that grows fast certainly uses more water, and gums and wattles come under this type of plants. Not much work is available on the water use of bamboos which are also fast growing plants. However, plants could differ in their water use efficiency (WUE). This is the biomass produced per unit of water consumed. How is this possible? Some of the researches in Australia have shown that eucalypt species differ in their WUE. This they achieve by closing the stomata when the water loss by transpiration is potentially the maximum. At the same time the plants maintain a highly negative water potential so that they can take up the scanty amount of water available in the soil. It appears a wonderful thing if it is really happening. It certainly happens in the case of some species in Australian environment. At the same time they are using some other species which do not have the stomatal control for lowering water tables in some salinity affected areas of Western Australia. This shows that one has to be very choosy in introducing a particular species of eucalypt.

What shall we do about this in Kerala? At the moment we do not know much about water use of the two species of eucalypts introduced in Kerala, namely, *Eucalyptus tereticornis* and *E. grandis*. It is

now important to study whether they exhibit a stomatal control mechanism in our environment. Let them use as much water as they want during our monsoon and grow fast for our paper needs. But let them not use our precious water resources during summer. After all, water is more important than paper.

To find out the real answers to many of these problems we need to study them. Blaming the plants or introducing anything will not solve our problems. In K. F. R. I., we are initiating the process of a detailed study on the water use of gums and wattles. At the end of this study we hope to give concrete recommendations regarding them. Certainly we need paper, and water too. Is it possible to provide enough raw materials from the available land? Can this be done without adversely affecting our environment? I feel these are possible by judicious use of the diversity shown by plants.

Jose Kallarackal
Division of Plant Physiology

'Man has often been called the tool maker but he might just as well be referred to as a predator whose natural instinct is to kill with a weapon'

ROBERT ARDREY

Diseases of Forest Trees in Kerala

3. Bombax ceiba

Bombax ceiba L., distributed throughout India, occurs specially in moist deciduous forests. Being an important softwood species it is raised in plantations as well as in homesteads and farmlands. In Kerala, it is usually grown in 'softwood plantations' mixed either with teak or *Ailanthus triphysa*.

A disease survey conducted during 1982-1985 in numerous nurseries and plantations in the State has revealed the occurrence of eight parasitic diseases including one phanerogamic parasite on *B. ceiba*. Certain diseases common to both nurseries and plantations are described under plantations where they were more prevalent.

NURSERY DISEASES

1. Collar rot

Causal organism: *Rhizoctonia solani* Kuhn state of *Thanatephorus cucumeris* (Frank.) Donk.

Occurrence: The disease, resembling damping-off, was recorded in 1-to 2- month-old seedlings of *B. ceiba* at Peechi. The disease, first noticed in isolated patches spread fast in all seedbeds affecting a large number of seedlings. More than 50 per cent of the seedlings died due to this disease within a month.

Symptoms: The initial symptom of the disease was the appearance of water soaked lesions on the hypocotyle (Fig. 1). Later these lesions turned brown in colour and the infected area got decayed. Affected seedlings usually collapsed from the decayed portion, fell over the ground and died.

Control measures: Collar rot of *B. ceiba* was controlled by drenching the seedbeds twice with Emisan-6 (0.0025% a.i.) at an interval of ten days. Since the disease is manifested under high soil moisture regimes, the watering frequency as well as quantity per bed should be reduced after the appearance of the disease to check its further spread.

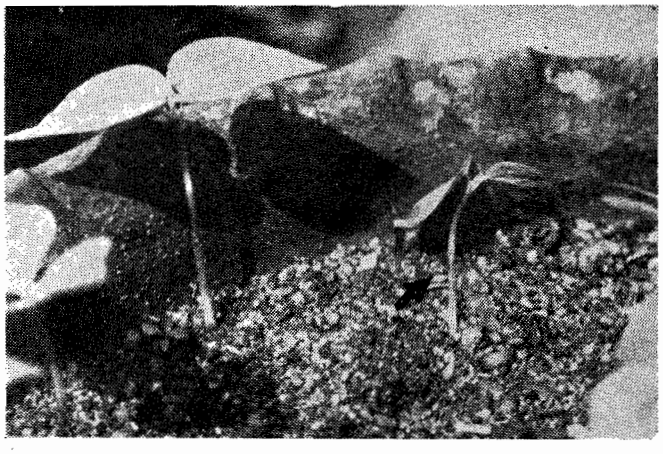


Fig. 1. Collar rot caused by *Rhizoctonia solani* in 1-month-old seedlings.

2. Leaf blight

Causal organism: *Corticium rolfsii* Curzi

Occurrence: The disease was first observed during the monsoon, affecting seedlings of *B. ceiba* and *B. insigne* in a nursery raised at Peechi. Usually severe leaf blight was followed by stem infection which killed the seedlings. In some of the seedbeds as many as 25 per cent of the seedlings died.

Symptoms: The initial symptoms of the disease were the appearance of small circular brownish-yellow spots in concentric rings on the leaflets. These spots increased in size and coalesced to form large necrotic areas which often covered the entire leaf and even the petioles (Fig. 2). Soon, because of rotting of petioles, the leaves bent downwards and dried up. The infection spread rapidly through contact of diseased leaves with healthy ones causing extensive premature defoliation. Contact with stem caused stem decay which resulted in death of seedlings. On the affected leaves and stem, numerous off-white sclerotia developed which fell over the ground after getting detached easily from the mycelium.

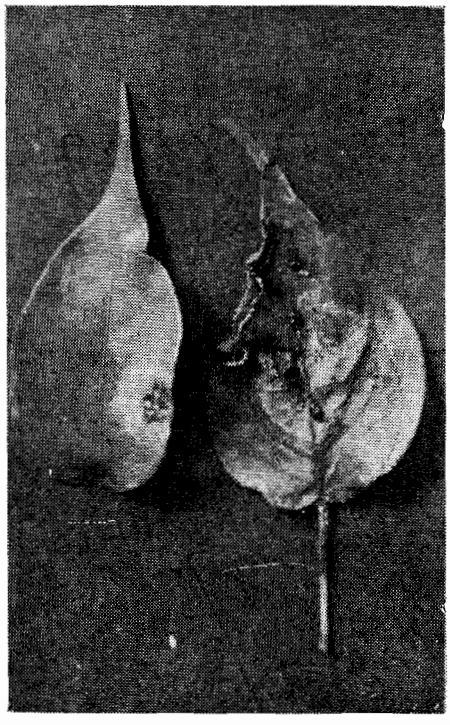


Fig. 2. Cotyledonary leaves showing leaf blight symptoms.

Control measures : Two foliar sprays of Emisan-6 (0.005% a. i) applied at a week's interval were found to be effective against leaf blight disease of *B. ceiba.*

PLANTATION DISEASES

1. Leaf rust

Causal organism : Uredo bombacis Petch. Only the uredinial stage was observed on *B. ceiba.*

Occurrence and severity : Leaf rust of *B. ceiba* was observed throughout Kerala. The rust usually appeared towards the middle of South-West monsoon (July/August) and continued to attack healthy leaves till the time they were shed in January/February.

The incidence and severity of the disease varied depending upon the locality and time of observation; generally, the severity varied from low to medium in most of the plantations, except in some plantations in northern Kerala where it was absent.

Symptoms : The rust infection first appeared only on leaflets of mature leaves. Later, as the top young leaves matured, the infection proceeded upwards and by December all the leaves got infected. Initially infection appeared as light greenish-yellow flecks on the upper surface during the rains. Uredinia developed in the form of light yellowish-orange blisters, 1-2 mm across, scattered on the lower surface. Later, after the eruption, the pustules appeared bright-orange-brown in colour. Upper surface of leaf showed characteristic yellowish-orange flecking at the location of uredinia on the lower surface (Fig. 3). When the rust infection was severe (> 25 uredinia cm^{-2}) the whole leaflet turned yellow and defoliated prematurely.

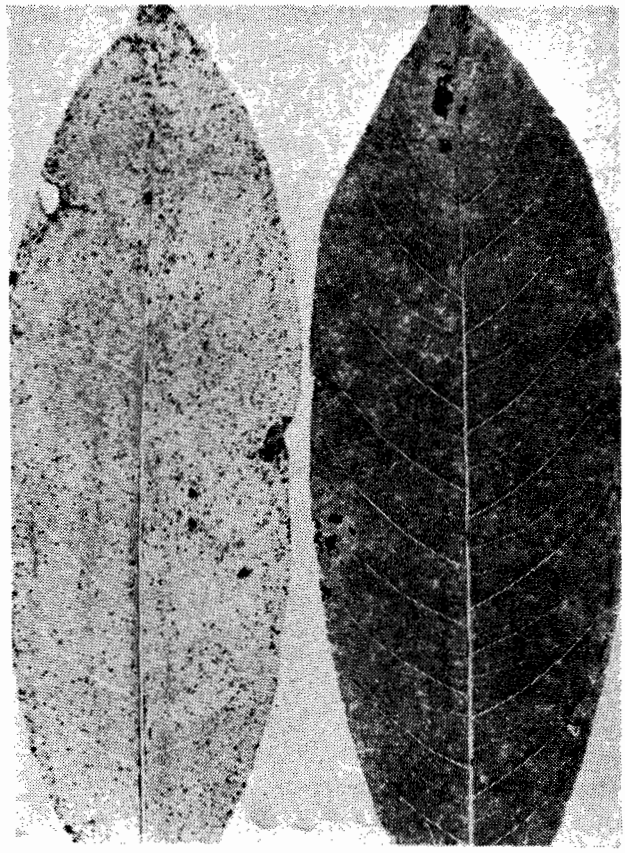


Fig. 3. Symptoms of leaf rust on the abaxial and adaxial surfaces of leaflets.

During December / January, possibly a different strain of the rust was noticed causing angular necrotic spots, dull whitish-grey to light brown in colour. Unlike the other strain in this case the uredinia were grouped. The same leaf was found to be attacked by both types of rust strains.

2. Myrothecium leaf spot

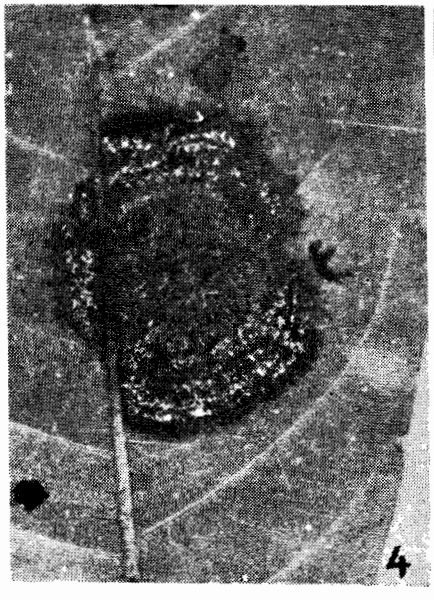
Causal organism : Myrothecium roridum Tode ex Fr.

Occurrence : Myrothecium leaf spot, a serious disease of *B. ceiba* was observed throughout Kerala.

The disease usually appeared towards the end of the monsoon during August/September and continued to affect fresh foliage till November/December.

The incidence of the disease was quite high in all the plantations but the severity varied greately from locality to locality and year to year and it showed a decreasing trend as plants grew older. Severe infection resulting in premature defoliation was recorded in plantations located in high humid areas.

Symptoms : Initially, amphigenous, minute, circular light brown spots with dark brown margin developed on leaflets of any leaf irrespective of



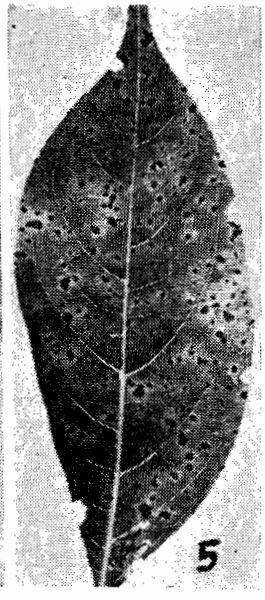


Fig. 4. A magnified view of Myrothecium leaf spot.
Fig. 5. Leaflet showing symptoms of Colletotrichum leaf spot.

maturity but more on older ones. Sporodochia developed on both the surfaces, usually more on the lower surface, at the periphery of spots. The sporodochia produced abundant olive-green conidial mass which later turned dark in colour. The fungus invaded the adjoining green tissues and formed large necrotic brown areas. As the spots enlarged, more concentric rings of sporodochia were added. The sporodochia of the inner rings became more or less inactive producing fewer conidia as compared to those situated in the outer ones. Thus, each leaflet developed one to four large spots, circular to oval with uniform to irregular dark brown margin, 15-25 mm in diam (Fig. 4), which eventually coalesced to give rise to large necrotic area. The severely affected leaflets dried up and defoliated prematurely.

3. Colletotrichum leaf spot

Causal organism : Colletotrichum gloeosporioides (Penz.) Sacc.

Occurrence : This disease was observed in 18-month-old saplings in a nursery at Peechi (Kerala Forest Research Institute Campus) and in a young plantation at Choodal. Infection was severe at Peechi while at Choodal the disease appeared to be unimportant. The disease was recorded during September-November.

Symptoms : The disease was characterised by circular, 1-2 mm diam dark black leaf spots with a narrow yellowish green border on the upper surface of leaflets (Fig. 5). On the lower surface the spots appeared dull grey in colour. Under high humid conditions, occasionally conidia were produced on the under surface of the spots. The necrotic area of the old spots got detached and formed shot-holes.

4. Cercospora leaf spot

Causal organism : Cercospora bombacina T. S. & K. Ramakrishnan

Occurrence : The disease, observed during October/November, was recorded only from two plantations at Choodal and Kannoth. The severity of the leaf spot was low at Kannoth while it was severe at Choodal.

Symptoms : The infection occurred on young as well as mature leaves as both were found to be equally susceptible to disease. initially small pale brown spots appeared on the leaflets which turned into cream coloured necrotic areas with dark brown margins and light pale halo around (Fig. 6). Severe foliage infection in a nursery at Peechi resulted in early defoliation.

5. Pink disease

Causal organism : Corticium salmonicolor Berk & Br. Only cob web, pustule and pink stages were observed on the affected stem.

Occurrence: Pink disease of *B. ceiba* was found affecting young trees (4-year-old) in one plantation

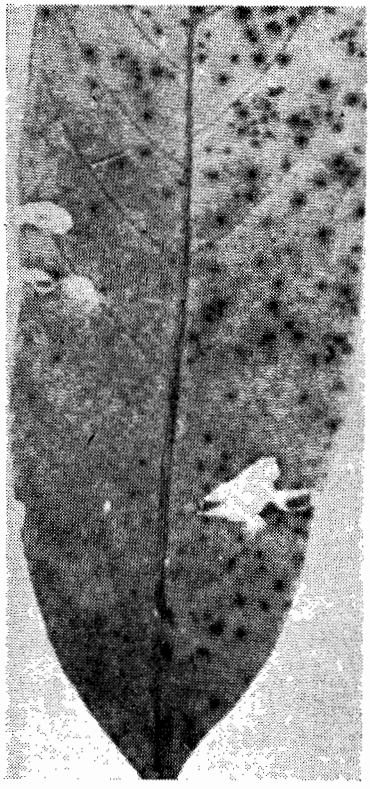


Fig. 6. Leaflet showing symptoms of Cercospora leaf spot.

at Mampazhathara. The disease was recorded during September at the end of South West monsoon.

Symptoms: The infection, characterised by pink encrustation over a canker, occurred somewhere on the upper half part of the stem. The stem above the canker rarely died due to incomplete girdling of phloem.

6. Phanerogamic parasite

Parasite: Dendrophthoe falcata (L.f.) Ettingsch.

Occurrence: Infestation of trees with a phanerogamic parasite was recorded at Choodal, Thundathil and Peechi, (Kerala Forest Research Institute Campus). Except at Peechi, where more than 3 clumps per tree were noticed, elsewhere there were only one to two clumps with about 2 per cent incidence in the plantations.

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'The state of health and well being of an individual is largely a function of the quality of the environment'.

UNESCO MAB

MIKANIA MICRANTHA H.B.K. - A Noxious Weed in the Forests of Kerala

Mikania micrantha H. B. K. belonging to the family Compositae is a weed of South American origin first recorded in India as *Mikania scandens* Willd. from the North-eastern part of the country towards the end of last century. Subsequently it was reported as a noxious weed mainly in tea plantations in Bengal and South India and Sri Lanka either as *M. scandens* or as *Mikania cordata* (Burm. f.) B. L. Robinson. Occurrence of this weed in Tripura, Manipur and Bhutan had also been established and its distribution in Burma and Malaysia is reported, where it is known as a weed that spread-mile-a-minute.

The status of this herbaceous straggler as a gregarious weed in the natural forest, forest plantations, agricultural lands, tea gardens, etc. in North-East India had already been noted. The author had also observed a decade back, the colonisation of this plant along the hedges, tram-lines and waste lands in Calcutta City and adjoining areas. Recently, it was noticed in the natural forests of Kerala in the Pooyamkutty Hydroelectric project area of Idukki District, where it is gregarious along the banks of Pooyamkutty river and its tributaries. Profuse growth of this weed in the area may be seen in disturbed and moist, reed extracted regions of the natural forests at an altitude of about 150-200 m above msl, where it completely suppresses the ground flora and also prevents reed regeneration. Climbing on shrubs and small trees covering their crowns is also very common here (Fig. 1). It is also a major weed in the teak plantations of Kothamangalam Division and teak seedlings and saplings may be seen dried up due to

Fig. 1. Spread of *Mikania micrantha* in the natural forests of Pooyamkutty.

it in the plantations around Edamalayar Hydro-electric Project. Deep interior in the natural forests of Western Ghats at Anamalai, Manali and upper Edamalayar of Malayattoor Forest Division also, the species has acquired a weed status.

Identity of the weed

Botanical identity of this Composit species in India was much disputed in the past. When Clarke (1876) reported it from North-East India, it was identified as *Mikania scandens* (L.) Willd. (syn. *Eupatorium scandens* L.) of North American origin now seen in Taiwan, Philippines, Celebes, Malaysia and so on. Later, Robinson (1934) pointed out that the Old World species known as *M. scandens* is not truly that species, and later, based on Koster's (1935) morphological differentiation of the Malaysian Mikanias, Raizada (1958) came to the conclusion that the species known as *M. scandens* in North-East India is *Mikania cordata* of Asiatic origin. Subsequently Vaid (1973) examined the identity of this weed in India with the help of specimens collected from North-Eastern parts of the country, Bhutan, Manipur, Calcutta, etc. which he got identified at Gray Herbarium, Harward, USA as *M. micrantha* and this agrees with some of its Assam collections in Kew Herbarium. Those plants collected from Pooyamkutty is also *M, micrantha* H. B. K.

Characters

Climbing, straggling or rarely suberect herbs or undershrubs; stems and branches sparsely puberulous or subglabrous. Leaves opposite, 4-8 x 2-5 cm, ovate with wavy margins, acuminate at apex, cordate at base; petioles 1.5-3.5 cm long, puberulous or subglabrous. Flowers in compact, terminal, corymbose paniculate heads on axillary branches, white, homogamous, 0.4-0.5 cm long, 4-5 flowered; bracts 4 or 5, elliptic-oblong, shortly acute or mucronate at apex; calyx with often short, annular limbs; corolla white, campanulate, slender, 5-fid; stamens syngenesious; anthers obtuse at base, appendiculate. Achenes about 0.2 cm long, 5-angled with 1-2 seriate, white pappus hairs.

Ecology

Disturbed, moist areas in natural forests, especially along river banks and in plantations of teak. Multiplication by seeds, cuttings and runners. Flowers by November-December and fruits by February-March.

Control

Being a noted weed of the tea gardens of North-East India, its chemical control was attempted with 2, 4-D, MCPA, etc. with partial success. In Sri Lanka and North-East India, as a step for the biological control of the weed, parasitic *Cuscuta chinensis* plants were introduced where again the weed was affected only partially. It is worthwhile to attempt chemical or biological control measures to check this weed which in Kerala conditions is found to be more gregarious than in North-East India.

Selected reading

Clarke, C. B. 1876. *Compositae Indicae*. Calcutta.

Koster, T. J. 1925. The Compositae of Malay Archipelago. *Blumea* 1 : 352-536.

Raizada, M. B. 1958. Comments on the note on distribution of *Mikania*. *Indian For.* 84 : 648.

Robinson, B. L. 1934. *Mikania scandens* and its near relatives. *Contr. Gray Herb.* 104:55-77.

Vaid, K. M. 1973. A. preliminary note on the identity of the controversial *Mikania*. *Indian For.* 99 : 19-22.

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The most accurate, up-to-date research data will be worthless unless they are presented with the end user's objectives in mind.

UNESCO MAB

Bamboo Resources in China

The author visited China as a participant in the International Farm Forestry Training Programme held at Beijing during May 1 to 30th, 1987. This programme was organised and sponsored by the International Development Research Centre, Canada, and Ministry of forestry, People's Republic of China The route map and places visited are shown (Figs. 1-2). A brief summary of the bamboo resources in China are given here.

In China there are more than 400 bamboo species belonging to 34 genera. The total area under bamboos, excluding small bamboo undergrowths and alpine bamboo thickets, is estimated to be about 3 4 million ha with a standing stock of over 72 million tonnes and an annual yield of about 7 million tonnes. The most important commercial bamboo is *Phyllostachys pubescens*, which covers 2.40 million ha with a standing stock of 56.55 million tonnes and annual production of 5 million tonnes.

Traditionally, bamboo has been used in agriculture, construction, rural industry, handicrafts, etc. Tender shoots of about 100 bamboo species are edible. Their production extends over 1 million tonnes per annum. With the increasing demand for bamboo products and improvement of processing techniques, bamboo industry is growing up rapidly. There are more than 100 factories engaged in production of bamboo plywood, particle boards, hardboards, laminated furniture, moulded and woven bamboo products and modern bamboo paper mills.

The main bamboo growing regions are:

1. Yellow river bamboo region

Here, the main genera found are *Arundinarea, Fargesia, Phyllostachys* and *Pleoblastus*.

2. Yangtze River Bamboo region

The main genera found in this region are *Brachystachyum, Indosasa, Indocallamus, Phyllostachys* and *Pleoblastus*. Among the bamboo forests probably, this is China's largest and richest bamboo area. Over 2,400,000 ha of *Phyllostachys pubescens* are available here.

3. South China bamboo region

In this area numerous species of Chinese bamboo occur. The main genera are *Acidosasa, Bambusa, Chimnobambusa, Dendrocalamus, Indosasa, Melocanna, Oxytenanthera* etc. are frequent.

4. Alpine bamboo region

It is located in the high mountainous range of West China. This area is of primeval bamboo forest, where animals like Panda and golden monkey are naturally inhabited. The main bamboos seen here are *Chimnobambusa, Fargesia, Yushania* and *Queongzhuea*.

Bamboos are grown in China for the following purposes.

The production of timber bamboo stands

China has an area of 7 million ha of bamboo forests, among which 4 million ha are pure bamboo forest, 3 million ha primeval mixed bamboo forests and alpine bamboo forests. Of the former, 2,800,000 ha is covered with *Phyllostachys pubescens*. Annual felling is 10 million tonnes of which 5 million tonnes are commercially used.

Production of Shoot-bamboo stand

Bamboo shoot has been a traditional dish for the Chinese. *Phyllostachys pubescens, P. praecos, P. nuda* are commonly used for the purpose and grown in large scale and yield better quality edible shoots. For edible shoot production, the timber bamboo stands as well as shoot bamboo stands are depended. In the timber bamboo stand over 50-60 per cent of the bamboo shoots that are of low quality for timber, are extracted for edible purposes. In the shoot bamboo stands various managerial practices are undertaken to yield the high quality edible shoots.

Bamboo stands for paper pulp

About a million tonnes of bamboo is used for paper making. Main species of bamboo used for paper pulp are *Bambusa rigida, B. textilis, B. syno-*

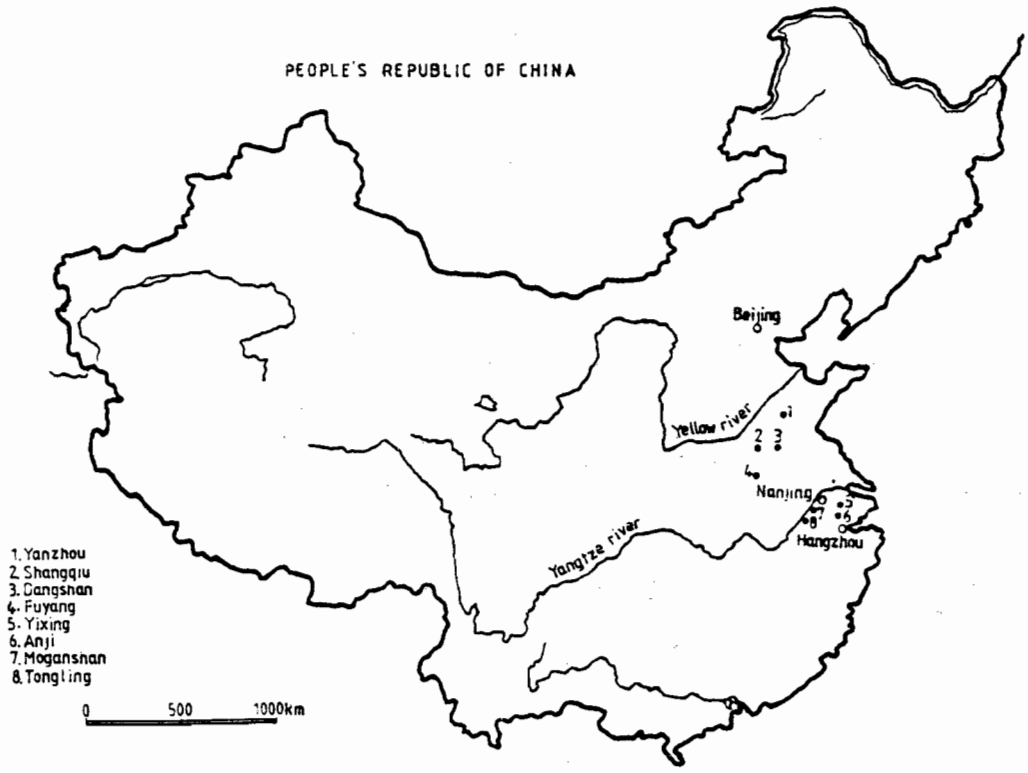

Fig. 1. Areas visited

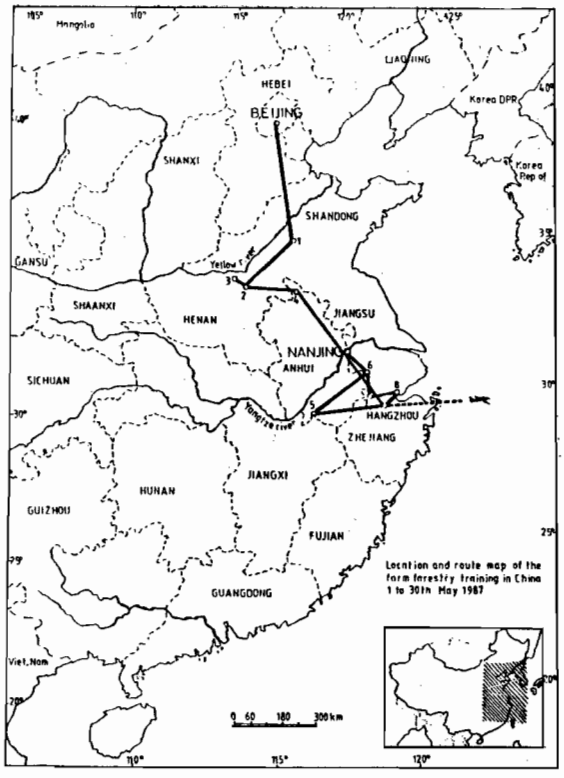

Fig. 2. Route map

spinosa, Lingnania chungii, Phyllostachys makinoi, P. pubescens, Sinocalamus affinis, S. farinosus and *S. oldhami*. The management levels of bamboo stands for paper pulp differ from place to place. The Chinese traditional handmade paper is produced from young bamboos. Since paper making is recently mechanised, mature bamboo is also used.

The protective bamboo stands

Bamboo is planted on the sides of the river banks, lakes and reservoir to provide soil protection and water conservation.

Propagation

The main methods for bamboo propagation are by seed and culm cuttings. In the vegetative method of propagation, culms and nodes are used. Other methods like strip planting, layering, offset planting, stock planting, seedling cluster and even tissue culture is being practised.

Pests

More than 200 species of insect pests are so far recorded. The most important one is the bamboo locust (*Ceracris kiangsu*) which occurs in ten provinces south to Yangtze river and destroys large areas of bamboo plantation. Others like bamboo leaf roller (*Algedonia coolesalis*), bamboo shoot borer (*Cyrtotrachelus longimanus*), bamboo shoot noctuids (*Oligia valgaris*) are important pests in some localities. Bamboo powder post beetles (*Dinoderus* sp.) are very common in South China. Bamboo coccids (*Nesticoccus sinensis, Rhizococcus fransversus* and *Bambusaspis hemispherica*) and bamboo twig wasp (*Aidomorphus rhoploics*) are also reported to be economically important.

Disease and pest management

In the dense bamboo plantations pest and disease incidences are comparatively low. There are over 60 species of scale insects recorded from bamboo. They are controlled by spraying insecticides. Parasitic wasps and lady beetles are used as natural enemies. Injection of Methamidophos or Acephate into the base of bamboo pole is also practised.

Although pesticides are still being used extensively, as part of the integrated pest management programmes more emphasis on biological control of forest pests is given recently. Synthetic pheromones are being used for monitoring pest population density and to prevent the mating opportunities of insects. A small wasp (*Trichogramma dendrolimi*) which parasitises insect eggs and two microbes *Beauveria bassiana* and *Bacillus thuringiensis* are being used as natural pest controlling agents.

In the farm forestry area of Loagshan, bird predation is considered to be a major control method. The birds feed on the larvae of *Dendrolinus punctatus* in large quantities. Birds that are being reared for this purpose include *Cyanopica cyana* (Azure winged magpie) and *parus major* (Tit).

Bamboo research

Recently in China a number of Universities, Institutes and Business Organizations have undertaken many important research projects related to bamboo production and utilization. Bamboo Research Institute at Nanjing is one of the most important research laboratory where several research project on bamboo is being undertaken and have gained national as well as international recognition.

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'Once nature dominated Man
Today Man threatens nature'

— WESTOBY

Data Base on Indian Forest Entomology

A computer data base of Indian literature on Forest Entomology has been developed. The data base presently contains about 1,000 references. Users can conduct on-line searches with the help of library staff. References may be searched based on author, year of pubication, journal, publisher or keywords. For example, if the search is carried out using the keyword, 'defoliator' all references with this keyword will be displayed. This will include defoliation on all species of plants as well as defoliation caused by different insects. To narrow down the search, the search terms can be specified as illustrated below.

defoliation * Hyblaea	:	defoliation in all species of trees caused by *Hyblaea*
defoliation * teak	:	defoliation by all insects in teak
defoliation * (teak + Ailanthus)	:	defoliation in teak and *Ailanthus* by all insects

The data base has been prepared using the PC version of CDS/ISIS package developed by UNESCO. It is mainly intended for on-line data search and retrieval. But considering the Indian conditions where many people do not have access to computers, a variety of off-line services are offered, which can be obtained from the KFRI library through mail on payment. Some of these are :

1 Copies of the references in floppy disks	:	Copies of references will be available in ISIS format or in word processor format. References can also be supplied in popular data base packages like dBASE or Scimate.
2 Print out and index of the data base	:	A print out of the data base with indexes is available.
3 Retrieval based on author, year or subjects	:	Print out on the basis of keywords, year or author can be supplied.
4 Index cards	:	The references can also be output in the form of index cards.

The ISIS package is not sufficient to meet all the above requirements. Additional services are being made available through programs specifically developed for this purpose at Kerala Forest Research Institute. This data base will be continuosly updated and maintained.

KFRI library

Recent Publications

Bhat, K. M. 1986. Effect of agroforestry practices on wood quality. *In* P. K. Khosla *et al. Agroforestry System - A New Challenge*. ISTS. pp. 105-109.

ABSTRACT

An arbitrary model depicting the effect of agroforestry practices on wood characteristics is hypothesized. *Eucalyptus* spp. and *Gmelina arborea* forming important components of agroforestry system are examined with a perspective to support the paper industry. The fast growth rate of these species results in lack of severe juvenile wood. The harvesting at young age might result in wood supply with moderate density, lower content, thinner fibre walls with larger lumen, which are desirable in paper industry. There is also an indication that faster growing trees yield longer fibres without seriously affecting the density of wood. The silvicultural management and genetic manipulation therefore offer considerable promise for better yield and desirable quality of wood.

Chacko, K. C., Sudheendrakumar, V. V. and Balagopalan, M. (1985). Studies on the feasibility of stump planting of *Eucalyptus tereticornis* Sm. *Malaysian Forester* 48(4): 330-338.

ABSTRACT

A study was conducted to find out the feasibility of stump planting of *Eucalyptus tereticornis* Sm. at Nilambur, Kerala, India. One and a half year old stumps with 15 cm tap root and 2.5 cm shoot with lignotuber intact were used. Effect of planting methods, fertilizer and insecticide treatments were studied. In all cases, most of the stumps sprouted during the first two weeks of planting and sprouting was complete in three weeks. Initially, the stumps had 4-10 shoots and the number came down to 2-4 in 9 months and subsequently only one strong shoot was left behind. Dipping of stumps in Aldrin 2% EC prior to planting delayed sprouting. Based on survival percentage and height growth, planting stumps in soil pits was found superior to planting in holes made of crowbar. In all cases of application of Factam Phos, increase in height growth was observed, the difference being remarkable in crowbar hole planting.

Florence, E. J. M. and K. V. Sankaran (1987). Seedling diseases of *Gmelina arborea* in Kerala - new records. Indian J. Forestry 10(4) : 271-272.

ABSTRACT

Two new diseases viz. a collar rot and leaf blight of *Gmelina arborea* caused by *Sclerotium rolfsi* have been reported from India for the first time.

Gnanaharan, R. (1987). Basic structure of coconut wood and its utilization potential in comparison with other standard woods. In P. K. Thampan *et al.* (Eds.) *Processing and Marketing of Coconuts in India*. Coconut Development Board, Cochin. pp. 159-161.

Gnanaharan, R. (1987). Commercial exploitation of coconut wood-Prospects. In P. K. Thampan *et al.* (Eds.) *Processing and Marketing of Coconuts in India*. Coconut Development Board, Cochin. pp. 162-164.

Mathew, G. (1987). Natural enemies of some timber borers in Kerala and their possible role in regulating pest incidence. *In* Advances of Biological Control Research in India (Eds K. J. Joseph & U. C. Abdurahiman), *proc. Nat. Semi. Entomoph Ins., Calicut*, Oct. 1985. pp. 170-175.

ABSTRACT

The role of various natural enemies in regulating the build up of wood boring insects in Kerala is reviewed. Twenty eight species of insects belonging to the families Cleridae, Colydidae, Histeridae, Tenebrionidae, Passandridae (Coleoptera); Braconidae, Pteromalidae (Hymenoptera) and three species of birds were listed as the natural enemies of 11 wood boring insects in Kerala. They belonged to the families Bostrychidae, Scolytidae, Platypodidae (Coleoptera); Cossidae and Hepialidae (Lepidoptera). Among the entomophagous insects listed, the clerids, histerids, colydids and braconids were present in large numbers in borer infested timber which could probably have played a role in keeping the pest population at a low level. The role of natural enemies in regulating the incidence of the wood borers needs to be further investigated.

Mathew, G. (1987). Insect borers of commercially important stored timber in the state of Kerala, India. J. Stored Prod. Res. 23(4): 185-190.

ABSTRACT

About 100 commercially important timber species are being extracted from the natural forests and plantations in Kerala State (India), and stored in depots. The stored timber is often attacked by boring Coleoptera. In the present study, 68 species of borers were recorded as pests of 50 species of stored timber. Fourteen new host records are included. The timbers most susceptible to borer infestation were *Anacardium occidentale, Bombax ceiba, Hevea brasiliensis, Mangifera indica,* and *Polyalthia fragrans* susceptible to infestation by cerambycid, platypodid, scolytid, or bostrychid borers; and *Artocarpus heterophyllus Canarium strictum, Erythrina indica, Lophopetalum wightianum, Tetrameles nudiflora,* and *Vateria indica* susceptible to infestation by scolytid, platypodid, or bostrychid borers. The nature and extent of damage by these borers warrants adoption of effective prophylactic treatments to timber stored in depots and storage yards.

Mathew, G. (1987). Cossid pests of plantation crops in India and the prospects of their management. *Proceedings of the Workshop on The Insect Pest Management Strategies in Coffee, Cardamom and Tea Cropping Systems.* Jan. 1987. Central Coffee Res. Inst., Chikmangalur. pp. 137-140.

Mathew, G. (1987). Biosystematics in lepidoptera and its importance in forest entomological research. *Proc. India Acad. Sci. (Ani. Sci.),* 96(5): 613-618.

ABSTRACT

Lepidoptera constitutes one of the dominant groups of insects in the forest ecosystem both in terms of species diversity as well as their economic importance. Segregation of taxa in this order is mainly based on the external morphological characters at supraspecific and specific levels, although the morphological details of genitalic armature are also currently being used. More recent trends in the systematics of this group include studies of their ultrastructure, biochemistry, karyology, biometry, cytogenetics etc.

Lepidopterans differ in their habits and habitats, each species having its characteristic habitat requirements, but very sensitive even to slight changes in the environment. As a result, members of different populations which are subject to extrinsic factors affecting the habitats, host-plants or associated organisms exhibit considerable variation. Besides, changes are also brought about by intrinsic factors like parthenogenesis, intraspecific hybridization, changes in the genetic constitution of individuals, etc. which result in a high degree of intraspecific variability within a population.

Mathew, G. and Nair, K. S. S. (1985). Insects associated with forest plantations of *Paraserianthes falcataria* in Kerala, India. *Malaysian Forester,* 48(3) : 200-205.

ABSTRACT

In a study conducted in Kerala, India, in the years 1977-1982, 25 species of insects belonging to the Orders Lepidoptera, Coleoptera and Hemiptera were found on *Paraserianthes falcataria* of which all except 6 were recorded for the first time on this host. They included leaf-feeders, sap-suckers and live-tree-borers. The most serious pest was the bagworm, *Pteroma plagiophleps* Hamp. (Psychidae). Sporadic outbreaks of the leaf-feeding caterpillar, *Eurema blanda silhetana,* the bark-feeding hepialid sapling borer, *Sahyadrassus malabaricus* and the wood-boring scolytid, *Xyleborus fornicatus* were recorded, but the damage was minor. Damage caused by other species was negligible.

Mathew, G. and Nair, K. S. S. (1986). Bagworm (Lepidoptera, Psychidae) of Kerala-their potential as pests of tree crops. *Proc. IIIrd Oriental Entomology Sym.,* Feb. 1984 Vol 2, pp. 163-167.

ABSTRACT

Bagworms, known previously as minor pests of various crops, have gained greater pest status in recent years, in Kerala. Nine species, including four undetermined ones representing 5 genera are recorded for the first time from Kerala. Due to several reasons bagworms are more adapted to tree crops than to agricultural crops. Based on various considerations four species, viz., *Pteroma plagiophleps, Metisa plana, Manatha albipes* and *Bracychyttarus subteralbatus* are judged to be potentially capable of assuming pest status in different crops in Kerala. The crops under greater threat include forest plantations of *Albizia falcataria,* avenue plantings of *Delonix regia* and *Terminalia catappa* and plantations of coconut and oilpalms.

Mathew, G., Koshy, P. and Mohanadas, K. (1987). Preliminary studies on insect pollinators of teak in Kerala, India. *Indian Forester* 113(1): 61-64.

ABSTRACT

In a study on the insect pollinators of teak in Kerala, 17 species of insects belonging to the orders Hymenoptera, Diptera and Lepidoptera were collected and identified. Maximum number of insects collected belonged to the order Hymenoptera. Among these, the solitary bees, *Halictus* sp., *Prosopis pratensis* and *Allodope marginata* were the most frequent visitors. None of the domesticated bee species was observed and this could probably be due to their absence in the vicinity. The possibility of enhancing pollination with the help of domesticated bee species needs to be explored.

Mohanan, C. and Varma R. V. (1988). *Paecilomyces farinosus*, a potential biocontrol agent of some lepidopterous tree pests in India. *Trans. Br. Mycol. Soc.* 90 (1), 119-122.

ABSTRACT

Paecilomyces farinosus was isolated from naturally infected pupae of *Eligma narcissus* (Lepidoptera: Noctuidae), a major pest of *Ailanthus triphysa* Field surveys during 1983-6 showed approximately 40% pupal mortality due to *P. farinosus*. Inoculation of larvae of *E. narcissus* and *Atteva fabriciella* (Lepidoptera: Yponometuidae), another major pest of *Ailanthus*, with this fungus caused mortality within 48-72 h of incubation.

Nair, K. K. N. 1987 (88). Medhya-Rasayana drug Brahmi-its botany, chemistry and uses. *J. Eco. Tax. Bot.* 11(2) : 359-365.

ABSTRACT

The crude drug Brahmi (Sanskrit) is the dried stems and leaves of the plant *Bacopa monnieri* (L.) Pennell (Scrophulariaceae). From ancient times the drug value of this wetland herb was known to Indians and it was used in Ayurvedic and Unani systems of Indian medicine. The drug properties of Brahmi is mainly due to the presence of an alkaloid 'Brahmine' in the plant body. It was Bose and Bose (1931) who first isolated this alkaloid from dried samples of *Bacopa monnieri* plants. Today Brahmine is well-known as a better substitute for strychnine or Nux-vomic, the cardiac stimulent. The paper elucidates the botany, pharmacognosy, chemistry and uses of the drug Brahmi whose economic potential is yet to be exploited to the maximum extent.

Nair, K. K. N. 1987 (88). A catalogue of Robert Wight's collections of flowering plants from Courtalium (Tamil Nadu) at Central National Herbarium (CAL). *J. Eco. Tax Bot.* 11(2). 375-381.

ABSTRACT

Robert Wight (1796-1872) botanised many parts of Peninsular India and his explorations on the flora of Courtallum (Thirunelveli) is well known in the botanical field. In this catalogue, all those specimens collected by Wight from Courtallum, now available at Central National Herbarium, Botanical Svrvery of India (CAL) are enumerated family-wise with their correct identity and up-to-date nomenclature.

Nair, K. S. S. (1987). Migration, a mechanism of parasite evasion. In: Advances of Biological control research in India (Eds. K. J. Joseph and U. C. Abdurahiman), *Proc. Natl. Semi. Entomoph Ins., Calicut,* Oct. 1985. pp 84-86.

ABSTRACT

Migration is a strategy used by some insects to escape parasitism, although it may serve other functions as well. The teak defoliator, *Hyblaea puera*, is a good example of this, in which, moths newly emerging from an epidemic area migrate to another area for egg laying, leaving behind the parasitoid population built up during their generation. An interesting theoretical consequence of this is that an epidemic of *H. puera* may prevent an epidemic of another teak defoliator, *Eutectona machaeralis*, through the action of the polyphagous parasitoids left behind.

Nair, K. S. S. (1987). Life history, ecology and pest status of the sapling borer, *Sahyadrassus malabaricus* (Lepidoptera, Hepialidae) *Entomon* 12 (2) : 167-173.

ABSTRACT

The sapling borer, *Sahyadrassus malabaricus* (Moore) has an annual life cycle, with most moths emerging in late April to May, in the pre-monsoon season. Although eggs were laid soon after emergence, the

new generation of larvae was found on saplings only about three months later when the larvae were 1.5-2.0 cm long, indicating that the early larval instars survived elsewhere and migrated to saplings later. The larva feeds on the bark of saplings, particularly on callus tissue in the vicinity of the tunnel mouth, under cover of a thick mesh-work of bark, wood and frass particles. Fifteen new hosts were recorded in this study, bringing the total to 50 species of woody shrubs and trees belonging to 22 families. *Trema orientalis* (Ulmaceae) was the most acceptable host, harbouring as many as 30 larvae per tree while multiple infestation was rare in other hosts. Predation by wood-pecker and infection by the fungus. *Metarhizium anisopliae* were recorded. In some 2 to 4-year-old teak plantations studied, 6 to 61 of the saplings were attacked, but economic damage was negligible. However, plantations of *Albizia falcataria*, *Casuarina equisetifolia* and *Eugenia caryophyllata* suffered serious damage due to ring-barking.

Nair, K. S. S. (1987). Control of the sapling borer, *Sahyadrassus malabaricus* (Lepidoptera, Hepialidae) in forest plantations. *Entomon* 12(2) : 137-139.

ABSTRACT

A simple method was developed to control the larva of *Sahyadrassus malabaricus* which tunnels into the stem of forest tree sapling. The tunnel mouth and the surrounding area is covered by a mesh-work of bark, wood and frass particles spun together with silk. When the cover is removed, the larva rebuilds it overnight using wood particles gnawed out from the region. This behaviour was made use of to kill the larva by superficial spot application of insecticide after removing the cover. HCH, lindane, carbaryl and 'sevimol' were tested at 0.5% (a.i) concentration and quinalphos at 0.125%. Quinalphos alone gave complete control.

Sankaran, K. V., Florence, E. J. M. and J. K. Sharma (1987). Two new species of *Phomopsis* from India. *Trans. Brit. Mycol. Soc.* 89(3), 404-407.

ABSTRACT

Phomopsis micheliae sp. nov. and *P. gmelinae* sp. nov. are described from Kerala, India. *P. micheliae* causes a leaf spot disease of *Michelia champaca* and *P. gmelinae* a stem canker of *Gmelina arborea*.

Sudheendrakumar, V. V. (1987). Studies on the parasites of *Hyblaea puera* in teak plantations at Nilambur. In: Advances of Biological control Research in India (Eds. K. J. Joseph U. C. Abdurahiman), *Proc. Natl. Semi. Entomoph. Ins, Calicut*, Oct. 1985, pp. 116-122.

ABSTRACT

Five species of parasites of *Hyblaea puera* namely, *Palexorista solennis* Walker (Tachinidae), *Brachymeria lasus* Walker (Chalcididae) *Symptesis* sp. (Eulophidae) and two species of unidentified ichneumonid wasps were recorded. Among these parasites *Sympiesis* sp. is a new record on *H. puera*.

Presence of *P. solennis* was noted almost throughout the infestation period of the pest, though it was found to have a dominant role during the period of high host density. The ichneumonid parasites were recorded only during the period of high pest activity. *Sympiesis* sp. had a dominant role during the period of low host density.

During the first wave of pest infestation, parasite activity was very low and *P. solennis* was the only parasite present. In general, overall rate of parasitism was found to be higher in the period of high host density.

Research Reports*

Nair, K. S. S. and George Mathew. 1988. Biology and control of insect pests of fast growing hard wood species. KFRI Research Report No. 51. Final Report of the project Entom 05/1977-1982.

Abstract

A study was made of insect pest problems in plantations of *Albizia falcataria* and *Gmelina arborea* in Kerala.

Twenty-five species of insects were found associated with *A. falcataria* of which all except 4 were recorded on this tree for the first time in India. The insect complex included leaf-feeders, sap suckers and live tree borers, but most were minor pests, with the following exceptions.

The bagworm, *Pteroma plagiophleps* Hamp. (Lepidoptera, Psychidae) formerly known as an occasional minor pest of the tamarind tree, is recognized as a serious pest of *A. falcataria*. Outbreaks of this insect occurred in some plantations which resulted in total defoliation in patches leading to large-scale tree mortality (up to 22% was recorded in one plantation) and growth retardation. The biology of this little-known species, its seasonal incidence, host range and distribution in Kerala are reported. It has now spread to *Delonix regia* planted as avenue trees throughout Kerala. The importance of several natural mortality factors including insect parasitoids and disease organisms have been recognized, but their quantitative impact needs to be investigated further. For emergency control, several insecticides were tested and the most effective ones determined. Caterpillars of the plerid butterfly *Eurema blanda silhetana* caused occasional localised defoliation in young stands and the scolytid beetle, *Xyleborus fornicatus* bored into the stem of live saplings. The latter is recognized as a potential pest, particularly in poorer sites where the saplings are under physiological stress.

Thirty-four species of insects were found associated with *Gmelina arborea*, of which all except 5 were recorded on this tree for the first time in India. The insect complex included leaf feeders, sap suckers and live tree borers, but only the following are considered important.

The most serious was the tinigitid bug, *Tingis beesoni* which erupted into outbreaks in young plantations and caused defoliation, leading to dieback of terminal shoot. Young plantations were also affected by the scolytid borer, *X. fornicatus*, as in the case of *A. falcataria*. The leaf and shoot webbing caterpillar, *Epiplema fulvilinea* caused moderately high defoliation on some occasions. The defoliating beetle, *Calopepla leyana*, recognized as a major pest elsewhere in India was present in small numbers but outbreaks were not noticed. The above 4 species are recognized as potentially serious pests; but their full impact can be judged only when more extensive plantations are raised.

* The KFRI Research Reports are now available in two forms — summary reports and detailed reports. Summary reports will be available free of cost and detailed reports can be obtained at cost from the Librarian, KFRI.

Seminars, Symposia, Workshop..... .....

National

Dr. S. Sankar attended a Workshop on Tribal Development, organized by the Kerala Tribal Development and KIRTDAS at Palghat during Sept. 24-26, 1987.

Dr. R. V. Varma attended the National Symposium on Social Insects at the University of Agricultural Sciences, Bangalore during Oct. 7-8, 1987. He presented a paper-Field evaluation of preservative treated rubber wood against subterranean termites, by R. V. Varma and R. Gnanaharan.

Dr. K. S. S. Nair, Dr. V. V. Sudheendrakumar and Shri K. Mohanadas attended the National Symposium on Integrated Pest Control-Progress and Perspectives, held at Trivandrum from Oct. 15-17, 1987. Dr. K. S. S. Nair presented a paper 'Pest

(Continued in page 25)

Forthcoming Events

5-11 June, 1988. IUFRO Regional Workshop on Pest and Diseases of Forest Plantations, Bangkok. Thailand.

Contact : Dr. H. Schmutzenhofer, IUFRO Secretariat, A-1131 Wien, Austria.

20-24 June, 1988. Symposium on Growth and Yield in Tropical Mixed/Moist Forests, Kuala Lumpur, Malaysia.

Contact : Dr. Wan Razali Bin Wan Mahd., Forest Research Institute, Malaysia, Kepong, 52109 Kuala Lumpur, Malaysia.

12-19 July, 1988. Symposium on Regeneration of Dipterocarps, Bangkok, Thailand.

Contact : Dr. Chumni Boonyobhas, RFD, Phaholyothin Rd., Bangkhen, Bangkok 10900, Thailand.

21-26 August, 1988. IUFRO Workshop on Virgin Forest Management, Corvallis, Oregon, U S A.

Contact : Dr. R. Hermann, College of Forestry, Oregon State University, Corvallis, Oregon 97331-5704, U. S. A.

27 August - 1 September, 1988. International Congress on Microbial Ecology, Kyoto, Japan.

Contact : Dr. U. Simidu, Secretary General. C/o. Inter Group Corp., Akasaka Yamakatsu Bldg., 8-5. 32. Akasaka, Minato-Ku, Tokyo, Japan.

29 August - 2 September, 1988. Modelling Forest Growth Processes, IUFRO Working Party Meeting, Uppsala, Sweden.

Contact : Dr. K. Perttu, Box 7072, S-75007 Uppsala. Sweden.

25-30 September. 1988. IUFRO Conference on Forest Tree Physiology, Nancy, France.

Contact : Dr. J. Bohin, N. R. A.- Ahampenoux, F-54280 Seichamps, France.

14-18 November, 1988. International Bamboo Workshop, Cochin, India.

Contact: Dr. R. Gnanaharan, Convener, International Bamboo Workshop, Kerala Forest Research Institute, Peechi-680 653, Kerala, India.

28 November-3 December, 1988. IUFRO Workshop on Breeding Tropical Trees-Population Structure and Genetic Improvement - Strategies in Clonal and Seedling Forestry, Pattaya, Thailand.

Contact: Dr. K. G. Eldrige, CSIRO, Division of Forest Research, P.O. Box 4008, Australia.

28-30 December, 1988. 8th National Symposium on Plantation Crops Research and Development (Placrosym VIII), Cochin, India.

Contact: Dr. R. Naidu, Director, Indian Cardamom Research Institute, Myladumpara, Kailasanadu 685 553, Idukki, Kerala, India.

11-14 April, 1989. IUFRO Conference on Data Capture, Collection and Processing, Gembloux, Belgium.

Contact: Dr. J. Rondeux, Fac. des Sciences Agr. de L' Etat., Dept. Techn. Agr. Alim. et Forestiere B-5800 Gembloux, Belgium.

23-30 August, 1990. 5th International Congress of Ecology, Yokohama City, Japan.

Contact: Dr. A. Miyawaki, Institute of Environmental Science & Technology, Yokohama National University, 156, Tokiwadai, Hadogaya-ku, Yokohama 240, Japan.

28 August-3 September, 1990. 4th International Mycology Congress, Regensburg, F.R.G.

Contact Dr. A. Bresinsky, Institute fur Botanik, Univ., Regensburg, Universitat strasse 31, Postfach 3108, 8400 Regensburg, F. R. G.

International Bamboo Workshop

KFRI is organising an International Workshop on Bamboo at Malabar Hotel in Cochin, with the following objectives:

— To review recent developments in the management and utilization of bamboo.

— To examine the socio-economic aspects relating to bamboo cultivation and utilization.

— To chart future research needs and directions.

Last date for sending the abstract of the paper: **30 June 1988**

Registration fee: Rs. 600/- (US $ 50)

For further details write to —

Dr. R. GNANAHARAN
Convener
International Bamboo Workshop
KFRI, Peechi 680 653
Kerala, India.

(Continuation from Page 23)

Management in Indian Forestry - How to bridge the gap between theory and practice' and also chaired a session on biocontrol. Dr. Sudheendrakumar presented a paper - 'Comparative pathogenicity of some *Bacillus thuringiensis* strains on larvae of *Eligma narcissus* (Lepidoptera, Noctuidae), a major pest of *Ailanthus triphysa* by R. V. Varma, M. I. Mohamed Ali and V. V. Sudheendrakumar.

International

Dr. K. M. Bhat and Dr. C. Renuka participated in the International Rattan Seminar at Chiangmai, Thailand during Nov. 12-14, 1987. Dr. K. M. Bhat presented a paper "Management and utilization of rattan resources in India - a state of the art report" - by K. M. Bhat, C. Renuka, K. K. Seethalakshmi, P. K. Muraleedharan and C. Mohanan.

Campus News

Shri K. Shanmughanthan, Silviculturist left KFRI on 31-12-1987 after serving the Institute for about 3 years.

Shri. K C. Chacko took over as Silviculturist from 1-1-1988.

Dr. R. C. Pandalai, Scientist, Silviculture Division successfully completed the Diploma course in Forestry (1986-'87) from the State Forest Service College, Coimbatore, and he has returned to the Headquarters at Peechi.

Shri Samuel Rajasekharan, Scientist, Silviculture Division was deputed to the Diploma Course in Forestry (1988-89) at State Forest Service College, Coimbatore from March 1st, 1988.

Shri. T. Surendran and Shri Mathew P. Koshy returned to the Institute in December 1987, after successful completion of M. Sc. in Environmental Forestry at the University of Wales, Bangor, U. K.

Joined KFRI Recently

Dr. Jose Kallarackal — Scientist C, Division of Plant Physiology.

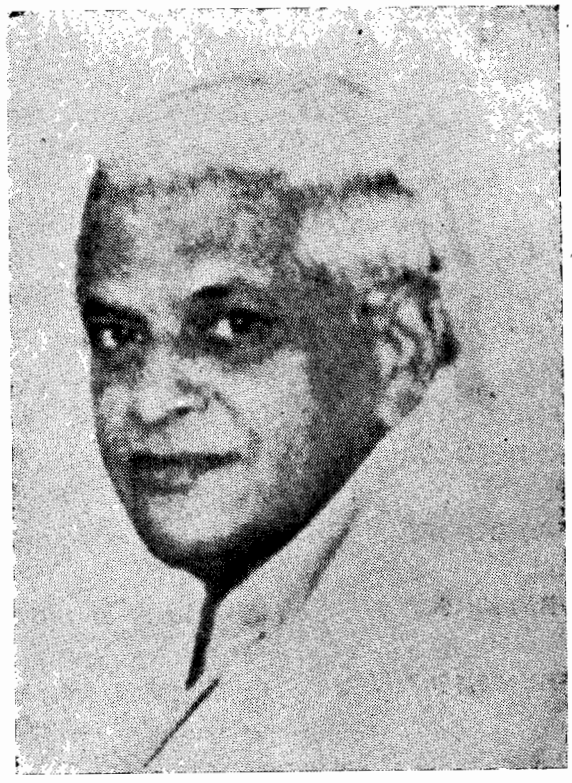
Miss M. P. Sujatha — Scientist E, Division of Soil Science

Visitors

Shri. T. N. Seshan Secretary to Govt. of India Ministry of Environment & Forests, New Delhi	31-10-1987
Mr. William Stewart Programe Officer Ford Foundation, New Delhi	17-11-1987
Dr. Clive Wing IDRC, New Delhi	03-12-1987
Mr. Karim Oka IDRC, New Delhi Dr. Cherla B. Sasthry IDRC, Singapore	13-01-1988
Dr. Charles Antholt Dr. Barry Prim Dr. J.S.P. Yadav USAID, New Delhi	14-01-1988
Prof. Kamaljit S. Bawa Professer Massachussetts University U. S. A.	01-03-1988

Y.M.L. Sharma

(1915 - 1988)



With profound sorrow we announce the sad demise of Prof. Y. M. L. Sharma on 4th April 1988 at Bangalore. He was a devoted forester and was active till the end striving for the cause of forestry research and education in our country. He was an able administrator and teacher and served as Chief Conservator of Forests in Karnataka, as Dean, Indian Forest College, Dehra Dun and as Principal, Southern Forest Ranger's College at Coimbatore.

Even after retirement he shared his experience and knowledge for the cause of forestry. He opened up an international forestry consultancy and served as a consultant to FAO and other International Organisations.

Prof. Sharma was a member of the first Governing Body of KFRI and served in that capacity for several years. He was closely associated with the activities of KFRI in various ways.

May his soul rest in peace.

New Research Projects taken up by KFRI

Sl. No.	Code No.	Title of Project	Sponsored by
1	KFRI/101/1987	Development of a management strategy for the teak defoliator, *Hyblaea puera*.	
2	KFRI/102/1987	Soil technology packages for enhancing productivity in teak plantations of Kerala.	
3	KFRI/103/1987	Spatial and temporal distribution of *Ailanthus* pests, *Eligma narcissus* and *Atteva fabriciella*.	
4	KFRI/104/1987	Tree improvement of Eucalypts for disease resistance and higher productivity.	
5	KFRI/105/1987	Studies on the lepidopteran fauna (Insecta) of Silent Valley.	Nilgiri Biosphere Reserve Programme, Govt. of India.
6	KFRI/106/1987	Decay in standing trees in natural forests.	
7	KFRI/107/1987	Soil and Plant Community relationship in wet evergreen forests of Silent Valley.	Nilgiri Biosphere Reserve Programme, Govt. of India.
8	KFRI/108/1987	Silviculture, Management and utilization of Bamboo resources in Kerala.	IDRC, Canada.
9	KFRI/109/1987	Rattan Management and utilization in Kerala.	IDRC, Canada.
10	KFRI/110/1987	Diseases of bamboos, reeds and canes in Kerala.	
11	KFRI/111/1987	Ecology and behaviour of Sambar deer *Cervus unicolor niger* in Parambikulam Wildlife Sancturary.	
12	KFRI/112/1987	Feeding and ranging patterns of Lion-tailed Macaque (*Macaca silenus*) in Silent Valley National Park.	Nilgiri Biosphere Reserve Programme, Govt. of India.
13	KFRI/113/1987	Wood properties of some less known tree species of Kerala.	
14	KFRI/114/1987	Studies of selected indigenous species for future plantation progamme in Kerala.	Dept. of Environment Govt. of India.
15	KFRI/115/1987	Genetic improvement of *Ailanthus triphysa*.	
16	KFRI/116/1987	Human ecology and socio-economic interactions in Tribal Communities of Attappady.	Nilgiri Biosphere Reserve Programme, Govt. of India.
17	KFRI/117/1987	Regeneration studies on some important trees in moist deciduous forest.	
18	KFRI/118/1987	Community ecology of birds in Silent Valley	Nilgiri Biosphere Reserve Programme, Govt. of India.
19	KFRI/119/1987	Demand and supply of wood in Kerala and their future trends.	Social Foresty Wing, Kerala, Forest Department.
20	KFRI/120/1987	Afforestation trials in Attappady.	Nilgiri Biosphere Reserve Programme, Govt. of India.

Recent KFRI Publications

Research Reports

No. 45 Alexander, T. G , Sankar, S., Balagopalan, M. and Thomas, T. P .1987. Soils in teak plantations of different site quality. Final report of research project soils 10/84, 17 pp.

No. 46 Renuka, C. Bhat, K. M. and Nambiar, V. P. K. 1987. Morphological, anatomical and physical properties of *Calamus* species of Kerala Forests. Final report of research project Bot. 05/82. 58 pp.

No. 47 Sharma. J. K. and Sankaran, K. V. 1987. Diseases of *Albizia falcataria* in Kerala and their possible control measures. Final report of research project F 03/82, 50 pp.

No. 48 Balasundaran, M. and Mohammed Ali, M. I. 1987. Root nodulation potentialities of *Leucaena leucocephala* in Kerala. Final report of research project Pathol NF 04/82, 21 pp.

No 49 Bhat, K. M., Bhat, K. V. and Dhamodaran, T. K. 1987. Effect of age and location on pulp-wood quality of *Eucalyptus grandis*. Final report of research project wood 02/79, 23 pp.

No. 50 Surendran, T. and Seethalakshmi, K. K 1987. Vegetative propagation of some important tree species by rooting cuttings. Final Report of research project Physiol 01/79, 24 pp.

Hand book

No. 1 N. Sasidharan, Forest trees of Kerala. A checklist with an index to important exotics (1987).

For KFRI Publications

Write to :
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PEECHI - 680 653, KERALA, INDIA