annual report

1979-80

kerala forest
research institute

ANNUAL REPORT

April 1979-March 1980

kerala forest research institute

Peechi, Trichur 680653, Kerala

INTRODUCTION

The Kerala Forest Research Institute was registered as a Society on 3rd July 1975 under the Travancore-Cochin literary, Scientific and Charitable Societies Registration Act, 1955. After functioning in various rented buildings at Trivandrum and Trichur, the Institute moved to its permanent campus at Peechi in February 1978. Development of the campus and organisation of laboratories were continued during the year. Construction of all buildings of the main campus, except Auditorium and Museum, was completed. More scientific and other staff were positioned and apart from the on going research projects, new projects were identified and taken up for investigation.

GOVERNING BODY

Shri Aryadan Mohammed, Minister of Labour and Forests, Kerala - Chairman
Prof. A. Abraham, Chairman, State Committee on Science & Technology, Kerala - Vice-Chairman
Shri M. K. Dalvi, Inspector General of Forests, New Delhi
Dr. P. K. Gopalakrishnan, Special Secretary to Government of Kerala, Planning & Economic Affairs Department
Shri Hari Singh, Rtd. Inspector General of Forests, Bangalore
Shri A. K. Kaderkutty, Managing Director, Western India Plywoods Ltd., Baliapatam
Shri N. Kaleeswaran, Vice-Chancellor, Kerala Agricultural University, Trichur
Shri K. K. Nair, Chief Conservator of Forests, Kerala
Prof. T. S. Sadasivan, Rtd. Professor of Botany, University of Madras
Shri S. K. Seth, Rtd. Inspector General of Forests, Lucknow, U. P.
Shri Y. M. L. Sharma, International Forestry Consultant, Bangalore
Dr. P. M Ganapathy, Director, Kerala Forest Research Institute

The Governing Body met twice during the year.

EXECUTIVE COMMITTEE

Prof. A. Abraham, Chairman, State Committee on Science & Technology, Kerala -Chairman
Dr. P. K. Gopalakrishnan, Special Secretary to Government of Kerala, Planning & Economic Affairs Department
Shri A. K. Kaderkutty, Managing Director, Western India Plywoods Ltd., Baliapatam
Shri K. K. Nair, Chief Conservator of Forests, Kerala
Dr. P. M. Ganapathy, Director, Kerala Forest Research Institute

The Executive Committee met on five occasions.

ADMINISTRATION

As in sister Institutes a post of Registrar was sanctioned. Shri M P Mathew, Nair, Retd. Additional Secretary and Chief Electoral Officer, Kerala Government was also worked as Registrar, Cochin University was appointed to the post on contract basis for a period of two years. He joined the Institute on 10th December 1979. In the meeting held on 14th January 1980, the Governing Body adopted resolutions delegating certain administrative and financial powers to the Registrar.

CAMPUS DEVELOPMENT

The Institute campus is located at Peechi in a 28.174 ha forest land leased out by the Forest Department for a period of 99 years on a rent of Re. 1/- per annum. The Master Plan for campus development was prepared by Shri L. W. Baker, Architect, Trivandrum, keeping in view that the architecture should merge with the sylvan surroundings of Peechi and that the construction technology should adopt low cost concept consistent with optimum structural requirements.

The following constructions in the main campus were already completed in the previous years.

Administration
Wood science
Forest Utilisation and Extension
Economics and Statistics
Library
Botany and Genetics
Silviculture, Management and Wildlife
Ecology and Soil Science
Entomology and Pathology
Corridor
Vehicle Shed and Store.

It was decided to provide water-proof treatment with tar-felt to the Reinforced Brick Concrete roof of buildings in the main campus. Based on expert opinion on the matter, M/s Shalimar Tar Products Ltd., Cochin was entrusted with the work and they took up the work towards the end of the year.

There is provision for an Auditorium and Museum in the main campus. Based on the architectural drawings of Shri Baker, the Consultancy Cell in the Government Engineering College, Trichur, provided structural design, specification and estimate for the Auditorium with a water-tank on top of it. The work has been entrusted to the Kerala State Construction Corporation (KSCC) and is in progress.

Drawings for the Museum have not been prepared so far. This work is to be taken up during 1982-83 if funds are available.

Construction of staff quarters at Peechi, entrusted to the KSCC, is in progress. Construction of 16 numbers of Type I quarters is almost completed and the quarters will be ready for occupation by October 1980 *(Figure 1)*. Construction of 20 numbers Type II quarters and 10 numbers Type III quarters is in progress. During the period under report, the KSCC was entrusted with the construction of five more Type III quarters.

WATER SUPPLY TO INSTITUTE CAMPUS

The Public Health Engineering Department (PHED) having expressed its inability to provide water supply to the Institute campus from its Trichur Water Supply System, it was decided to have the Institute's own water supply system by providing a well, pump house, and filtration unit on the bank of the Kannara river about 1.5 km from the Institute. The work has been entrusted to PHED as a deposit work at an estimated cost of Rs.9/- lakhs The work is in progress.

ESTABLISHMENT OF SUB CENTRES

Forest land measuring 43.358 ha has been lased to the Institute for the Sub-Centre at Nilambur for 99 years on a rent of Re.1/- per annum Office building, staff quarters and a rest house have been constructed there. Nursery and experimental plots are being developed.

The Division of Wildlife Biology is functioning at Thekkady in connection with a project financed by the Kerala Forest Department. The reconnaissance report of this project was prepard and communicated to the Department. Government have already issued orders leasing out 1.5 ha of land for developing the Sub-Centre at Thekkady. Two buildings have been taken on rent for office-cum-residence. Plans and estimates for the buildings required for the Sub-Centre are being finalised.

TEAK MUSEUM

As decided by the Executive Committee, the tenders and the offer received from the KSCC for construction of the Teak Museum at Nilambur were placed before the Government for orders. The tenderers withdrew their offer after the expiry of the firm period since no decision could be taken on the tenders by that time. The Governing Body considered this question in the meeting held on 14th January 1980 and decided to request the Government that the development of the Teak Museum and Research Centre be integrated with the activities of the Institute and to treat the amount so far released as grant to the Institute The matter has been taken up with the Government.

STAFF

The staff in position as on 31st March 1980 is shown on pages 7-10

The Institute could not get a suitable person for the post of Silviculturist. The State Forest Department was approached for the services of a suitable Forest Officer against

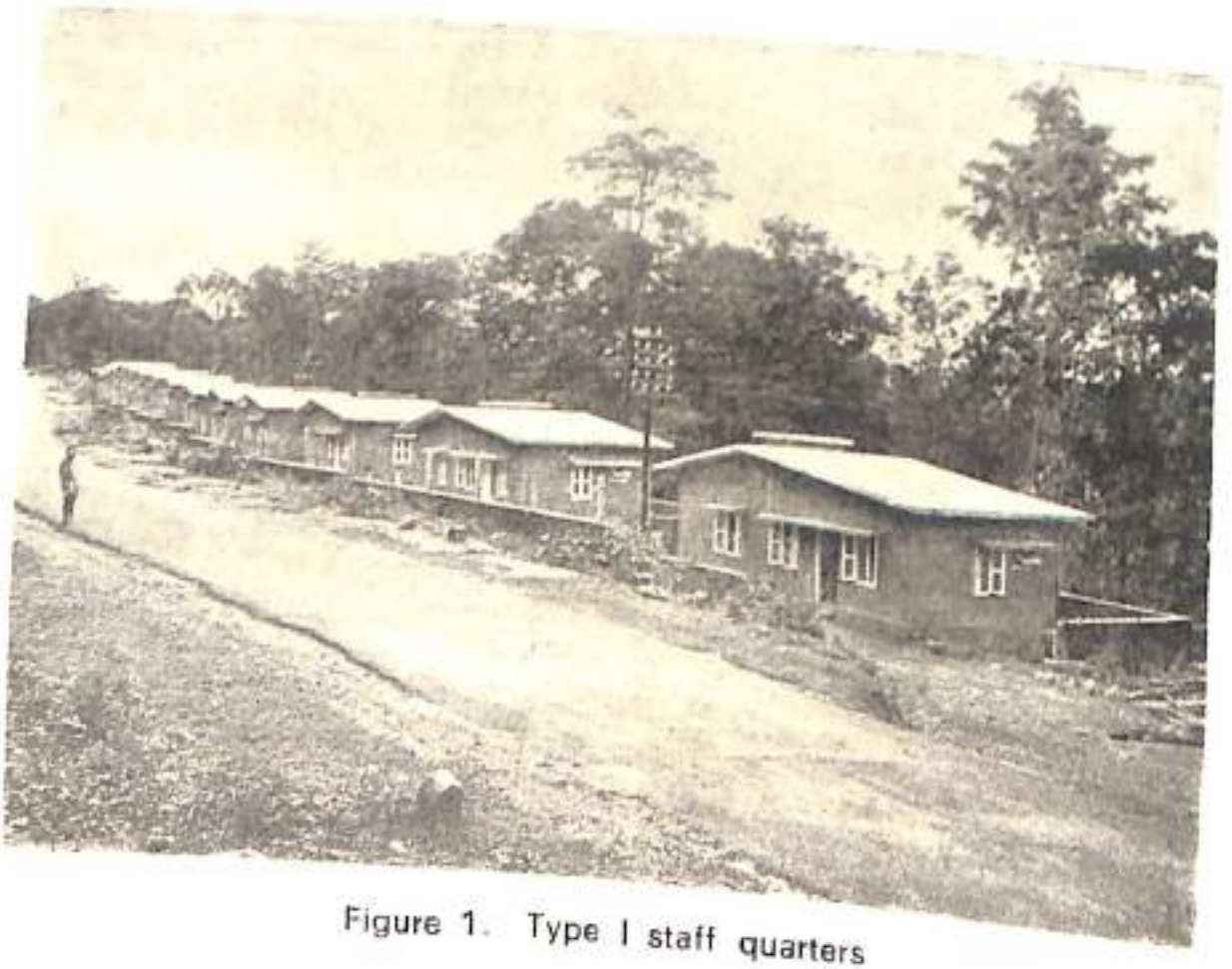

Figure 1. Type I staff quarters

this vacancy, but the response was not favourable. Since then, the Executive Committee has offered the post to Shri E. Muhammad, Rtd. Conservator of Forests. He has yet to be given permission by the Government to accept the offer.

FINANCE

The budget for 1979 80 approved by the Governing Body was for Rs. 54 77 lakhs out of which Rs. 0.77 lakhs were to be funded by external agencies.

Under the general grant, the Government of Kerala released Rs. 45.89 lakhs.

The Government of India (Department of Science & Technology) released Rs. 56.900/- towards the project "Studies on the changing pattern of man-forest interactions and their implications on ecology and management - A case study of the Reserve and Vested Forests in Attappady, Kerala". This project is in progress and is expected to be completed by the end of September 1980. The Government of India (Department of Science & Technology) have sanctioned another project "Long term environmental and ecological impacts of multipurpose river valley projects – a comprehensive study in Western Ghats - Wildlife Studies" at an estimated cost of Rs. 5.912 lakhs. This project will take three years for completion. They have released Rs. 2.5 lakhs towards the first instalment of the grant.

The expenditure incurred during 1979 - 80 was Rs. 53.69 lakhs. The break – up is given below :

General Grant

Books and periodicals	Rs. 2 26,690-00
Civil Works	Rs. 16,43,453-00
Furniture and Fittings	Rs. 2,34,739-00
Establishment charges	Rs. 10,04,485-00
Vehicles	Rs. 66,186–00
Fuel and maintenance of vehicles	Rs. 1,10,635-00
Misc. Stores & Chemicals	Rs. 1,70,940-00
Telephone Charges	Rs. 24,853-00
Printing and Stationery	Rs. 21,765–00
Advance with the KSCC	Rs. 1,16,446-00
Other advances and Deposits	Rs. 8,07,591-00
Research Equipments and Contingencies	Rs. 6,96,908-00
Other items	Rs. 1,16,568-00
Total	Rs. 52,41,259-00

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Projects financed by external agencies

Kerala Forest Department	Rs. 79 481 (0
Food & Agriculture Organization	Rs 4,147 00
Kerala Forest Department (Teak Museum)	Rs. 3 391 00
Government of India, Department of Science & Technology	Rs. 40,242.00
Total	Rs 1 28,061 00
Grand Total	Rs 53,69,320-00

M/s Varma and Varma, Chartered Accountants, Trichur took up the auditing of accounts of the Institute for the year.

LIBRARY

Acquisition of Documents

The following table gives details of books and other documents acquired in the Library during the year and the progressive total.

Item	Acquired during the period under report	Total acquisition
Books	488	6409
Photostat copies of articles	105	449
Reprints	74	1721
Journals	23	209
Backvolumes	34	593
Total	724	9381

Technical processing and arrangement

Technical processing of books was completed and the arrangement was made more effective with shelf labels. Organisation of reprint collection and preparation of classified index are being attended to.

Photography section

An Artist-Photographer joined in July 1979 and most of the essential photographic equipments were positioned. The section can carry out all the photography works of the Institute except colour processing.

Binding

A binder was appointed on daily wages and the binding of backvolume of journals is in progress.

REVIEW COMMITTEE

In the meeting held on 14th January, the Governing Body resolved to review the working of the Institute in terms of Rule 16 of the Rules and Regulations of the Institute and appointed a panel consisting the following members of the Governing Body.

Shri Hari Singh
Shri A. K. Kaderkutty
Shri K. K. Nair
Shri Y. M. L. Sharma

The panel took up review towards the end of the year.

DISTINGUISHED VISITORS

Dr. F. B. Armitage, F. A. O. Consultant, UK
Dr. Stephen Berwick, Yale University, USA
Dr. I. A. S. Gibson, F. A. O. Consultant, UK
Dr. John Hedger, University College of Wales, UK
Dr. K. F. S. King, Director General, International Council for Research in Agroforestry, Kenya
Shri C R. Ranganathan, Rtd. Inspector General of Forests, Bangalore
Dr. M. S. Swaminathan, Secretary, Ministry of Agriculture, Government of India, New Delhi
Sir John Thomas, British High Commissioner in India, New Delhi

INSTITUTE STAFF AS ON 31st MARCH 1980

Dr. P.M. Ganapathy – Director

Administration

1	Shri	M. P. Madhavan Nair	Registrar
2	Shri	P. Viswanathan	Secretary
3	Shri	P. K. Balan	Accountant
4	Shri	C. V. Jose	P. A. to Director
5	Shri	E. Mohammed	Office Assistant
6	Shri	R. K. Padmanabhan	Office Assistant
7	Shri	K. N. Thulaseedaran Nair	Office Assistant

46	Shri	T. Surendran	Research Assistant (at Nilambur)
47	Shri	C. K. Soman	Field Assistant
48	Shri	M. A. Sankarankutty	Attender

Botany (Taxonomy)

49	Prof	V. P. Krishnan Nambiar	Scientist Grade C
50	Shri	N. Sasidharan	Research Assistant
51	Kum.	C. Renuka	Research Assistant
52	Shri	K. K. Unni	Field Assistant
53	Shri	T. Prabhakaran	Gardener
54	Shri	P. A. Sankarankutty	Attender

Ecology

55	Dr.	K. Balasubramanyan	Scientist Grade C
56	Shri	K. Swarupanandan	Research Assistant
57	Dr.	A. R. Ramachandra Menon	Research Assistant
58	Shri	A. S. Sreenivasan	Attender

Entomology

59	Dr.	K. S. S. Nair	Scientist Grade C
60	Dr.	R. Venugopal Varma	Research Assistant
61	Shri	George Mathew	Research Assistant
62	Shri	V. V. Sudheendra Kumar	Research Assistant (at Nilambur)
63	Shri	P. Padmanabhan	Field Assistant
64	Shri	K. S. Karunakaran	Attender

Genetics

65	Dr.	C. S. Venkatesh	Scientist Grade B
66	Shri	Mathew P. Koshy	Research Assistant
67	Kum.	E. P. Indira	Research Assistant
68	Shri	P. V. Subramanian	Attender

Pathology (Fungal Diseases)

69	Dr.	J. K. Sharma	Scientist Grade C
70	Shri	C. Mohanan	Research Assistant
71	Shri	K. K. Achuthan*	Field Assistant
72	Shri	E. T. Kuttikrishnan	Attender

Pathology (Non-Fungal Diseases)

73	Dr.	S. K. Ghosh	Scientist Grade C
74	Shri	M. Balasundaran	Research Assistant

46	Shri	T. Surendran	Research Assistant (at Nilambur)
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Pathology (Non-Fungal Diseases)

73	Dr.	S. K. Ghosh	Scientist Grade C
74	Shri	M. Balasundaran	Research Assistant

Silviculture

75	Shri K. C. Chacko	Silvicultural Assistant at Nilambur

Soil Science

76	Dr. T. G. Alexander	Scientist Grade C
77	Dr. (Smt.) K. Sobhana*	Research Assistant
78	Shri M. Balagopalan	Research Assistant
79	Shri Thomas P. Thomas	Research Assistant
80	Kum. M. V. Mary	Research Assistant
81	Shri M. C. Mohandas	Attender

Statistics

82	Shri K. Easwarankutty	Scientist Grade C
83	Shri R. Balakrishnan Asan*	Research Assistant
84	Kum. P. Rugmini	Research Assistant
85	Shri Shahul Hameed*	Research Assistant
86	Shri A. R. Rajan	Field Assistant
87	Shri A. Ramakrishnan	Typist
88	Kum. P. K. Karthiayani	Typist
89	Shri C. Radhakrishnan	Attender

Wildlife Biology (at Thekkady)

90	Dr. V. S. Vijayan	Scientist Grade D
91	Shri P. S. Easa	Research Assistant
92	Shri K. K. Ramachandran	Research Assistant
93	Shri P. V. Balakrishnan	Research Assistant
94	Shri K. K. Ahammad	Attender
95	Shri P. M. Vasu	Watcher

Wood Science

96	Dr. R. Gnanaharan	Scientist Grade C
97	Shri K. Mahabala Bhat	Scientist Grade D
98	Dr. (Kum.) Nazma	Scientist Grade D
99	Shri K. V. Sidharthan	Attender

General Project

100	Shri A. N. Balasubramanyan	Research Assistant
101	Shri C. M. Kurian	Research Assistant

* Left the Institute during the year.

RESEARCH PROJECTS

First research project was initiated in 1976. As more scientific personnel joined more projects were initiated. The projects were first discussed in the Internal Research Committee and placed before the Executive Comittee for consideration and approval. During the period the Internal Research Committee met nine times. Care has been taken to identify projects which are relevant to scientific forestry management.

The progress of research projects during the year is summarised below.

BOTANY (PHSIOLOGY)

Plan for the infrastructural facilities of the laboratories has been finalised and laboratories organised. A small nursery was developed in the Institute campus for experimental studies.

Since, plant physiological research requires a lot of instrumentation, steps have been taken to procure these equipments. The indigenously available equipment has started arriving, but some sophisticated equipments have to be imported for which steps have already been taken.

An area has been marked for Physiology experiments in the nursery at Nilambur, Sub-Centre, and special beds have been made keeping in view, the conducive conditions of root initiation.

Physiol 01/79 - Studies on the physiology of vegetative propagation of important timber species by rooting stem cuttings

Periodic rooting trials with stem cuttings of *Tectona grandis, Hopea parviflora, Melia composita, Swietenia microphylla, Anthocephalus cadamba, Gmelina arborea, Xylia xylocarpa* which were started in the previous year are continuing. The cuttings were treated with various auxinic and non-auxinic chemicals for 24 hours by dip method prior to planting in beds.

The problem of rooting at the base of the cuttings was observed and some common fungicides have also been included in the treatments. Combination of various growth hormones has also been tried.

Physiol 02/79 - Investigations on the possibility of vegetative propagation of bamboos and reeds by stem cuttings

Experiments are in progress both at Nilambur and Peechi (*Figure 2*).

Physiol 03/79-Studies on the Physiology of induction of flowers in teak and eucalypts

Experiments on physiological growth analysis of *Eucalyptus grandis; E. tereticornis* and FRI 4, 5 and 10 are in progress.

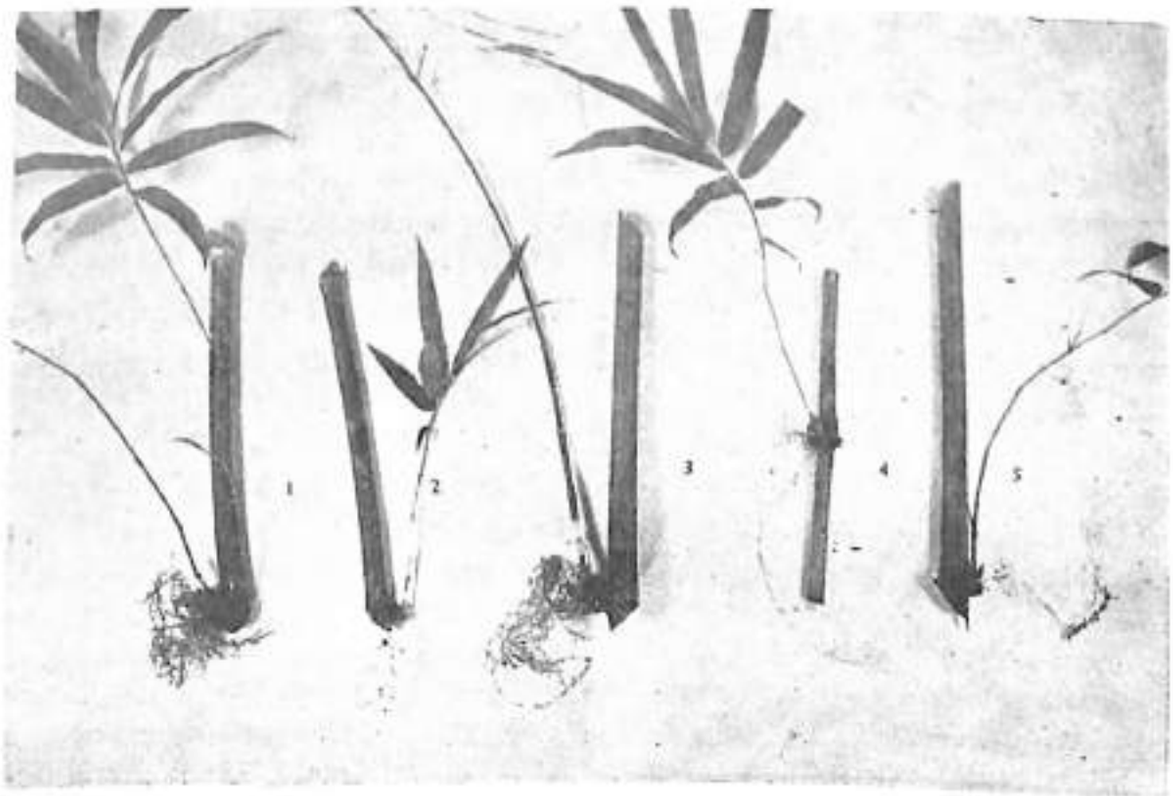

Figure 2. Rooting of bamboo and reed stem cuttings

BOTANY (TAXONOMY)

Organisation of the laboratory and herbarium was continued. Design for construction of an orchid house in the Institute campus was prepared.

Bot 01/79 - Study on the medicinal plants of Kerala Forests

About 200 plants of medicinal importance found naturally in the forests of Kerala were collected and established in a garden in the campus. A comprehensive check-list of medicinal plants of Kerala incorporating valid scientific names, synonyms, common names, distributional details, properties and uses has been prepared Important plant materials used in Ayurveda were collected, identified and stored for reference purposes. After consultation with some leading firms manufacturing, Ayurvedic medicines, nine medicinal plants in much demand have been selected for habitat studies.

Bot 02/79- Establishment of an Orchidarium in the Institute

A few orchids have been collected, identified and established in the campus. Intensive collection and cultivation of orchids can be taken up only after establishment of the orchid house. Costruction of the orchid house could not be taken up so far due to budgetary constraints.

Other activities

About 750 Specimens have been added to the earlier collection in the herbarium. Problems of identification and nomenclature referred by Scientists in the Institute were attended to.

Extension bulletin in Malayalam on *Ailanthus triphysa* and technical bulletin for cultivation of cane were prepared for the Forest Department.

Wood samples/plant material sent by the Forest Department in connection with court cases were identified.

ECOLOGY

Facilities for laboratory studies were developed and action for procurement of equipment and instruments for laboratory as well as field studies was initiated.

Ecol 01/79 – Preparation of soil-cum-vegetation map of the forests of Trichur Division

Basic maps for the study were procured. Detailed discussions were held with the concerned officers of Forest Research Institute, Dehra Dun to avoid duplication of work. Methodologies have been worked out and field studies will be taken up.

Ecol 02/79 - A field key to the identification of indigenous arborescent species of Kerala Forests, based on eco-taxonomic features

A comprehensive list of about 600 arborescent species of Kerala forests has been compiled of which 185 are of economic importance of varying extent. About 175 constant diagnostic characters have been chosen and available data from literature gathered. Field observations have been made to the extent possible to supplement information from literature. Based on the charactors identified, punch cards are being prepared.

Ecol 03/79- Eco- taxonomic study of seedlings of commercially important tree species of Kerala and preparation of key for their identification

Propagules (seeds/seedlings) of about 50 identified tree species have been collected and grown in the campus. Detailed diagnostic characteristics have been worked out for about 20 species and drawings made. A new type of field key has been devised to facilitate easy identification.

ENTOMOLOGY

Collection of forest insects were made and several species identified and preserved as reference collection. Suitable insect boxes and cabinets were designed and prepared for storage of collections.

Entem 01/76- Termite control in *Eucalyptus* plantations

During previous years, various insecticides and methods of their application were field-tested at Varavur and Kondazhi for control of termits attacking *Eucalyptus* seedlings. It was seen that aldrin, chlordane and heptachlor were effective at rates of 0.25 g a.i. (active ingredient) and above per plant, when applied in various ways. Further experiments showed that drenching container seedlings with an EC (emulsified concentrate) formulation of the insecticide or premixing the insecticide with the container soil was simple and effective and could replace cumbersome field-pit treatment. With most insecticides, as low as 0.03 g a.i. per container gave satisfactory protection. In the current year, further experiments were laid out at Potta, Trichur Division with selected doses of aldrin, chlordane and heptachlor, both as dust and EC, to gather confirmatory data. In addition, the efficacy of root-dip treatments with aldrin and use of smaller treated containers are under trial.

In addition to the above, large-scale trials covering about five hectare of plantation for each treatment were laid out at Potta with the following treatments (1) premixing of container soil with about 0.03 g a.i. of aldrin dust, (2) drenching container seedling with about 0.06 g a.i. of aldrin EC, and (3) drenching container seedling with about 0.12 g a.i. of aldrin EC. The last treatment is also under trial at Kalikavu, Nilambur Division. Data obtained so far indicate that all the three treatments are effective.

A study of the termite fauna in the experimental area showed that although more than a dozen species of termites were present in the area, only 3-4 species were responsible for damaging eucalypts.

Entom 02 / 77 - Studies on the seasonal incidence of teak defoliators and the effect of defoliation on volume increment of teak

Experiments were laid out previously in a 1974 teak plantation at Karulai, Nilambur to study the seasonal incidence of defoliators and to assess possible growth loss due to insect defoliation over a period of 4-5 years. In plot number 1 and 5 in Block I, three waves of defoliation occurred, in May - June, July and September, in contrast to only two overlapping waves of defoliation in plot number 9 and 11 in Block II (*Figure 3*). All major defoliations were caused by *Hyblaea puere*.

In defoliator - protected plots, approximately 4 - 5 cm increment in GBH was recorded during the current year; most increment occured before end of October. In the unprotected plots in Block I, the mean annual increment in GBH was considerably low compared to protected; such a clear-cut difference was not noticeable in Block II. The data are being analysed statistically.

Entom 03 / 77 - Biological control of *Eupatorium odoratum*

Project deferred pending external collaboration for which proposals have been sent.

Entom 04 / 79 - Preliminary investigations on the biology and control of beetles damaging stored reed

This is a modified project arising from a project sponsored in 1977 by the Hindustan Paper Corporation Ltd. (H. P. C.), to investigate the ecology and control of insects damaging stored reed at the Kerala Newsprint Factory storage yard at Vellur. Apart from recommending control measures for termites and general observations on the biology of *Dinoderus* beetles, no progress was possible in previous years as the H. P. C. was not able to provide reed stacks in the project area. Since the sponsoring agency informed that reeds could be made available only when the factory starts regular cutting and stacking of reeds, the project was modified to limit the scope to laboratory investigations. The modified project was approved by the Sponsoring Agency in July 1979. Since then large cultures of the beetles are being built up and maintained in the laboratory for investigations.

Entom 05/77 - Biology and control of insect pests of fast - growing hardwood species

Defoliation of a 1974 plantation (20 ha) of *Albizia falcataria* in the Industrial Plantation Division, Vazhachal by the bagworm *Pteroma plagiophlens* was first noticed in 1977 and since then the dynamics of infestation is being studied. This insect has not been reported earlier as a pest of *Albizia*. During the current year, there was heavy build-up of infestation in April-May, resulting in considerable damage to trees. After part

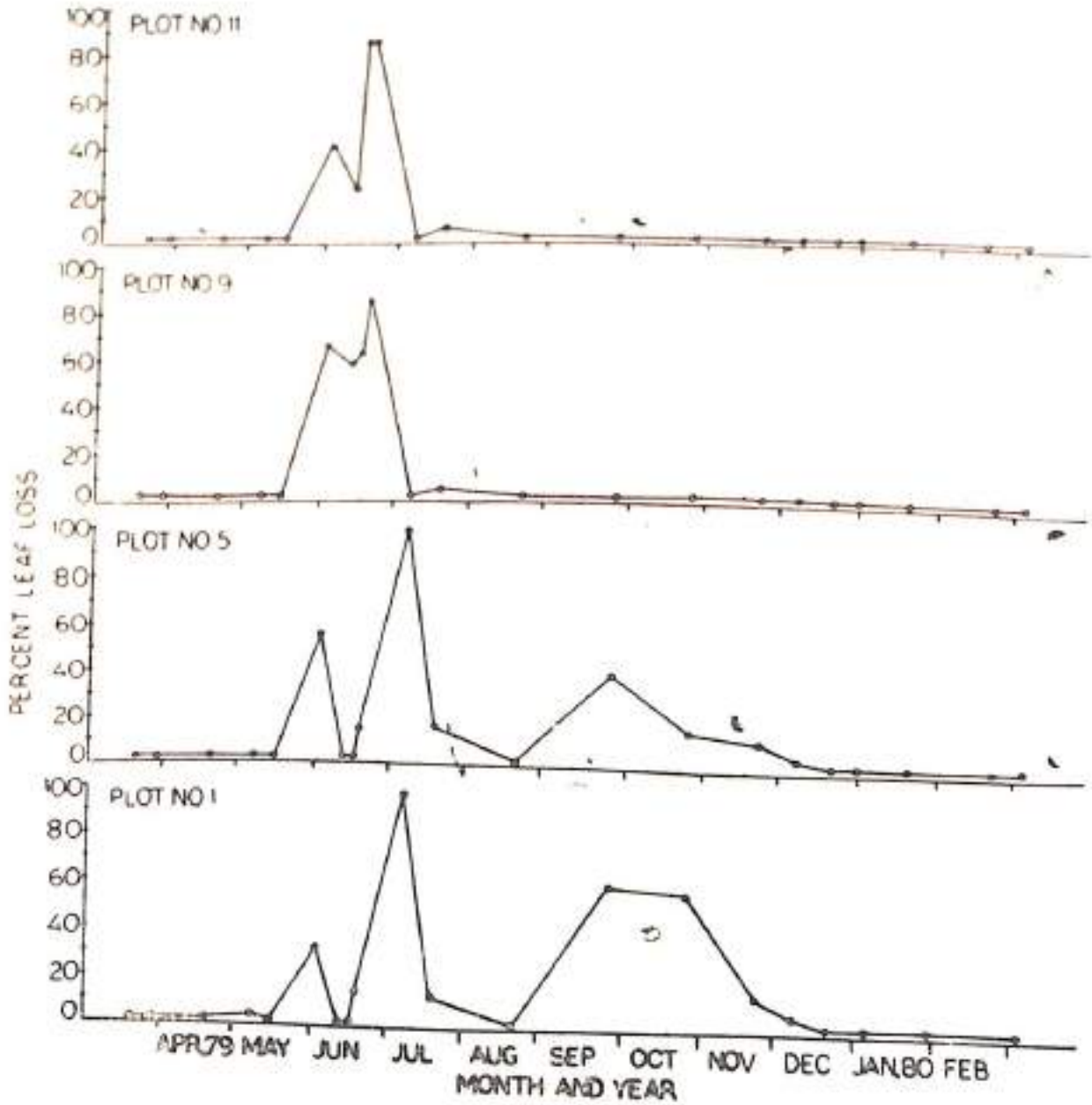

Figure 3. Seasonal incidence of teak defoliation in four plots in a 1974 plantation at Karulai, Nilambur

of the plantation suffered heavy defoliation, the plantation was sprayed with 0.1% lindane to check further defoliation. The spraying was carried out by the Forest Department as per our recommendations. No build-up of the insect has been noticed since then. In heavily defoliated patches, nearly half of the trees suffered total or partial death. The insect has not so far been found in other *Albizia* plantation in Vazhachal or in the Southern Circle. However, the pest was recorded from road side *Delonix regia* trees in Trichur Division this year.

A bostrychid borer (unidentified) was found to attack a 5-year old *Gmelina arborea* plantation in Kottappara. The beetles and larvae bore into live branches causing die-back of the attacked branches. Obervations are being continued to assess the pest status.

Entom 06/79 - Investigations on the possibility of non-insecticidal control of termites

Different methods were tried to rear subterranean termites under laboratory conditions, but successful establishment of a colony has not been obtained.

Seeds of eight species of *Eucalyptus* obtained from Australia were sown with a view to study the preferences, if any, of termites to different *Eucalyptus* species. Except *E. camaldulensis*, sufficient number of seedlings were not obtained to undertake the planned experiment. Fortyfive seedings of *E. camaldulensis* were planted out at Potta (Wadakkanchery). Although none was attacked by termites, further experiments are necessary to draw conclusions. A suitable baiting material for termites was selected to test the repellent/attractant effect of different plant products. Wood blocks of rubber, *Bombax ceiba* and *Terminalia tomentosa* (30 cm x 1.5 cm x 1 cm) were used for the study. Three months exposure around a termite mound showed rubber wood to be the most susceptible.

Entom 07/79 – A survey of beetles damaging commercially important stored timber in Kerala

Collection of timber beetles was made from several timber depots in Kerala. Additional collections are planned to cover more timber species, in different localities and seasons. Studies so far indicated that in Kerala, *Ailanthus, Bombax, Erythrina, Hevea* etc. are prone to heavy damage by insect borers. Borer damage to peeled and stored veneers of *Ailanthus* and *Bombax* was also recorded. Sixteen species of borers belonging to Anthribidae, Bostrychidae, Cerambycidae, Curculionidae and Platynodidae have so far been identified from 15 timber species.

Entom 08/79 – Seasonal incidence, host range and control of the teak sapling borer, *Sahyadrassus malabaricus*

Survey of 3-5 year old teak plantations in Athirapally, Parambikulam, Kaliar and Kallar Valley showed that 10-32% of the plants were attacked by the borer, *Sahyadrassus malabaricus*. In some plots, the incidence was as high as 46%. Generally, the plants were

able to withstand the attack, although a small number of them were seriously damaged either due to ring-barking or wind snapping at points weakened by the borer attack. Some growth retardation of attacked plants may have also occurred. The insect was recorded specifically from Kulathupuzha, Achencoil, Vazhachal, Kalady, Peerumedu, Pamba, Kothamangalam, Deviculam, Trichur, Peechi, Wadakkancherry, Parambikulam, Nilambur, Sultan's Battery and Manantoddy. It has a wide host range, of which *Clerodendron viscosum* and *Trema orientalis* appear to be most common.

Data gathered so far indicate that most moths emerge in late April to early May and that the insect may have an annual life cycle.

Trials conducted at Parambikulam, Kaliar and Athirapally showed that brush application of 0.5% lindane or carbaryl around the borer hole gave a high degree of control, but not complete control. Application of tar or 0.5% HCH (BHC) gave poor control. Further trials are planned with new formulations.

Other activities

Field investigations were made on several insect pest problems reported by the Kerala Forest Department and suitable recommendations made. These included attack of borer, *Sahyadrassus malabaricus* in young teak plantations at Athirapally, Kaliar and Karulai; incidence of termite attack in eucalypt plantations at Manantoddy and Agali; incidence of terminal shoot damage of teak due to insect defoliation at Konni and defoliation of *Albizia falcataria* by the bagworm, *Pteroma plagiophleps* at Vazhachal.

GENETICS

Laboratory facilities were developed and infrastructural facilities for field investigations arranged.

Genet 01 / 79 - Genetic improvement of Teak in Kerala

Budwood material were collected from the crowns of fifteen selected plus trees in Nilambur area and established as grafts on stumps in the nursery at Nilambur Sub-Centre. Successful grafts were duly established in the ground during the monsoon in 1979 in a completely randomized 15-clone orchard design. There were a few mortalities of the planted grafts in one corner of the orchard, which were duly replaced.

Six of the eighteen different species of insects collected visiting teak inflorescences, were identified. Phenological observations on flowering and fruiting were made. Floral biology and fruit setting pattern on the inflorescence were studied.

Certain morphological marker characters like tomentum, epidermal glands etc. of leaves collected from different individual trees were studied for possible correlation with skeletoniser and defoliator attack. *Tectona hamiltoniana*/ *T. grandis* heteroplastic grafts were established out of material brought from Forest Research Institute, Dehra Dun-

Genet 02/79- Improvement of eucalypts by selection and interspecific hybridization

Synchronously flowering trees of *Eucalyptus grandis* and *E. deglupta* were identified at Vazhachal where reciprocal hybridization between the two was attempted. Seeds of individual *E. grandis x E. tereticornis* (FRI-10) hybrids were sown in Nilambur nursery and duly field planted. These and two other hybrids FRI-4 and FRI-5 are being concurrently assessed for relative chlorophyll content, in the Physiology Division.

Genet 03/79- Genetic improvement of important matchwood species *Ailanthus triphysa* and *Bombax ceiba*

Grafting of *Ailanthus* was attempted. Plus trees of *Bombax* were located. *Bombax ceibaX B.insigne* interspecific hybridization was attempted at Peechi, using fresh as well as stored pollen.

Genet 04/79- Provenance trials and floral biological studies of *Gmelina arborea*

Trial grafts were established. Some potential plus trees were spotted in Nadugani.

Other activities

A plus tree workshop was organised at the Nilambur Sub-Centre in November 1979 to initiate and actively involve junior level forest officials in the plus tree selection programme.

PATHOLOGY (FUNGAL DISEASES)

Laboratory was organised and representative areas selected in various plantations for detailed investigations.

Pathol (F)01/79- Survey of representative plantations in the State for leaf, stem and root diseases of forest trees and assessment of level of infection

A total of 28 plantations were selected for the study (*Figure 4*). Observations on the occurrence of various diseases and their level of infection will be recorded during monsoon (June/July) and after monsoon (Ocotober/November).

A total of about 550 disease specimens belonging to six host species were collected for the herbarium. About 200 fungal cultures were isolated in pure cultures from disease specimens of various host species.

New Disease Records

During the course of survey of plantations occurrence of following hither to unreported disease in India were recorded.

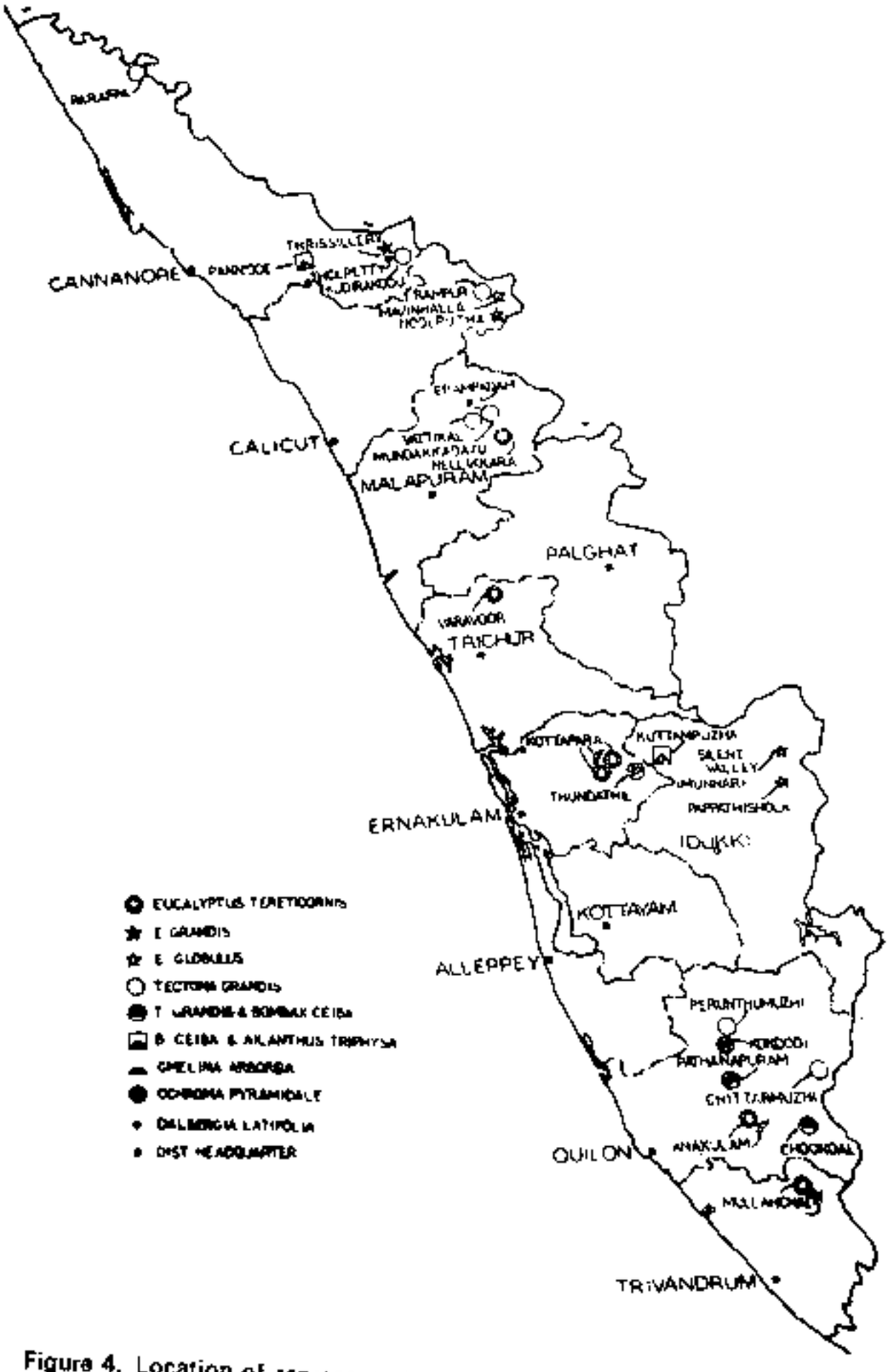

Figure 4. Location of representative plantations selected for disease survey

Tectona grandis.

Bacterial wilt, Mosaic disease, and Leaf spot caused by *Gloeosporium* sp.

Eucalyptus spp. : *Phaeoseptoria* leaf spot (*Figure 5*), *Pestalotia* leaf spot, Crown cankerous gall disease (*Figure 6*), *Botryodiplodia* canker (*Figure 7*), Collar rot caused by *Cylindrocladium scoparium*, Shoot blight caused by a new species of *Cylindrocladium*, Inflorescence infection by *Colletrichum* and *Torula* sp., and Silver mosaic (*Figure 8*).

Allanthus triphysa: Sooty mold on leaf, and *Corticium salmonicolor*.

Gmelina arborea: *Corticium salmonicolor*.

Detailed investigations related to authentic identification of causal organisms, pathogenecity trials and control measures of some of the important diseases are under way.

Some Priliminary Observations

Eucalyptus

i) *Phaeoseptoria* sp. which causes premature defoliation was the main pathogen. It was found to be widespread in most of the eucalypt plantations.

ii) *Cylindrocladium* posed the main threat to the foliage of younger plants during monsoon. However, during the dry period it caused infection of roots mainly in younger plantations and nurseries. Fresh infection of leaves during dry period was found only in tracts of high humidity.

iii) At least five species of *Cylindrocladium* were isolated which cause wide variety of symptoms. *Cylindrocladium* which is known to cause shoot/seedling blight was also found to be associated with damping off collar rot and wilt of seedlings. Except *C. scoparium* and *C. quinqueseptatum* the other three species are new records.

iv) Leaf sport caused by *Pestalotia* was observed during the whole period reported.

Tectona grandis

i) Bacterial wilt caused by *Pseudomonas* (?) was the major disease problem in 1 – 2 year old plantations at Thundathil and Kuttampuzha.

ii) *Corticium salmonicolor* caused typhical canker and girdling of stem which killed the main upper shoot in younger plants (1-2 year old); consequently epicormic shoots developed from the lower part of the stem.

iii) Leaf spot caused by *Gloeosporium* sp. was the major foliage disease encountered during and after monsoon period.

iv Teak rust, *Olivea tectonae* was prevalent throughout the State and appeared to be a matter of concern only in younger plantations

Figure 5. Young seedling of *Eucalyptus tereticornis* with necrotic spots caused by *Phaeoseptoria* sp.

Figure 6. Crown of *E. tereticornis* with canker gall disease

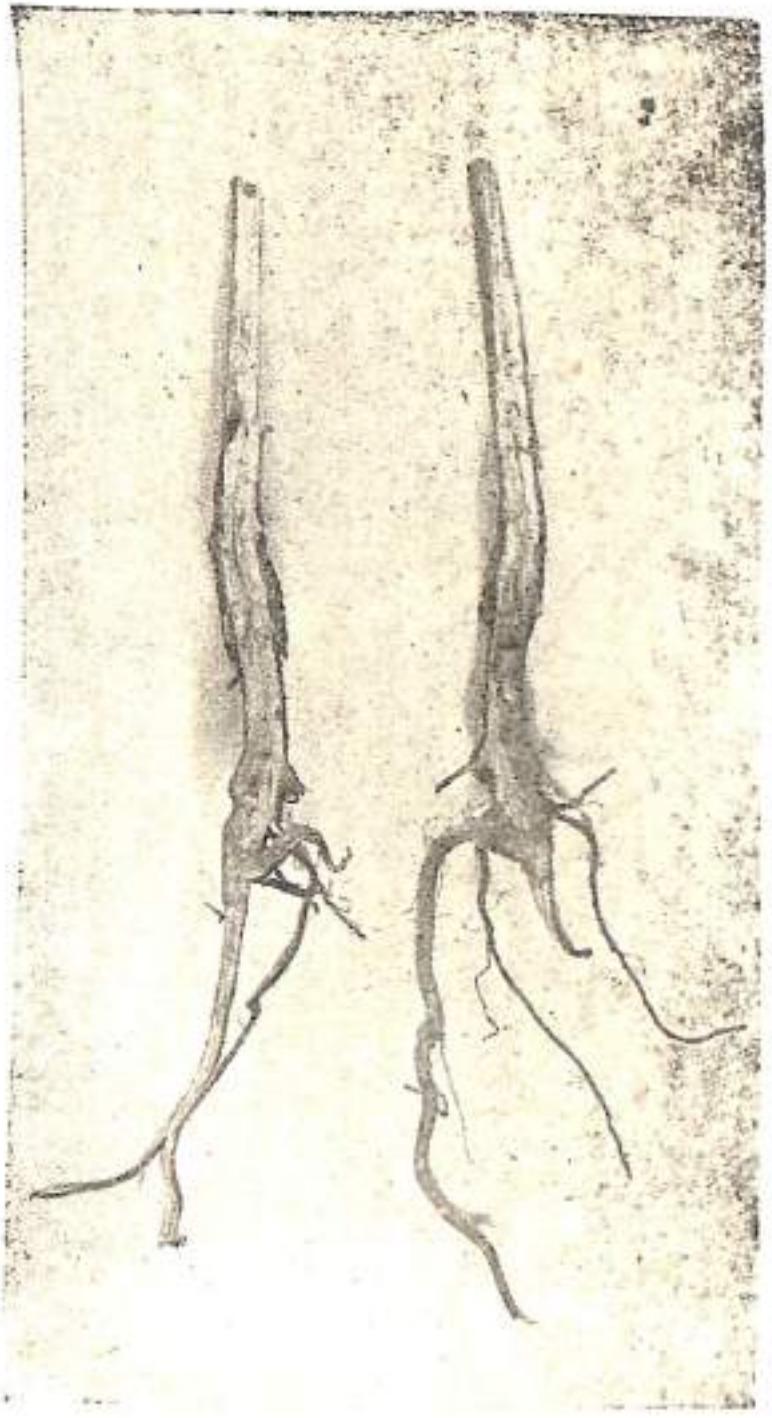

Figure 7. *Botryodiplodia* canker in *E. tereticornis* collar region

Figure 8. Silver mosaic of *E. tereticornis*

v) Powdery mildew, *Uncinula tectonae*, was also widespread and noticed in younger plantations. Usually in most of the plantations it was found appearing towards the end of the season when the leaves already had matured and thus did not cause any serious damage. However, at walayar very heavy infection was recorded even at the beginning of the season in the new flush.

Bombax ceiba: Spot disease caused by *Myrothecium* sp. was the major disease affecting foliage in most of the plantations. The disease severity varied from locality to locality. The heaviest infection was recorded at Choodal (Thenmala) and Pathanapuram were it resulted in premature defoliation.

Ailanthus triphysa : The most prevalent foliar disease observed in most of the plantations was caused by sooty mold fungus on the upper surface of leaves.

Ochroma pyramidale A serious disease, shoot die back, was observed at Konni and Nilambur. Although the pathogen isolated from the cankers produced on shoots was a *Fusarium* sp. its association with the disease as a primary pathogen is not yet confirmed.

Gmelina arborea: The only disease caused by a species of *Cercospora* was recorded in Kottappara area.

Dalbergia latifolia : Two diseases, namely, a rust (*Marvalia achroa)* and a leaf spot caused by *Phomopsis* sp. were recorded in most of the plantations visited.

Preliminary experiments and results

i) Attempts were made to transmit disease of *Eucalyptus tereticornis* collected from Tamarassery add Potta, by mechanical (sap) and graft techniques. So far no symptoms have appeared even after 5 months of inoculation. The plants are under observation.

ii) The culture filtrates of *C. salmonicolor,* varying in age and concentration were tested for the production of toxin by the fungus. Results gave a positive Indication of the production of toxin by *C. salmonicolor.* A large scale experiment is planned to further confirm these results employing seedlings of varying ages of different species of *Eucalyptus* grown under aseptic conditions.

iii) Taxonomic characters of 14 isolates were studied and cultures sent to Commonwealth Mycological Institute, England for authentic indentification.

Survey of nurseries for the occurrence of diseases: A total of eight nurseries of eucalypts were surveyed for the occurrence of seedling disease.

Damping off, wilt, collar rot were recorded and *Pythium* and *Cylindrocladium* sp. isolated from affected seedlings and soil samples.

Pathol (F) 02 79 – **Epidemiology of *Cylindrocladium* associated with *Eucalyptus* leaf blight and its control using soil fumigants and systemic fungicides**

A plantation of *Eucalyptus tereticornis* (1978) was selected at Machadmala, Wadakkancherry and visited three times for recording regular observations on incidence of leaf blight. Since the disease incidence was very poor even during the peak period of disease spread, this plantation was found unsuitable for this work. One plantation each at Kottappara (1970 coppiced) and Chandanathod (1976) have been selected for the purpose. At Chandanathod heavy infection of *Cylindrocladium* causing die back of shoots and leaf blight was recorded during monsoon. However, later in the month of March, no *Cylindrocladium* infection was found, but *Phaeoseptoria* and other weaker parasites were prevalent.

Twentysix cultures of *Cylindrocladium* were isolated from different eucalypts (*E*) *tereticornis*, *E grandis*, *E. torelliana*, *E. alba*, *E. citriodora*, FRI 4 and 5. The isolates are maintained in pure cultures for further epidemiological studies.

Preliminary Observations

i) Widespread high incidence of *Cylindrocladium* was observed during monsoon period (June-September). Later in the drier period, the infection was localised only in tracts of high humidity.

ii) *C. scoparium* caused mortality in two year old *E. tereticornis* by infecting the root system.

iii) *C. scoparium* caused nursery seeding blight in FRI 4 and 5.

iv) *Cylindrocladium* sp. (3-celled conidia) was found to cause collar rot in nursery seedlings of *E. grandis*.

v) Taxonomic characters of seven isolates of *Cylindrocladium* were studied and the cultures sent to Commonwealth Mycological Institute, U. K. for authentic identification.

Other activities

A young teak plantation (1979) was visited in Begur Range, Wynad Division, where yellowing and wilting of saplings was reported. It was found that they were due to the prevailing drought conditions.

An *Eucalyptus tereticornis* plantation (1978) was visited at Cheenkannipalli, Edamanna Range, Nilambur Special Division where more than 50% plants were found to be affected by seedling blight caused by *Cylindrocladium quinqueseptatum*. An immediate spray of 0.3% Dithane M - 45 was recommended for controlling the infection.

A young 1978 teak plantation with ginger as taungya was visited at Kuttampuzha, Kodanad, Malayattur Division. The area was examined thoroughly in relation to *Pythium* infection in teak. It was observed that at places where ginger was badly affected due to

Pythium, teak did not show sign of infection. Quite a few plants were uprooted and examined and it was found that death was due to bacterial wilt. A few plants, which may have died due to some fungal infection of roots were collected for further study in laboratory.

Teak plantations (1975, 1976, 1977) were visited at Mallana, Kodanad Range, Malayattoor Division where dying of teak plants was reported. It was observed that all the plants of 1975 and 1976 had profuse branching, stunting of internodes and premature defoliation. In 1977 plantation the stunting of internodes was just starting. Close examination of dead shoots revealed that the death was not due to any parasite but due to premature defoliation which possibly resulted from some nutritional deficiency or some soil / physiological factors.

A Cardamom plantation was visited at Padagini, Nelliampathy hills. Servere infection of *Mycosphaerella* was found to cause necrosis and yellowing of leaves in the plantation. It was suggested to apply at least three sprav of Bordeaux mixture (one before monsoon, second after monsoon and third during dry period) to control the disease. Heavy infestation of *Aschersonia*, a parasitic fungus of nymphs of white fly was recorded on cardamom leaves in one parts of the plantation.

A plantation of *E. tereticornis* (1979) was visited at Tamarassary where heavy mortality of plants was reported. The cause of death of plants was due to a canker in the root collar region. The same type of canker caused by *Botryodiplodia* was also found in dying plants in Kottappara area. The same fungus was isolated from Tamarassery specimens. Since it is a soil borne fungus and no literature is available to control this disease, suggested to plant casuality replacement saplings in fresh pits to avoid any furthe infection.

A nursery of *E. tereticornis* was visited at Kottappara where damping off of seedlings was reported. An immediate treatment of 0.3% dithane M- 45 was advised. In case the treatment was not effective, a soil drench of Hexathir or Thiride (0.25%) was also suggested. A *Pythium* sp. was isolated repeatedly from the specimens.

A balsa plantation (1978) was visited at Erambadam, Nilambur Range. There was more than 20% mortality in one part of the plantation. Species of *Fusarium* was isolated consistently from the cankers.

PATHOLOGY (NON-FUNGAL DISEASES)

Organization of the laboratory has been completed according to the plans and specifications given. Most of the instruments and equipments have been procured.

A detailed plan for the Institute Glass House has been prepared.

Pathol (NF) 01/79 – Studies on the host-parasite relationship of phanerogamic parasite(s) on teak and their possible control

a) Identification of the parasite(s)

The only angiospermic parasite attacking teak in the area has been identified as *Dendrophthoe falcata* var. *pubescens* Hook. *f*. (*Figure* 9a and c).

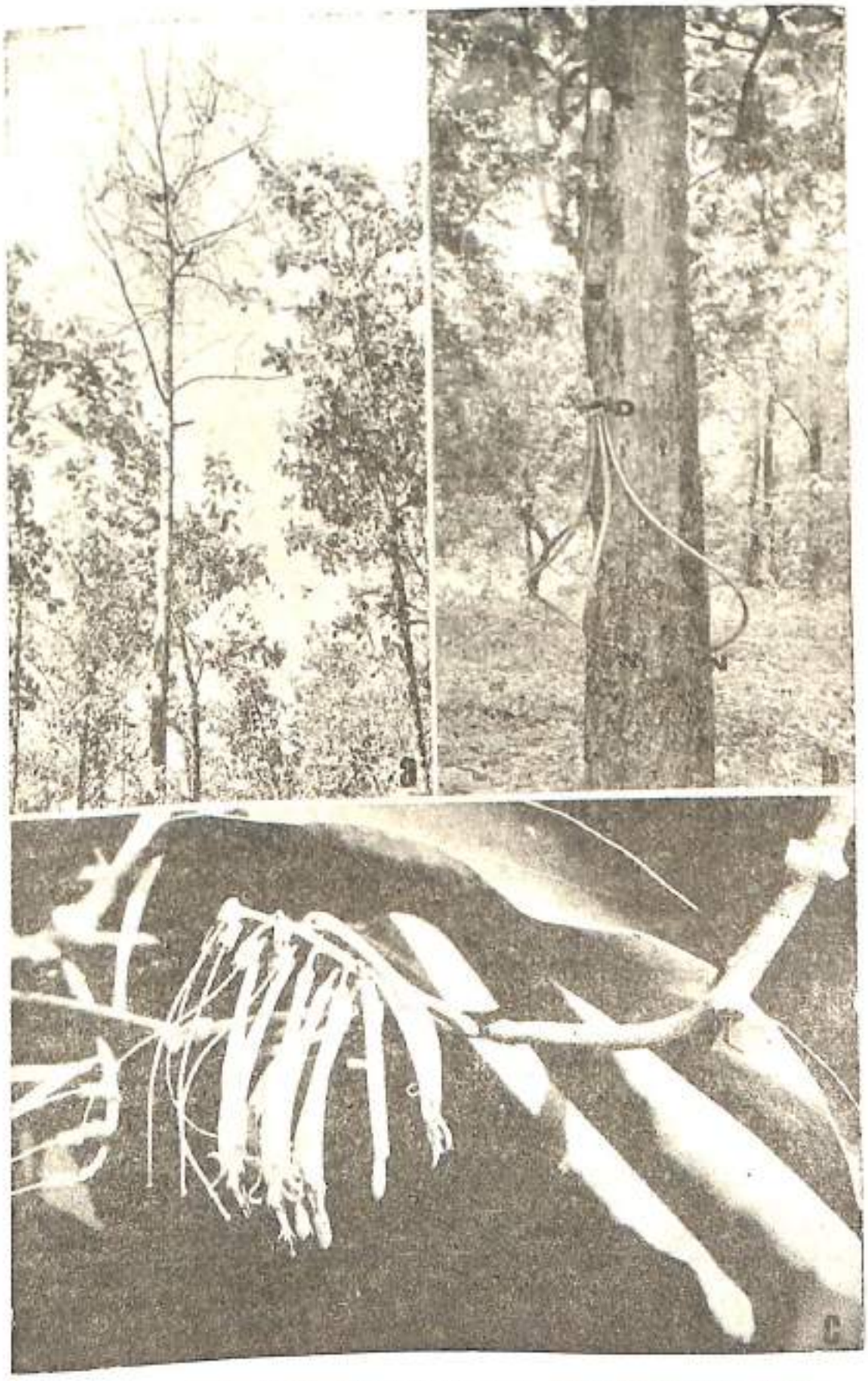

Figure 9. (a) Teak plantation with *Dendrophthoe falcata* infestation; (b) Tree-injection set R : reservoir, C : dripping-device, S : stop cock, D : distributor, N : nozzles (C) Flowers of *D. falcata* var. *pubescens* Hook. f. on teak

b) Survey of the extent of parasite infestation

An extensive tour was made in the various plantations in Nilambur Division. Representative plantations were surveyed systematically and observations were taken at random from 10% of the trees in the plantations. Preliminary survey showed that all the plantations in Nilambur Division prior to the year 1972 are having *Dendrophthoe falcata* infestation. Analysis showed that extent of infestation ranged from 35% to 93% depending on the age of the plantation. Percentage of infestation has a direct correlation with the age of plantation. Experiment has been designed and data are being collected to find out the volume loss of timber, if there is any, due to the parasite.

c) Development of a tree injection technique

A simple technique for infesing chemicals in general, and, for combating the loranthaceous parasites in teak in particular, has been developed. The technique involves drilling holes into the main trunk and inserting locally made steel injectors into them which are connected to a reservoir of chemical. A dripper is connected between the resorvoir and the injector through which dripping (intake) of the chemical can be viewed (*Figure* 9 b). Aqueous indicator dye takes approximately two hours to reach a height of about 20 m and the tracer dye could be detected in all parts of the tree.

d) Experiment to find out the most suitable time for maximum infusion of chemicals by tree injection method

Rhodanine B, the indicator dye is injected to the trees by the technique earlier developed, at monthly intervals, to find out the suitable season for applying the chemical by tree injection method.

e) Experiment on chemical control

(i) *Tree injection:* The injection technique developed is found to be suitable to infuse various toxic chemicals and selective herbicides to the trees. A large number of firms manufacturing herbicides have been approached and some samples of herbicides have been procured. Site for the screening of chemicals has been selected in Nilambur. Periodic observations on the effect of these chemicals both on the host and the parasite are recorded systematically in a carefully prepared proforma. A score card has been developed to assess the degree of effect of the chemicals on the host and the parasite.

(ii) *Spray of chemicals*: In addition to infusion of chemicals by tree injection method, chemicals are also directly sprayed on the parasites to combat them.

f) Experiment on volume loss of timber

In order to find out the loss in volume of teak due to angiospermic parasite attack, data on timber yield from infested and healthy trees from final felling areas have been collected. Statistical analysis of the data is in progress.

g) Experiment on growth increment

To find out the effect of the parasite on growth increment, long term experiments have been set up in the plantations of Nilambur Division. Growth increment of

parasite infested and uninfested trees will be compared with the growth of trees from which the parasite has been physically removed.

h) **Experiment on the seed storage**

Mature fruits and seeds of the parasite have been stored in the refrigerator under suitable moisture Viability of these stored fruits and seeds are checked at intervals by germination test.

i) **Experiment on the pathological anatomy**

Specimen for pathological anatomy has been collected with the help of Wood Science Division and the study is in progress.

j) **Experiment on the physical and anatomical Properties of woed**

An experiment has been chalked out with the help of the Wood Science Division. Material will be collected from the final felling area in Nilambur Division.

k) **Experiments on the epidemiology of the parasite**

An experiment has been planned with the Ecology Division. Data on the flowering and fruiting of both the host and the parasite will be collected regularly. Also data on temperature, atmospheric precipitation, relative humidity of the teak growing areas will be collected and attempt will be made to correlate these data with the presence or absence of the parasite.

Pathol (NF) 02/79 – Studies on the little leaf disease of eucalyptus

a) Survey of *Eucalyptus* little leaf disease

Data are being collected along with the Disease Survey Project of Pathology (Fungal) Division about the distribution of this disease in Kerala.

b) Maintanance of living disease specimen under laboratory conditions

Disease specimens from different areas have been brought to the laboratory and maintained for transmission and microscopic studies.

c) Experiment on the transmission of the disease

Attempt has been made to transmit the disease by grafting as well as through the vegetative vector *Cuscuta chinensis*

Other activities

Seedling blight of *Delonix regia in* the nursery at the Nilambur Research Range Office was reported. On close observation, the seedlings were found to be infested with a free-living nematode. Spray of the recommended insecticide gave complete recovery of the disease.

Dr. S. K. Ghosh, invited by the Dean and joint Director (Ed.), I.A.R.I., gave guest lectures on Plant Mycoplasmas, in the Summer Institute, organised by I.C.A.R. at the Mycology and Plant Pathology Division, I.A.R.I., New Delhi (22-24 July 1979). Also he was invited by the Indian Institute of Science, Bangalore to help in establishing Plant Protoplast Culture Laboratory in the Microbiology and Cell Biology Division (5-10 November 1979.).

He was invited by the Joint Director of the Central Plantation Crops Research Institute, Regional Station, Kayamkulam to deliver a talk on [illegible] coconut in Western Africa.

SILVICULTURE

Silvi 01 79 - Silviculture and management of fast- growing indigenous hardwood species with multiple end uses

Experimental plots of *Gmelina arborea* raised in Chengankotti in 1977 and 78 remeasured in 1978 were maintained and regular growth measurements were recorded. Out of the seedlings raised from seven provenances at Chengankotti, Cochin provenance has shown good results. Seedlings from nine provenances raised at Kariem muriem have indicated that Sankosh provenance has good prospects. In both the plots, local provenances have not done well. During the year, seeds from 11 provenances were raised in the nursery. After collecting nursery data, the seedlings will be planted out in a plot already selected at Edakode.

Seedlings of *Anthocephalus chinensis* raised in the nursery were planted out in water logged areas in Kariem muriem. Due to severe drought, the seedlings did not survive. More seedlings have been raised in the nursery which will be planted out in water logged areas selected for the purpose.

Complete nursery behaviour data for *Acrocarpus fraxinifolius* were collected. Seedlings in containers as well as naked seedlings were planted out in crowbar holes and standard pits at Edakode to evolve suitable planting practices. Observations indicate that pit planting is more suitable. Stump planting of this species did not yield encouraging results although a few stumps sprouted.

Nursery behaviour studies of *Melia composita* were continued. Although lime pre-treatment gave indications of fair germination percentage, overall result was poor. Alternate methods on the basis of data obtained from Sri Lanka are being tried to overcome the difficulties in germination. Stem cuttings of this species were tried but the results were not encouraging. Although callus formation was uniformly good, development of roots was poor despite treatments. If success is achieved in obtaining good germination, this species can be tried in a wide range of habitats.

Seeds of *Leucaena leucocephala* received from the Forest Department (provenance not known) was sown in nursery to study the nursery behaviour. Various pre-treatments were tried and the results are summarised below:

Pre-treatment	Germination percent	Plant percent
Control	19	14
Seeds stored in water for 24 hours before sowing.	18	7
Seeds dipped in warm water for 4 minutes and stored in cloth bags for 48 hours.	29	20
Seeds in cloth bag immersed in water for 48 hours.	60	40

Seedlings were planted out in open area as well as under shade in teak Plantation Growth data are being record. The phenomenal growth rate of this species recorded elsewhere is not found in this case. Seeds from known provenance have been obtained through F. A. O. and sown in the nursery.

Investigations to study the possibility of stump planting of *Eucalyptus tereticornis* were continued. Results are very encouraging. More intensive studies have been planned to standardise the technique and planting stock has been raised in nursery for this purpose.

Silvi 02/79 - Study of afforestation techinque in grasslands of Kerala

Out of 14 plots, 10 were planted with *Erythrina lithosperma* stem cuttings and the remaining 4 with *Eucalyptus* stumps. Pre rooted *Erythrina* cuttings (1½ to 2 meters) planted out in pits as well as crowbar holes showed very encouraging results. All the stumps sprouted and root system established satisfactorily both in pits and crow bar holes. During summer, however, there were sings of desiccation. Stump Planting of *Eucalyptus grandis* in this area was not successful. Nursery stock of *Leucaena leucocephala* and *Calliandra calothyrsus* has been raised for planting experiments in grasslands.

SOIL SCIENCE

Soils 01/77- Agrisilvicultural practices in relaton to soil properties, soil erosion and soil management

Soil sampling and the analyses of particle-size, organic matter and exchangeable bases have been completed. Statistical analyses are in progress.

Soils 02/77 - Properties of soils under teak

Soil sampling completed. Particle-size, organic matter, exchangeable bases, exchange acidity and phosphorus determinations are in progress.

Soils 03/77 - Properties of soils under eucalyptus

Soil sampling completed. The following analyses are in progress: Particle-size, organic matter, exchangeable bases, exchange acidity and phosphorus.

Soils 04/79 - Influence of site factors in *Bombax ceiba* plantations

Field visit to some of the *Bombax* areas was undertaken. Sampling not yet started.

Other activities

Soil Science Division is also associated with the projects: Bot 01/79, Ecol 01/79 and Silvi 02/77.

A recommendation was sent to the Range Officer, Manantody, regarding fertilizer experiment in a failed *Eucalyptus* plantation at Peria.

A recommendation on lime application in new *Eucalyptus* plantations was sent to the Regional Manager, Kerala Forest Development Corporation, Munnar

Suggestions for improving management of the soils in 1978 and 1979 teak plantations of Bavali in Kartikulam area were sent to the Range Officer, Begur

STATISTICS

Stat 02/77 - A Data Bank for Forestry Sector in Kerala

Yield data from teak plantations in Wynad, Kozhikode, Nilambur, Konni, Palghat and Trichur for the years 1974-75 to 1978-79 relating to thinning and clearfelling were collected Since data from Palghat and Trichur were insufficient, the data for other Divisions were analysed and a report incorporating the results was brought out.

Data from all ranges in Chalakudy Division on the following aspects were collected and compiled.

1. From clearfelling coupe in Chalakudy the details of species, individual girth and height of trees.
2. Class-wise collection of teak poles and their disposal in teak plantation.
3. Species-wise details of trees from selection felling coupe.
4. Quota supply of timber to industrial units.

Stat 05/79-Analysis of factors influencing timber prices in Kerala

Timber prices of all species sold in auction in the Government Depot at Chalakudy for the years 1966 to 1979 were collected and analysis was taken up. Prices of timber in two private depots in Chalakudy from 1974 to 1979 were also collected.

Other activities

A project for determination of volume-weight relationship in *Eucalyptus* was suggested by the Kerala Forest Department. Preliminary work was done in the 1968 *E. tereticornis* Plantations in Kottappara. Nine stacks were taken up for the preliminary work. The stack measurements and weights on the 1st, 7th and 14th day were recorded. A provisional report incorporating the results was sent to the Kerala Forest Department.

The Division assisted in the design and analysis of the following experiments in other Divisions of the Institute.

1. Analysis of data on neem cake experiment to evaluate a possible pretectent against subterranean termites attacking *Eucalyptus* seedlings.
2. Analysis of data on seed characters of *E. tereticornis*.

WILDLIFE BIOLOGY

Wild 02/77- An ecological study in Periyar Tiger Reserve with special reference to Wildlife

The reconnaissance report of Periyar Tiger Reserve has been completed. In the report, a check list of mammals and birds of the Reserve has been included. Out of 32 species of mammals reported, the liontailed macaque and the tiger are endangered.

The avifauna consists of 181 species out of which 16 are winter migrants, 3 local migrants, and 153 residents.

Among arboreal mammals, Nilgiri langur is the commonest. The reserve also has a good population of the giant squirrel. Among the herbivores, elephant is the most numerous. Next to it is the wild boar which is followed by the sambar. Wild- dog is the commonest predator. Tiger comes next to it in this respect and its number may be betw. een 25 to 30.

An indication of the habitat preference of the arboreal forms as well as terrestrial ones is given. Considering the extent of forest (678 sq. km out of 777 sq. km), it appears that there is no shortage in resource for the arboreal species like the Nilgiri langur, the Liontailed macaque and the Giant squirrel. However for various reasons, the population of both the arboreal and terretrial mammals are being disturbed. Following interim reco. ommendations have been made for the improvement of the Reserve:

1. Construction of a masonry wall along the northern border of the reserve (about 5 km) to prevent cattle from entering the reserve.
2. Establishment of check posts at vulnerable points.
3. Establishment of a communication system.
4. Construction of a road through the interior of the forest to check poaching.
5. Controlled fishing under the supervision of Forest Deaprtment.
6. Prevention of collection of minor forest produce.
7. Taking over of all private estates in the reserve by the Forest Department
8. Bringing under one authority (Forest Department) all the activities of the Reserve, including Tourism.

Food and Food habit study

Intensive observations were made on larger animals like the elephant, the gaur, the sambar, the barking deer and also on the mouse deer.

Feeding behaviour of wild boar was observed for a comparatively longer period. An interesting behaviour was their feeding on the tadpoles of *Rana curpipes*. These tadpoles have a pair of poison gland and no avian predator to this is known. The only factor which checks their population was the trampling by elephants. A number of them were killed by elephants while they moved through the lake shore.

Food habits of predator species like tiger, panther and wild dog were studied mainly by analysing droppings. Three instances of cattle lifting by tigers were noted. Major natural prey species was the sambar. Behaviour of the wild dog while preying on the sambar was noted. Antipredator behaviour of the sambar was also observed several times.

Droppings of the sloth bear were collected and they are being analysed to study their food preference.

Breeding period of a few of the passerines were noted. January, February and March were the months when most of them breed. Insect abundance in the area is being studied since October 1979.

Productivity study

Action to dig trench for productivity study has been taken and it is hoped that by August data can be collected on this aspect.

Altogether, it is found that visual observation for food and feeding habit study and visual counting for population assessment are not possible in this kind of terrain. Therefore it is decided to concentrate more on faecal matters, for getting an idea about food and feeding habit. Also action is being taken to make pens for keeping sambar, barking deer and mouse deer to study their food preferences. Population will be studied by pellet group counting.

WOOD SCIENCE

Organisation of the laboratories is in progress. Wood working tools, binocular microscopes, projection microscope and hot-air ovenhave been procured. Order for major item like microtome is being processed.

Samples from about 50 species have been made for the Xylarium.

Wood 01/79 - A Handbook of Kerala Timberes

Data were collected for about 200 species First draft of the manuscript has been completed. Available information on structure, properties, uses etc. of the timber has been compiled.

Wood 02 / 79 - Structural variability in the wood of *Eucalyptus grandis* and *E. tereticornis* in relation to age and locality

Samples from various plantations have been collected for anatomical studies Due to lack of basic facilities, laboratory work could not be taken up.

Wood 03 / 79 - Preservative treatment of rubber wood

Literature survey has been completed. A portable dip treatment tank has been fabricated. Preliminary trial on 12 mm and 19 mm boards has been done and found promising.

Other activities

M/s Gwalior Rayons have referred a problem on the preservative treatment of their raw materials in storage. After studying the problem in all aspects including Entomology and Pathology, a project outline has been proposed.

GENERAL

Genl 01 / 78 - Studies on the changing pattern of man-forest interactions and their implication on ecology and management -- A case study of the Reserve and Vested Forests in Attappady, Kerala

Field work pertaining to the project has been completed in respect of data from house-holds, vegetation, soil and medicinal plants. Analysis of the data will be taken up and it is expected that the report will be ready for submission to the Department of Science & Technology, Government of India in September 1980.

PARTICIPATION IN SYMPOSIA CONFERENCES / SEMINARS

The Institute was represented by:

Dr. T. G. Alexander in a group meeting on "Multiple Cropping in Plantation Crops", C. P. C. R. I., Kayamkulam (May 28-30, 1979).

Prof. V. P. K. Nambiar in the Regional Meeting of the International Development Research Center on "Rattan Research Priorities in Asia", Singapore (June 4-6, 1979).

Dr. J. K. Sharma in the Second Annual Symposium on Plantation Crops, "Plant and Crop Protection", Ootacamund (June 25-30, 1979).

Shri. George Mathew in the Workshop on "Advances in Insect Taxonomy in India and the Orient", Manali (H. P.) (October 9-12, 1979).

Dr. R. Gnanaharan in the Symposium on "Role of Technological and Research Institutions in the Industrial Development of Kerala", Trivandrum (November 17, 1979).

Dr. C. S. Venkatesh in the Second Botanical Conference, "Relevance of Botany to Agriculture and Forestry", Bhagalpur University (December 29-31, 1979).

Dr. R. N. Chibbar in the Workshop on "High Performance Liquid Chromatography", Indian Institute of Science, Bangalore (January 1980).

Dr. C. S. Venkatesh, Dr. K. S. S. Nair, Dr. R. N. Chibbar and Dr. K. Balasubramanyan in the Second Forestry Conference, F. R. I., Dehra Dun (January 16-19, 1980).

Kum. K. K. Seethalakshmi in the Symposium on "Physiology of Productivity", I. A. R. I., New Delhi (February 11-12, 1980).

Dr. R. Gnanaharan in the Seminar on "Wood Science and Technology", I. I. T., Madras (March 13-14, 1980).

Dr. P. M. Ganapathy, Dr. C. S. Venkatesh, Dr. K. Balasubramanyan and Dr. S. K. Ghosh in the National Seminar on "Trees and People", Ernakulam (March 22-23, 1980).

PAPERS PRESENTED AT THE SYMPOSIA CONFERENCES SEMINARS

"Systematics of Indian Pyralidina (Lepidoptera : Pyraloidea) – Shri George Mathew and Prof. M.G. Pamdas Menon*

"Wood as raw material" - Dr. R. Gnanaharan

"Botanical research in relation to Forestry" - Dr. C. S. Venkatesh

"Genetically tailoring forest trees for industries" – Dr. C. S. Venkatesh

"Problem of insect defoliation of teak - to spray or not to spray" - Dr. K. S. S. Nair

"Studies on the physiology of vegetative propagation by rooting stem cuttings" - Dr. R. N. Chibbar

"Litter production in the dry evergreen forest near Marakkanam, Coromandal Coast" - Dr. K. Balasubramanyan

"Preliminary studies on the effect of some growth regulatory substances on the growth and development of seedings of *Hopea parviflora* - Kum. K. K. Seethalakshmi and Dr. R. N. Chibbar

*Emeritus Scientisaist Kerala Agricultural University, Mannuthy.

"The importance of wood preservation" – Dr R. Gnanaharan

"The environmental importance of Tropical Forests" Dr. K. Balasubramanyan and Dr. P. M. Ganapathy

"A forest tree improvement working plan for Kerala" - Dr. C. S. Venkatesh

PAPERS PUBLISHED

George Mathew. 1980. Occurence of *Sylepta derogata* FB. (Lepidoptera, Pyraustidae) as a pest of Balsa (*Ochroma pyramidale*) in Kerala. Entomon 5(1)71-72.

Nair, K. S. S. 1980. Current state of pesiticide use In Kerala Forest and future projection upto 2000 AD. In Pesticide Residues in the Environment in India (eds. C. A. Edwadrs, G. K. Veeresh and H. R. Krueger) Proc. Sym. Univ. Agric. Sci. Hebbal, Bangalore, 1978 pp. 32-35.

Ghosh, S. K. and M. Balasundaran 1980. A simple technique for injecting chemicals into teak Curr. Sci. (In press).