



**TROPICAL BOTANIC GARDEN  
AND RESEARCH INSTITUTE  
PALODE, THIRUVANANTHAPURAM**



**ANNUAL REPORT  
1992 - 94**



*Impatiens coelotropis* Fisch.

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April 1992 - March 93  
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## Foreword

The years 1992-93 and 1993-94 witnessed remarkable achievements in the R & D front through action oriented research programmes systematically introduced and steadily implemented by different R & D Divisions of the Institute. They were mainly aimed at tapping the rich and varied but hitherto untapped and underexploited plant genetic resources of the nation to the best economic advantage and well being of the people.

The year 1993 was memorable in the history of the Institute with the development that helped the organization to find a place as one of the Centres of Excellence in the third world countries that facilitated international collaboration and cooperation. Recognition of TBGRI as the accredited organization of the UNCED has brought the Institute in the limelight of organizations and countries which are committed to conserve the rich biodiversity of the tropics.

The entire activities of the Institute were streamlined through Garden System and Research and Development System which comprise nine divisions viz. Horticulture and Garden Development, Plant Biotechnology, Cryptogamic Botany, Microbiology, Ethnomedicine, Ethnopharmacology, Phytochemistry, Conservation Biology and Herbarium, Museum and Eco-Education.

Research programmes on Chemistry and Ethnopharmacology of Indian medicinal plants launched in collaboration with DANIDA in the field of plant derived drugs are sure to help the future of mankind in many ways. Several R & D projects sanctioned by Central and State Government funding agencies under report are expected to improve the socio-economic status of the rural mass as specific thrust was given in the projects on grass root level application. Skilled human resource development in conventional and nonconventional multiplication and cultural practices of high value ornamentals, medicinal plants, mushrooms and popularization of native edible fruit resources and propagation of simple inexpensive and effective herbal remedies for primary health care programmes in the rural sector are to go a long way in the upliftment of the poor for whom fruits of scientific research remained to a large extent inaccessible.

The period under report has also marked the massive restoration measures, botanical as well as structural, successfully launched by the Institute to combat the loss suffered during two occasions of devastating flood that denuded more than five acres of garden land which had been the centre of hectic plant introduction activities for the last ten years.

I am confident that R & D activities of the Institute can be reinforced with renewed vigor in the light of valuable guidance, sustained support and active cooperation from the Chairman and Members of the Governing Body and Executive Committee, the Government of Kerala and the entire staff of TBGRI.

P Pushpangadan  
Director

## Foreword

TBGRI 1992-1994  
at a glance

1. Number of Projects undertaken		15
2. Projects in hand		10
3. Processes released		3
4. Publications :		
Monograph 1		
Books 2		
Booklet 1		
Journal International 7		
Journal National 26		
	<b>Total</b>	<b>37</b>
5. Technical papers presented in seminar / conference etc.		
International 5		
National 22		
	<b>Total</b>	<b>27</b>
6. Awards / Honours		3
7. Staff deputed abroad		6
8. Seminar / workshop conducted		3
9. Training Imparted:		
Academic 15		
Human Resource Development 320		
	<b>Total</b>	<b>335</b>
10. Exhibitions conducted / participated		20
11. Budget (Rs in Lakhs) :		
Plan 110		
Non Plan 50		
	<b>Total</b>	<b>160</b>
Receipt through projects (Rs in Lakhs)		157
12. Staff :		
Scientific 17		
Technical 21		
Non Technical 56		
Extramural (Scientists, RA, SRF, JRF, TA, Non Technical etc) 86		
Consultants 4		
	<b>Total</b>	<b>184</b>



# GARDEN SYSTEM

## DIVISION OF HORTICULTURE AND GARDEN DEVELOPMENT

The Garden System of the Institute was reorganized in March 1993 with the following functional units.

- Introduction, Accession, Plant Records and Quarantine.
- Central Nursery
- Conservation and Management of Rare and Endangered Plants.
- Arboretum, Palmetum and Aquatic plants
- Orchids
- Ornamental Plants, Cacti and Succulents
- Medicinal Plants
- Bamboosetum
- Ferns and Gymnosperms
- Seed Bank
- Service and Supplies (appear under Extension Activities)
- Training and Extension (appear under Extension Activities)

### A. Plant Introduction, Accession, Plant Records and Quarantine

This unit is formulated to coordinate and monitor all plant introductions to the Garden with proper collection data so that plant records are maintained appropriately. A hand book was prepared as guide lines and now plant introductions are being properly coordinated.

### B. Central Nursery

Propagation and multiplication of plants through conventional methods are done in Central Nursery. Nurturing of micropropagated plants during transplantation is undertaken here. Plants brought to the Garden by different working groups are reared here until they are properly established.

Standardization of conventional propagation methods is done in case of certain rare and endangered trees and woody medicinal plants. Work on propagation of rare and endemic plants already initiated are progressing well. The Nursery has started a study programme on certain endemic and rare trees to understand reasons for their rarity in the natural



*Cacti ready for the Rock Garden at Central Nursery*

habitats.

During this period about 36,700 rooted stem cuttings were produced; about 10,000 seedlings were transplanted and 850 plants were repotted. About 1200 seedlings/saplings of 160 species and 10,000 plants belonging to different categories were raised and supplied.

Wormicompost is used for mulching different kinds of plants.

### C. Conservation and Management of Rare and Endangered Plants

A conservatory for rare, endangered and endemic plants of the Western Ghats was established in the Garden. The conservatory presently holds about 450 plants belonging to about 90 species. This includes very rare and interesting plants such as *Nothopegia aureo-fulva*, recollected about 120 years after the original collection by Beddome in 1876. Several rare species listed in the Red Data Book of Indian Plants such as *Antistrophe serratifolia*, *Bentinckia condapanna*, *Glycosmis macrocarpa*, *Humboldtia decurrens*, *Humboldtia unijuga*, *Phaeanthus malabaricus* and *Popowia beddomiana* are also grown in the conservatory.

### D. Arboretum, Palmetum and Aquatic Plants

#### 1. Arboretum

Arboretum is a place where plants like trees, shrubs and large woody climbers are grown. Planting of tropical species in this Unit was started in 1984. Presently the Arboretum has 670 species.

There is a major *Ficus* collection in the Garden and now there are over 80 species in the Arboretum; most of their honsai forms are also exhibited in the Garden.

#### 2. Sacred Plants Garden

It is a venture aimed at developing and displaying collection of plants related to Indian mythology and religion. Plants of different 'vanas' mentioned in ancient Indian scriptures are identified and they are planted in such a way to simulate these 'vanas'. Plants in NANDANA VANA and NAVAGRAHA VANA were planted and that in SHIVAPANCHAYATNA was initiated.

#### 3. Palmetum

Palmetum, one of the attractions of the Garden, aims to conserve palms growing in the tropical parts of the world. During the period under report 37 species were introduced. There are 265 palms now in the palmetum belonging to 83

*The conservatory presently holds about 450 plants belonging to about 90 species. This includes very rare and interesting plants*

species. Four introduced palms viz. *Areca triandra*, *Chamaedorea metallica*, *Licuala peltata* and *Calamus travancorica* flowered during this period. Flowers were collected for further studies.

A few ornamental palms are being multiplied for distribution to the public. Plans are afoot to undertake an indepth study of tropical palms particularly with respect to their economic utility. Royal Botanic Gardens, Kew have helped TBGRI to establish the Palmetum by providing plantlings of many tropical palms.

#### 4. Aquatic Plants

The Garden has many water lilies including the giant water lilies *Victoria amazonica* and *Victoria cruziana*.

Future plan is to develop an aquatic garden in about 2 acres of garden land to conserve nearly 120 aquatic species reported from the tropical regions of the country.

#### E. Orchids

Work was initiated to develop a new open orchidarium to house both hybrids and wild species along with other high value ornamental plants. About 50 species were added to the collection of wild orchids, of which 35 were new to the Garden.

The Royal Botanic Gardens, Kew have supplied 26 taxa of tropical orchids during the period.

#### F. Ornamental Plants, Cacti and Succulents

The hillock in front of the main building was reshaped into a few terraces. Different species of plants were used to beautify these terraces. An area of 18 X 15 m in front of the Institute guest house was reshaped and the Institute emblem was developed by planting suitable species.

##### 1. Ornamentals

Reorganization of shrubbery was carried out by adding many attractive plants. The ornamental garden areas were kept attractive with annuals, roses, pot plants, cannas and other species. The shrubbery was enriched with 650 more plants. About 250 new plants were either purchased or collected for decorative purposes.

Bromeliads of Pineapple family are one of the fascinating group of ornamental plants. Presently the Garden has over 35 varieties of these plants that are attractively displayed with pebbles and tree stumps.

Wild ornamental species were introduced to the newly built conservatory. This was built with the financial assistance of the Ministry of Environment and Forests,

*The shrubbery was enriched with 650 more plants. Presently the Garden has over 35 varieties of bromeliads*

*Three display pockets were furnished with evolution charts of plant life, geological clock and an about 20 million year old fossil wood for educative purposes*



*Alstonia venenata from the Medicinal Plant Garden*

#### Government of India.

The canteen area was landscaped and made attractive by ornamental plants; like wise both sides of the main road leading to the nursery were beautified with canna beds. The path leading to woodland garden was paved with stones to check soil erosion .

Three display pockets excavated by the side of the main road were furnished with evolution charts of plant life, geological clock and an about 20 million year old fossil wood for educative purposes. Tops of these pockets were roofed with climbers and creepers to provide natural shade for the displays.

Thirty five species/varieties of Jasminums were collected and of these, 20 were introduced to the Garden. Many of them came from the Royal Botanic Gardens, Kew. Another Woodland Garden was developed by the side of the main road by planting a large number of shade loving plants among trees.

#### 2. Cacti and Succulents

Plants of this new Unit of the Garden were raised in the nursery from seeds obtained from other gardens or plant materials collected from elsewhere. A few plants were purchased from the National Botanical Research Institute, Lucknow. Now there are about 80 species / varieties of this group in the nursery ready for transplantation to the rockery.

#### 3. Rockery

One of the rocky areas in the Garden, 'Theepettiparra', was developed into a rockery with xerophytic plants in an informal design. A large number of rock pockets filled with soil were used to plant Euphorbias, Jatrophas, Pedilanthus, Catheranthus and Agaves. Rockery has attained a good shape now.

#### G. Medicinal Plants

During the period under report 32 species of medicinal plants and 10 species of trees were introduced to the Garden, which included *Scolopia ornata*, *Pellionea heyneana* and *Thottea* sp. In interspaces of established trees liliaceous plants were planted in groups. The Centella 'lawn' washed off in the flood of 1992 was replanted. Four specimens of *Coscinium fenestratum* were planted in the conservatory.

The present day tendency is to grow high yielding varieties of black pepper and remove land races from farmers' fields. In view of this alarming trend, development of a gene bank of *Piper nigrum* was initiated. The field gene bank developed in the medicinal plant garden harbours 20 genetically variant

racies of *Piper nigrum*. Taxonomical and cytological studies of *Piper*, *Peperomia* and *Pothomorphe* were also undertaken during this period.

A collection of Zingibers has been initiated in the medicinal plant garden for conservation, besides chemical and taxonomical studies.

The area surrounding the 'Dhanvanthari' statue was landscaped and five perennial beds were created. Forty two species of medicinal plants were introduced to the Garden during this period from places like Maruthuamala, Dellenoy Fort, Vattakotta, Brimore and Kulathupuzha. Three marshy medicinal plants were added to the existing collection. Some aromatic plants were replanted in the Garden. The medicinal plant garden now harbours about 750 species.

Using *Clerodendron inerme*, a medicinal plant, a 'snake boat' was shaped out to make the medicinal plant garden more attractive.

#### H. Bamboosetum

Bamboos are an economically important group of plants. In the past, bamboos were much dense in our forests and tribals and rural people depended on them for their livelihood. Now the situation has changed and population of bamboos in forests and rural areas are diminishing. To conserve tropical species of bamboos, TBGRI established a bamboosetum in 1987. It now covers an area of 5 ha. of garden land and harbours more than 200 accessions belonging to 37 taxa. This represents 30 % of the known species in India and is one of the best bamboo collections in Southern India.

#### I. Ferns and Gymnosperms

This unit was constituted taking into account the botanical importance of these two groups of plants. The Garden has already got about 33 species of gymnosperms. Another 28 species were procured from Ootty and Bangalore. Seven genera of Cycads were planted in front of the main building. Over 90 species of living ferns were introduced to the Garden. An area near Kalanpara in the Garden was cleared for the introduction of ferns and gymnosperms. This work is in progress.

#### J. Seed Bank

A seed store room was commissioned with controlled conditions of temperature ( $18 \pm 2^\circ\text{C}$ ) and humidity ( $18\% + 2$ ) to keep up the viability of seeds in store for prolonged periods. Procedure adopted for storage of seeds is as follows: Seeds are first cleaned and dried under a fan. They are then



Seed Bank - a view

kept in bottles containing silica gel to absorb moisture in seeds. Dried seeds are packed in air tight containers, labelled and stored in Seed Bank. The viability of the stored seeds are monitored periodically by germination tests. Germination and storage studies of selected seeds are carried out in the seed biology laboratory

Under seed exchange programme, 696 seed samples from various organizations have been received and the Institute has distributed 665 seed samples among 41 organizations/ individuals around the world. A reference collection of over 1200 seed samples have been assembled in the seed bank.

## PROJECTS

### 1. *Ex-situ* conservation of Rare and Endangered Plants of Agastyamala at TBGRI.

This project was sponsored by the Planning and Economic Affairs Department under the Western Ghats Development Programme. During the last three years Scientists working in the project conducted 29 field trips to this area and collected 5500 specimens.

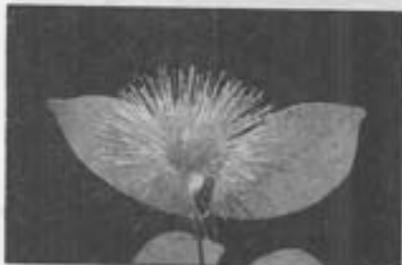
Our studies in this area revealed that about 10 % of the existing flora were endemic or rare. The Institute has taken steps to conserve one third of the plants listed as endemic or rare as their ecological requirements could be met with in forest areas of the Garden.

Altogether 600 living plants were introduced to the Garden from Agastyamala. Over 500 specimens of plants belonging to 95 species are cultivated in the conservatory. Over 5500 specimens belonging to about 1000 species were collected and processed for the Herbarium. Identification of about 1000 species has been completed. This includes four new species, eight rediscoveries, five new records and over 70 rare and endemic plants.

TBGRI has a plan to propagate and popularize these rare/ endemic plants and to reintroduce them in the Agastyamala with the help of Forest Department.

### 2. Eco-rehabilitation and Gene Pool Development of Selected Endangered Medicinal Plants of the Western Ghats.

This project funded by the State Committee on Science, Technology and Environment aims at collection, propagation and rehabilitation of endemic or endangered medicinal plants in suitable ecological conditions in the garden forest land. Seven rare accessions have been introduced during this period. The species collected under this project will be multiplied and supplied to the public.



*Syzygium laetum* - a species endemic to the Western Ghats

### 3. Germplasm Collection, Evaluation of Yield Potential and Exploitation of Fruit Crops of the Western Ghats.

This is a project sanctioned under the Western Ghats Development Programme of Planning and Economic Affairs Department, Government of Kerala.

The project aims at finding out edible fruits of the Western Ghats forests in order to educate the public about their value and to popularise them for cultivation in back yards.

Seeds and seedlings of about 30 species were collected conducting forty collection trips to different forests of the Western Ghats. In the nursery, seeds were sown in different media and about 6500 seedlings were raised through experimental trials. Steps are also taken to test the nutrient value of the fruits in our laboratory.

### 4. Survey, Exploration, Collection, Evaluation, *Ex-situ* Conservation and Propagation of Lesser Known/hitherto Unknown Wild Plants of Horticultural/Ornamental Value and Some Rare Endangered and Endemic Plants of the Western Ghats.

This project funded by the Ministry of Environment and Forests, Government of India aims at collecting wild plants of ornamental value from the Western Ghats forests of Kerala with a view to introduce and popularise them along with known ornamental plants.

During the period under report 15 collection trips were made and 300 wild plants of horticultural/ornamental value were collected. Hundred and eighty plants were found to have good ornamental value and of these 70 were with high desirable ornamental/horticultural characters suitable for introduction as garden plants. These plants were cultivated in a conservatory.

### 5. Botanical studies on the *In-situ* Medicinal Plant Conservation Area at Bonaccord (FRLHT Project).

This is a project started in December 1993 for the botanical studies of 300 hectare forest land at Bonaccord. Two study trips were conducted to the area and about 85 species were collected and identified.

### 6. National Gene Bank of Medicinal and Aromatic Plants

Work on development of a National Gene Bank for medicinal and aromatic plants was started with financial assistance from the Department of Biotechnology, Government of India under G-15 programme. Under this programme a 50 acre field gene bank, seed bank, tissue culture repository and a cryobank would be developed at the Garden for conservation of medicinal and aromatic plants



*Baccaurea courtallensis* - a potential wild fruit crop

*This project has the target of establishing a germplasm and a nursery of medicinal plants found in the southern districts of Kerala*

*So far nearly 350 live specimens of medicinal plants were collected*



*So far nearly 350 live specimens of medicinal plants were collected*

of peninsular India. Work on this project is in progress.

Over 400 accessions of plants and 75 seed samples were collected by conducting 9 major trips to different regions of Kerala and Tamil Nadu. Tissue culture attempts were initiated on six selected medicinal plants.

### 7. Medicinal Plant Conservation Park

This project funded by DANIDA (Danish International Developing Agency) through FRLHT (Foundation for Revitalization of Local Health Traditions) has the target of establishing a germplasm and a nursery of medicinal plants found in the southern districts of Kerala. The objectives of this programme are essentially to strengthen resource of local health traditions. A germplasm centre and a nursery are being developed under this project in an area of 25 acres of land. Establishment of a demonstration garden, herbarium, a seed museum and research on propagation studies which are in progress are other activities of the project.

So far nearly 350 live specimens of medicinal plants were collected by conducting a number of exploration trips to four southern districts of Kerala. Three hundred and ninety herbarium specimens were prepared and about 75 medicinal species used by different tribals of Kerala are exhibited in the form of a map made of plants.



# RESEARCH AND DEVELOPMENT



### DIVISION OF PLANT BIOTECHNOLOGY

Research activities in Plant Biotechnology Division are programmed in such a way that the available expertise in the field of biotechnology is employed to translate research findings into applicational mode keeping in view the requirements of the State. Biotechnological research was started with orchids in 1982 and the approach and techniques were steadily upgraded to achieve commercial production of orchids.

Today Orchids and Anthuriums are the most sought-after high-value floriculturals and Kerala is ideal for intensive floriculture using these crops. Expectations of literate local farming community are quite high and to keep pace with this reality, training in non-conventional propagation of otherwise slow-growing ornamentals and skilled human resource development was accorded top priority. Since ultimate benefits in terms of employment generation and enhancement of household income are expected to reach the growers, the Division got actively involved in the project on Ernakulam Biotechnology Zone. A catalytic interaction with the green fingered growers of Thiruvananthapuram was also established.

The following five components were accorded priority in Research and Development:

- a. Ex situ conservation through micropropagation of rare and endangered botanicals.
- b. Bioproduction of plant specific bioactive compounds using appropriate culture systems.
- c. Strengthening of tissue culture production of high value horticulturals to cater requirements of the public and to generate income to meet part of the high cost production.
- d. Physiological and biochemical investigations of native plants contributory to increased biomass production.
- e. Skilled human resource development in horticulture through training and extension services in non-conventional production of plants. (appears under Extension Activities)



Tissue cultured *Trichopus zeylanicus*  
*ssp. travancoricus* (Arogyappacha)

## A. Ex-situ Conservation through Micropropagation of Rare and Endangered Botanicals.

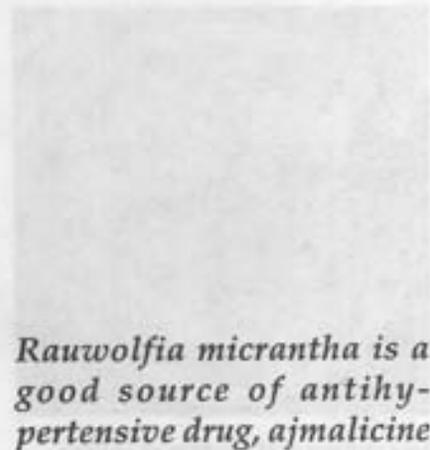
### 1. Rapid clonal multiplication of medicinal plants.

One of the key focuses of research was *Trichopus zeylanicus* var. *travancoricus*, a rare resource of the Agastyamala having potent adaptogenic properties. Scarce availability of raw material has restricted sustained production of drug from this plant. Therefore a protocol for mass multiplication of this herb essentially through shoot tip culture was developed. An integrated programme involving collection, culture initiation, subculture and multiplication, rooting and field establishment was launched for this purpose. Culture initiation was done in 553 shoot tips and 34 axillary buds. However, direct horticultural establishment of plants with root initiation in the mist chamber was encountered with problems; only 30% of the shoots got rooted and others perished. Since presence of root(s) was a pre-requisite for field establishment, *in vitro* rooting was achieved in 100% of the shoots in presence of appropriate auxins. In all, 300 rooted plants were raised and transferred to the field. Afterwards, 85 plants established in pots were used for field trials.



*Geophila reniformis* - a potential medicinal plant

*Rauwolfia micrantha* is a good source of antihypertensive drug, ajmalicine. Good sources of regeneration were established through somatic embryogenic pathway in root segment cultures of this plant. In other medicinal plants *Holostemma annulare* and *Plumbago rosea* direct shoot formation was noticed in root segment cultures. In *Janakia arayalpathra*, a rare ethnomedicinal plant, *in vitro* axillary shoot formation was the only route to increase the stock of plants. This method was inefficient as only a single shoot could be produced from a leaf axil; only in rare instances profuse axillary branching was noticed. A number of plants produced through tissue culture of different species were transferred to field for additional experiments. After field establishment and growth, it was observed that micropropagated plants of *Rauwolfia micrantha* contained concentrations of ajmalicine equal to that of the mother plants indicating the phenotypic uniformity of the conventionally and nonconventionally propagated plants.



*Rauwolfia micrantha* is a good source of antihypertensive drug, ajmalicine

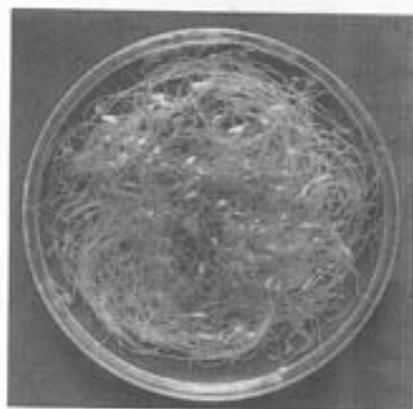
The only Indian picture plant, *Nepenthes khasiana* was multiplied and 481 plants were transferred to field.

### 2. Root cultures

Nearly 60% of the medicinal plants have roots as the source of drug used in traditional medicine. These plants are invariably subjected to destructive harvesting making some of them rare and endangered. As part of our ongoing



Root culture of *Hemidesmus indicus*



Root culture of *Hemidesmus indicus*

effort to develop root cultures of selected plants as renewable source of medicine, *Withania somnifera* (Amukkuram) and *Hemidesmus indicus* were investigated. Approximate nutrient media fortified with auxins were formulated. Maximum biomass yield was noticed in presence of low concentrations of auxins. Root morphology and clustering habit varied significantly in response to these growth regulators. Most of the cultures of *Withania somnifera* were tested and found to be rich in alkaloids. The work on the influence of various carbon sources on biomass yield and bioproduction is in progress.

#### B. Bioproduction of Plant-specific Compounds

Root cultures of *Plumbago rosea*, *Withania somnifera*, *Hemidesmus indicus* and *Janakia arayalpathra* were established to provide sustained supply of high value bioactive compounds. The isolated roots in culture stored plumbagin within and retained the same up to 55 days. After this the release occurred with the death of roots. At present, there is no alternative to destructive harvest of the compound. The product (plumbagin) was purified, characterized and structure was elucidated to establish authenticity. The data matched 1:1 with the standard plumbagin.

In *Withania somnifera* roots were found to be a rich source of total alkaloids. Axenic roots of *H. indicus* grown in still nutrient medium were more prolific than those under agitation.

#### C. Tissue culture production of high value horticulturals

The successful development of laboratory level rapid propagation protocols for selected hybrids of *Anthurium* and *Philodendron* and overwhelming response from the public enabled the Division to resort to mass propagation of ornamental plants of great interest and demand. Besides, the need to produce sufficient plant materials to meet the requirements of more than 700 members registered with our Institute was strongly felt. Accordingly, more than 7000 plants of *Anthurium andreanum* var. *rubrum* through foliar meristem culture and 12,329 plants of *Philodendron* Pluto and 1559 plants of *Philodendron* Blue Mistique through nodal segment culture were produced and released to the nursery. More than 25,000 cultured shoots of *Anthurium* were awaiting rooting at the end of the period of this report. Besides, as on 1st March 1994, shoot cultures of two cultivars of *Philodendron* Pluto, *P. Cardinal Black* and *P. Pink Prince* were initiated. The regenerative cultures established from the inflorescence of *Heliconia rubra* and rhizome buds of *Hedychium* sp. were also found quite promising. As an extension of this work, an attempt was made successfully to

preserve Anthurium shoot cultures under mineral oil. The tissue remained stable and regenerative during the six months of study. *In vitro* production of orchids was continued and 1500 orchids of varied hybrids were multiplied through embryo and tissue cultures.

#### D. Physiological and Biochemical Investigations of Native Plants

##### 1. Photosynthetic Productivity of Orchids

Photosynthetic studies on native orchids that are adapted to both light and shade conditions were initiated. The two orchids viz. *Vanda spathulata* and *Bulbophyllum neilgherrense* investigated for the purpose revealed interesting behaviour under sun and shade conditions. Shading decreased leaf area, leaf weight, thickness of cuticle, palisade layer and leaf dry biomass accumulation. Synthesis and accumulation of pigments including Chl-a, Chl-b and carotenes were found more in shade plants, so as to trap the available light efficiently under shade condition.

##### 2. Photosynthetic Productivity of Trees

Studies on photosynthetic productivity of trees in sacred groves were continued. Data on biomass production in 15, 30, 60 and 120 day old seedlings of *Adenanthera pavonina*, *Cassia fistula* and *Leucaena leucocephala* were carried out. After 120 days, the biomass accumulation per unit area was found high in *Leucaena leucocephala* followed by *Cassia fistula* and *Adenanthera pavonina*.

##### 3. Study on Sacred Groves

This study was meant for understanding the structural and functional dynamics of sacred groves giving special emphasis to productivity patterns. Most of the sacred groves stretching from Kazargod to Parasala were surveyed and data on floristics and soils are being consolidated. System analysis was done in five agroclimatically different sacred groves.

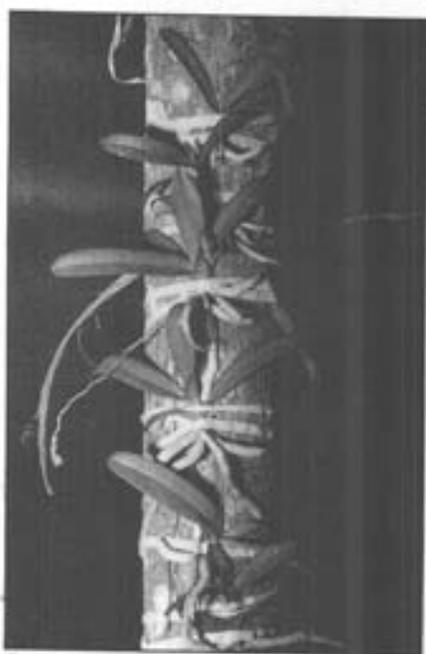
*Most of the sacred groves stretching from Kazargod to Parasala were surveyed and data on floristics and soils are being consolidated*

#### PROJECT

##### Conservation through micropropagation of rare and exquisite orchids of the Western Ghats

This project supported by the Ministry of Environment and Forest, Govt. of India, was aimed at *ex situ* conservation of selected showy and exquisite orchids of the Western Ghats. Major achievements are given below:

*Field survey and collection:* Altogether seven collection trips



Reintroduction of *Aerides crispum*  
in the forest segment of TBGRI campus

were made. One hundred and eighteen accessions including 11 newly relocated species were collected and introduced to the field gene bank (Vavilov Centre). Important species of horticultural value collected were *Dendrobium jerdonianum*, *Calanthe triplicata*, *Seidenfadeniella rosea* and *Anoectochilus elatus*.

**In vitro propagation:** Clonal multiplication through meristem culture was done in 8 species including the endangered and endemic lady's slipper orchid *Paphiopedilum druryi* and the Indian daffodil orchid *Ipsea malabarica*. Rapid propagation protocols quite useful in commercial production were developed for another 10 species.

**Field establishment and growth:** About 5050 seedlings belonging to 9 species were successfully established in community pots and reared in the Vavilov Center. Mericlones transferred to community pots were those of *Vanda spathulata* (452), *Papilionanthe subulata* (34) *Smithsonia maculata* (3) *Aerides crispum* (78) *Anoectochilus regalis* (155) *Calanthe triplicata* (29) *Eulophia flava* (12) and *Nervilia aragoana* (5)

**Genetic uniformity testing:** Two orchids, *Vanda spathulata* and *Papilionanthe subulata*, raised through meristem culture were tested for cytological stability and isozyme profile and compared with mother plants. Chromosome numbers of the randomly selected mericlones were identical to that of mother plants. Isozyme patterns with alpha-amylase and peroxidase further confirmed the uniformity of regenerated plants.

**Reintroduction:** Embryo culture-derived seedlings were used for reintroduction and restoration experiments in selected locations. One thousand, six hundred and twenty nine seedlings belonging to 11 species were introduced at Ponmudi where percent of establishment varied from 23 to 85%. Seedlings of *Smithsonia maculata* (154) reintroduced at Karamana River basin showed an establishment frequency of 48%. Seedlings of *Ipsea malabarica* (2324) and *Papilionanthe subulata* (50) introduced at Silent Valley are yet to be analyzed for re-establishment. Seedlings of these three species introduced in the forest segments of the garden site had high percentage (80%) survival.

#### DIVISION OF CRYPTOGRAMIC BOTANY

This division was started in 1992 with the objective of undertaking indepth study on lower groups of plants (Pteridophytes, Bryophytes etc.) of the Western Ghats. A brief account of the work done during the period under report is given below.

### A. Ferns and Fern Allies of Kerala

Three field tours were conducted to the high ranges of Munnar, Ponmudi, Kallar, Bonaccord and Chemungi. About 350 specimens of ferns belonging to 50 species including some interesting species of spleenworts (*Asplenium*) and tree ferns (*Cyathea*) were gathered. Specimens were later processed for herbarium and were identified, labelled and documented. Altogether 300 accessions were made to the pteridophyte collections.

### B. Fernery

Attempts to establish and maintain a fernery - a shade house for ferns and fern allies - in the garden were initiated. As part of the above activity about 100 accessions of live ferns representing 30 species in 12 genera were collected from various parts of the Southern Western Ghats and introduced to the garden for further establishment. The live collections included such appealing ferns as tree ferns, spleenworts, maiden hair ferns, polypodiaceous ferns, fork ferns and lycopsids.

### C. Taxonomic studies

The specimens collected through different explorations to the Western Ghats were subjected to critical studies. The identity of 40 taxa and their taxonomic disposition into species, genera and families were determined. Systematic enumeration including up-to-date nomenclature, brief descriptions and notes on habitat, distribution, taxonomic relationships, economic or other uses, if any, was done for all identified taxa.

### D. Palynology

As part of the taxonomic investigation, perispore pattern in *Cyathea crinita*, *C. gigantea*, *C. nilgirensis* and *C. spinulosa* was examined by LM and SEM studies. The study revealed occurrence of both smooth and striate types of perispore in all the four species examined.

### E. Propagation studies

Vegetative propagation by means of stem buds or 'cuttings' was attempted in *Cyathea gigantea* and *C. spinulosa*. In both the species emergence of lateral growths was observed in about four months after cuttings were planted in propagating mix.

Experimental studies on the techniques of propagation from spores and pattern of gametophytic development in certain selected species were initiated. Spore germination and gametophytic development in a thelypteroid fern,

*About 350 specimens of ferns belonging to 50 species including some interesting species of spleenworts (Asplenium) and tree ferns (Cyathea) were gathered*

*Christella hispidula*, was studied. Various developmental stages from spore to gametophyte were observed, described and illustrated.

#### F. Conservation biological studies on species of *Cyathea* (Cyatheaceae) in the Western Ghats.

A comprehensive study envisaging conservation and utilization of tree ferns of the Western Ghats was initiated. The genus *Cyathea* is represented in the Western Ghats by four species viz. *Cyathea crinita* (endemic), *C. gigantea*, *C. nilgerensis* (rare, and endemic), and *C. spinulosa*. Comparative studies on morphology (pattern of indumentum, venation, sori), palynology and taxonomy were carried out for all the four species.

Systematic field investigations were carried out so as to study features, associations, frequency of distribution and structure and size of natural populations. Comparative analysis of data on limiting resource factors such as light, temperature, humidity, rainfall, soil, pH etc. are in progress. Other aspects like population biology, dispersal, growth and establishment and *in situ* conservation strategies will be studied in due course.

As part of *ex situ* conservation studies vegetative propagation through cuttings and raising sporophyte through spore culture were accomplished for *Cyathea gigantea* and *C. spinulosa*. Propagation studies on other species are in progress.

### DIVISION OF MICROBIOLOGY

This division deals with the study of microorganisms belonging to both animal and plant groups. The thrust areas are:

- a. Plant microbe interaction.
- b. Survey and inventory of microflora of the Western Ghats.
- c. Biodegradation and utilization of organic waste materials
- d. Establishment of fungal culture collection and herbarium.
- e. Biofertilizer and its application.

#### A. Plant microbe interaction

To survey the microorganisms in the soils of our forests, soil samples were collected from selected localities of the Western Ghats forests. They were analysed to understand the interaction of different plants with the microorganisms under different climatic and ecological conditions.



Vesicular Arbuscular Mycorrhizal (VAM) Spore Aggregation

One spoonful of soil might contain over two billion microbial elements in the form of bacteria, microalgae, microfungi etc.

The presence of microorganisms in the soil of some endemic trees of the Western Ghats was studied in detail. The number of microorganisms in the rhizosphere of *Gluta travancorica* was found to be high compared with that of *Myristica malabarica*. The maximum growth of microorganisms in the root zone of these two species was noticed in the month of February and March.

The soil analysis revealed that when microorganisms are more, the soil is rich in carbohydrates and aminoacids. The biomass production would be high when the soil had enough nutrients to encourage speedy growth.

#### B. Survey, Inventory and collection of Mushrooms

Mushrooms have attracted the attention of man from very ancient times as source of food and medicine. More than 2000 species of edible, medicinal and hallucinogenic mushrooms were reported from various parts of the world. The Western Ghats with the soil rich in organic substrates are suitable for growth of mushrooms. No serious attempt was made to survey and inventorise mushroom wealth of the Western Ghats.

This Division has started a survey of the mushroom flora of the Western Ghats. An inventory of mushrooms of this area will be made and mushrooms will be collected for further biochemical and chemical studies. As a preliminary step survey in the forest areas of TBGRI was conducted and then extended to different parts of the Western Ghats. The habitat and habit were noted. Field characters such as colour and size of pileus, stipe and lamella, presence or absence of annulus etc. were noted for correct identification. Habitat sketches were drawn and spore prints were taken on slides. Based on these macro and micro characters mushrooms were identified and classified. The specimens were then dried at 50 to 60°C and kept as herbarium specimens. For further studies the dried specimens were revived with 10 % KOH (Potassium hydroxide). Sections of tissues of various parts were stained with suitable stains and observed under microscope. Amyloidity tests of spores were also conducted. It is based on all these tests, that the species identification is generally confirmed.

Most of the mushrooms collected are saprophytes growing on rotten wood, tree trunks and decaying organic matter. During this period of report a total number of 988 specimens were collected. These specimens belonged to 18 families and 58 genera. So far only 101 specimens could be identified up to species level. Out of this, 19 species are edible. This includes *Agaricus bisporus* and *Pleurotus* spp.

*The soil analysis revealed that when microorganisms are more, the soil is rich in carbohydrates and aminoacids*

*No serious attempt was made to survey and inventorise mushroom wealth of the Western Ghats. Microbiology Division has started a survey of the mushroom flora of the Western Ghats*



*Leucocoprinus cepaestipes* collected from TBGRI campus

*Azotobacter chroococcum* TG 1 is the bacterium present in the biofertilizer 'Tropbactrin'. The bacterium was isolated from the soil collected from Lakshadweep.

### C. Mushroom Herbarium

The mushroom herbarium is located in the Division of Microbiology. The Herbarium is having a collection of about 1000 dried specimens and about 120 wet collections.

### D. Culture collection

The division has a culture collection of 24 edible mushrooms. This includes 6 species of *Pleurotus*, 4 species of *Lentinus*, 2 species each of *Amanita*, *Entoloma* and *Lepiota* and one species each of *Macrolepiota*, *Ganoderma*, *Russula*, *Agaricus*, *Hygrocybe*, *Tricholoma*, *Termitomyces* and *Cantharellus*. In addition bacterial and fungal stock cultures are also maintained.

### E. Mushroom Cultivation

#### 1. Spawn production

Spawn production techniques for only a few species are developed and commercially exploited. Attempts are, therefore, made to develop spawn from all the available edible mushroom cultures. Spawn production technology for a few wild mushrooms of the Western Ghats was developed in this Division.

#### 2. Utilization of Waste Materials

In addition to the rice and wheat straws which are generally used for commercial cultivation of mushrooms, scientists in the Division have tried several waste materials and agricultural refuse such as leaf litter, kashayachandi (medicinal plant refuse after the extraction of active principles for Ayurvedic preparations), saw dust, coconut husk and wood shavings for mushroom cultivation. Only kashayachandi was found to be a suitable substitute for rice straw.

### F. Biofertilizer

*Azotobacter chroococcum* TG 1 is the bacterium present in the biofertilizer 'Tropbactrin' developed by scientists in the Division. The bacterium was isolated from the soil collected from Lakshadweep. This biofertilizer is active in a pH range of 4 to 10 and is temperature resistant.

The fertilizer is found to be capable of increasing vigor and yield. In the field trials it could increase grain production in rice from 3836 Kg ha<sup>-1</sup> to 4150 Kg ha<sup>-1</sup> when 100 Kg ha<sup>-1</sup> biofertilizer were added to the soil. In cassava, the trial revealed that an average yield of 1 Kg per plant could be raised to 2.5 Kg when 100 Kg ha<sup>-1</sup> biofertilizer were added.

Field trials of the 'Tropbactrin' were continued during the period under report. Samples were distributed to farmers and results of this fertilizer application on crops were noted. Enhanced growth and yield were noticed in Paddy (15 %), Pepper (300 %), Green peas (200 %), Tapioca (250%), Chillies (150 %), Cowpea (200 %), Brinjal (300 %), Ginger (400 %), Papaya (250%), and Turmeric (280 %).

In Palode area a few farms are adopted for experimental purposes

### G. Litter Production in Tropical Forests

Leaves of certain trees fall down before the arrival of monsoon. This enables leaves to decompose prior to monsoon. This helps plants to utilize the rich nutrients found in the soil when it gets sufficient water during rainy season. The study conducted in the forests of Kallar and Palode found that during the 1st quarter of the year the litter production was very high. In case of deciduous forests it was observed that litter production was very low during summer season. It was noted that about 76% of micro litter is from leaves alone and about 7 % from flowers and fruits.

## DIVISION OF ETHNOMEDICINE

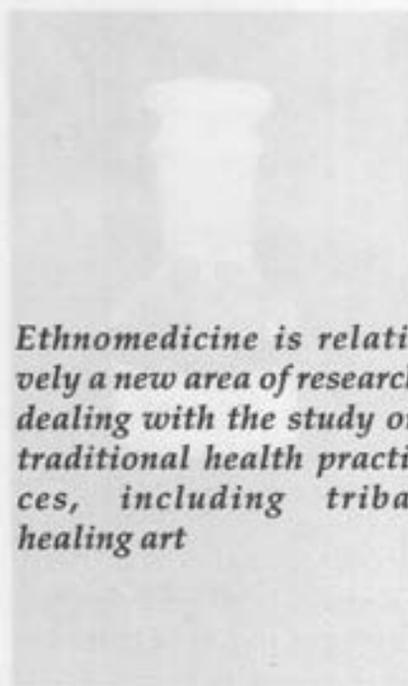
Ethnomedicine is relatively a new area of research dealing with the study on traditional health practices, including tribal healing art. It is one of the new Divisions that has started functioning at TBGRI since 1992.

Major thrust areas identified for conducting intensive research are as follows:

- Survey and documentation of ethnomedicinally important plants of the tribals and folkhealers of Kerala.
- Ethnomedico pharmaco linguistic studies of selected medicinal plants.
- Formulation of single/simple herbal remedies based on Ayurvedic pharmacology/pharmacy.
- Ethnopharmacological evaluation, drug developments and clinical trials of selected single/simple herbal remedies.
- Preparation of single/simple and inexpensive herbal remedies for primary health care programmes.
- Computerized data base on ethnobiologically and ethnomedically important medicinal plants.



'Tropbactrin' - a biofertilizer from TBGRI



*Ethnomedicine is relatively a new area of research dealing with the study on traditional health practices, including tribal healing art*



Jeevani - an adaptogenic and immunoenhancing formulation with Arogyapacha

- g. Publication of books on medicinal plants in Malayalam to popularise the role of medicinal plants in primary health care.

#### A. Studies on Arogyapacha (*Trichopus zeylanicus* ssp. *travancoricus*)

Based on the claim made by the Kani tribe of Kerala, 'Arogyapacha' has been brought under detailed ethnomedico pharmacological investigation. It is claimed that, to remain always healthy, agile, young and to be resistant to various diseases or infection, one should consume fresh fruits of 'Arogyapacha' regularly. It is a rare, herbaceous and rhizomatous wild plant belonging to the family Trichopodaceae endemic to Agastyar hills of the Western Ghats.

Preliminary investigations revealed strong anifatigue properties. Subsequent investigations revealed potent anti-stress, stamina boosting, antihepatotoxic and powerful immuno potentiating properties associated with various parts of the plant.

Based on the above observations a compound formulation with *T. zeylanicus* ssp. *travancoricus* as one of the ingredients has been developed and standardized. The formulation coded as TBR - 20/Jeevani was subjected to a battery of pharmacological testings which gave very promising results. The formulation TBR-20/Jeevani therefore seems to reciprocate the actions of this species and appears to be safe and free from toxicity. The formulation is being developed in the form of capsules, tablets and syrup to serve as a powerful stamina booster, antistress, antifatigue, hepatoprotective and immunostimulant product and as a general tonic for prophylactic and curative purposes. Clinical trial of the TBR-20/Jeevani is now in progress. Results show that the drug has got good adaptogenic and immunoenhancing properties. In addition, it shows remarkable antifatigue and antistress action. Significant responses noted during the treatment include:

- a. Feeling of fatigue, debility/weakness reduced .
- b. Body weight increased.
- c. Tenacity of undertaking and continuing physical work increased.

A glycolipid fraction isolated from the herb is already filed for a patent jointly by TBGRI and RRL (Jammu).

Preparation of syrup and suspension of Jeevani/TBR 20 are now under experimental stage. Clinical trial of TBG Oil 11 for psoriasis and dandruff (external application) is now in progress Two anti diabetic formulations are being designed and prepared for ethnopharmacological studies.

An antifertility formulation is also being designed for detailed studies.

#### B. Ethnomedical survey in the tribal settlements of Kerala.

Scientists from the Division conducted Ethnomedicobotanical survey at Ponmudi, Kallar, Mottamoodu (Thiruvananthapuram Dist.), Valadu, Thirunelveli, Mananthavady (Wayanad Dist.), Myladipotti, Dodalapotti and Panapuzha (Malappuram Dist.). The tribes brought under the above study are Kani, Adiyar, Kuruchiyan, Cholanaicken and Pathinaickens. Information on 30 medicinal plant species and samples of 10 medicinal plant species were collected for detailed Ethnopharmacological/Phytochemical investigations. Ethnomedicopharmacological study of 25 medicinal plants have been completed. To popularise the role of medicinal plants in the primary health care programme, two books 'Tulasi' (Basil) and 'Vepu' (Neem) were published.



*Tulasi (Basil) and Vepu (Neem) - two books published by TBGRI*

### DIVISION OF ETHNOPHARMACOLOGY

The Division of Ethnopharmacology was constituted in 1992 with the objectives to study pharmacological and toxicological actions of plant derived drugs and their formulations in experimental animals. Immunomodulatory, hepatoprotective, antimicrobial, cytotoxic and antitumour screenings of selected plants and formulations on animal models were carried out during this period in Ethnopharmacology Division.

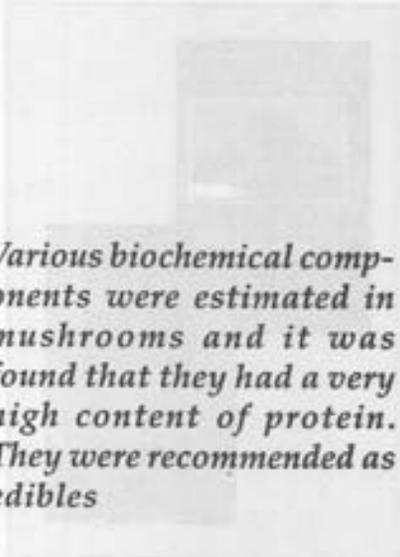
#### A. Antitumour Activity

Among various plant extracts screened for antitumour activity (*in vitro*) to Dalton's Lymphoma Ascites (DLA) and Ehrlich Ascites Carcinoma (EAC) cells, positive results were obtained with *Naringi crenulata* leaves, *Garcinia cambogea* fruits, *Commiphora mukul*, *Ixora coccinea*, *Ixora agastyamalayana* flowers, *Plumbago zeylanica* and *Psoralea corylifolia* seeds. Ethanolic extract of *Ixora* flowers and *Psoralea* seeds could completely inhibit DLA and EAC ascitic tumours in mice.

#### B. Hepatoprotective Activity

Tribals are using many plants in their vicinity for liver complaints. One of the important functions of liver is bile secretion. Based on the tribal information plants were screened for their choleric (bile secretion) activity. Of the 15 species screened six were found to stimulate bile secretion.

*Ethanolic extract of Ixora flowers and Psoralea seeds could completely inhibit DLA and EAC ascitic tumours in mice*



Various biochemical components were estimated in mushrooms and it was found that they had a very high content of protein. They were recommended as edibles

There was a marked stimulation in bile flow in the case of *Phyllanthus amarus*, *P. urinaria*, *P. debilis*, *P. ornamentalis*, *P. kozhikodanus* and *P. maderaspatensis*.

### C. Immunomodulatory Experiments

Experiments were carried out in mice using four medicinal plants species. The preliminary experiments showed positive results and were confirmed by confirmatory experiments. Of these, one species with immunomodulatory property can be used by humans as medicine for disease resistance and for adaptation of body to changes in environmental conditions like cold, humidity and high temperature.

### D. Studies on Mushrooms

It was experimentally proved that four species of mushrooms collected from the wild were nontoxic to mammals. Various biochemical components were estimated in these mushrooms and it was found that they had a very high content of protein. They were recommended as edibles.

### E. Anti-Bacterial, Anti-Fungal and Anti-Malarial Screenings of Indian Medicinal Plants for New Drugs.

Though there are plenty of antibacterial and antifungal agents available, majority of them have a narrow spectrum of action and have adverse side effects. Emergence of new infections which are resistant to conventional drugs make search for new drugs essential.

WHO gives second importance to malaria after AIDS as around 270 million people are infected with malaria and 2.1 billion (half of the world population) are at the risk of malarial infection. The search for new antimalarial drugs has become essential as parasites developed resistance to drugs.

As tropical plants are source of valuable drugs, TBGRI with the assistance of DANIDA entered into a collaboration with the Royal Danish School of Pharmacy, Copenhagen, Denmark to work in this field and scientists at TBGRI are screening Indian medicinal plants for antibacterial, anti-fungal and anti-malarial activities. Thirty nine plant species were already screened and some were found very affective.

Antimicrobial screening demonstrated that the drug from *Ixora coccinea* (brown ethylacetate fraction) inhibits the growth of *E. coli*, *Staphylococcus aureus* and *Aspergillus niger*.

### F. Drugs for Diabetes

A protocol was designed for clinical trial of an antidiabetic herbal drug formulated by TBGRI. This included toxicity studies, legal and ethical aspects of clinical trial and clinical evaluation.

## DIVISION OF PHYTOCHEMISTRY

The Phytochemistry Division was established in December 1992 and the laboratory became functional in June 1993. Main objectives of the Division are as under:

- a. Chemical standardization and validation of traditional/tribal medicines.
- b. Formulation of new drugs from traditional/tribal medicinal plants.
- c. Phytochemical investigation of tropical medicinal plants with a view to develop new drugs and drugs intermediates for the pharmaceutical industry.
- d. Search for new aroma chemicals and flavour compounds from aromatic plants of the tropics.
- e. Biomimetic synthesis of natural products with biological activity.

Salient features of the work done during the period under report are as under:

### A. Search for New Antihypertensive Drugs from Indian Medicinal Plants.

Eighty tropical medicinal plants used in traditional medicines as antihypertensive or diuretic agents were screened for antihypertensive activity using an in vitro technique utilizing inhibition of angiotension converting enzyme (ACE). This screening was carried out with the help of High Performance Liquid Chromatograph (HPLC). The study led to the identification of 8 medicinal plants whose antihypertensive activity was comparable with that of the standard drug captopril. Preliminary chemical studies carried out on one of the plants which showed 100 % ACE inhibition indicated that the compounds responsible for antihypertensive activity were flavanoids.

### B. Search for Anticancer Compounds form Traditional Medicinal Plants.

Acetone, alcohol and water extracts of 40 medicinal plants were prepared and studied for their anticancer activity. One of the plants showed DNA scission activity at 20mg level and detailed investigations are in progress.

### C. An Antipsoriatic Drug TBG -011

Psoriasis is a non contagious skin affliction affecting

*Eighty tropical medicinal plants used in traditional medicines as antihypertensive or diuretic agents were screened for antihypertensive activity*

elbows, knees, scalp and trunk characterized by eruption of circumscribed, discrete silvery scales. A drug coded TBG-011 was developed from the lipid soluble fraction of 3 traditional medicinal plants. The drug is found to be effective in the control/cure of psoriasis and dandruff. Preliminary clinical trial carried out in collaboration with Ethnomedicine Division of the Institute on 20 patients has shown encouraging results.

#### D. Synthesis of An Antiinflammatory Drug TBG-02

Synthesis of a substituted chromone derivative was carried out and this compound on preliminary pharmacological screening has shown antiinflammatory activity. The activity was compared with that of the known drug Ibuprofen and it was found that this compound was 1.5 times more potent than ibuprofen. LD 50 of Ibuprofen is 1g/Kg whereas TBG-02 showed LD50 of 2g/Kg. Detailed pharmacological investigation is in progress.

#### E. Studies on some Essential Oil Bearing Plants

A few aromatic plants collected from the Institute campus were steam distilled and their oil yield was estimated. Preliminary TLC studies of these oils were also carried out.

### DIVISION OF CONSERVATION BIOLOGY

Conservation Biology is a new pursuit of scientific research in Biology which deals with problems of scarcity and prospects of diversity in the biological system. The subject gained much momentum in the recent past mainly because of two reasons: (1) the unprecedented depletion of biological resources and extinction of species (2) value of biological diversity. The Division was constituted in 1992 with the main objective of initiating research in these lines with respect to the Western Ghats flora. A brief account of the ongoing research work in the Division during the period under report is outlined below.

#### A. Resource Check-List of Kerala Flora

Kerala is endowed with rich genetic resources. But only a few species are subjected to intensive research. A ready reference work on aspects dealing with economic importance, conservation status, nativity, nature of occurrence, affinity and distribution of species etc. are practically lacking as information available on these aspects are scattered in various publications which deal either with one plant or with a particular locality in the state. It is against this back drop the Division initiated preparation of a resource check list of



Rain forest conserving the tropical biota

Kerala flora as it would give a comprehensive account of the plant resources of the state, that would ultimately help taking up research in Conservation Biology of rare and threatened plants on one hand and research in sustainable utilization of economically important species on the other. It will also serve as a status report on the existing natural plant resources of the state.

More than 7,000 data sheets with details mentioned below have been completed with respect to 1020 species of dicot plants occurring in the state : Correct name with important synonyms, habit (trees, shrubs, climbing shrubs, herbs, climbing herbs, lianae etc.) reference to good descriptions and correct and diagnostic illustrations available in literature, status (endemic, native, exotic), locality (in case of endemics), conservation status (extinct, endangered, vulnerable, indeterminate etc.) uses (dye, fibre, food, medicinal, poisonous etc.) and local names. The work is in progress.

#### B. Pollen Atlas of the Wet evergreen Forests of the Western Ghats

Palynology is the science that deals with the study of pollen grains. It has wide applications. It is helpful to elucidate information on history of forest flora, past climate, past ecology and species radiation. Information can be applied to estimate biopollution and allergy. But application of palynological science depends upon detailed knowledge on the existing plant species indigenous or naturalized in or outside the forests.

The Division has undertaken a study of pollen of wet evergreen forests of the Western Ghats in this direction in collaboration with the French Institute, Pondicherry. During the period under report pollen of 65 species considered as markers of wet evergreen forests were studied and described. Description covered the following palynological features that were found helpful in identification of individual species from one another. Ornamentation, aperture types, shape and size classes and measurements of polar and equatorial axes. Pollen materials for this purpose were collected either fresh from forests or from herbaria of different Institutions. Salient ecological characters were also gathered for each species pertaining to world distribution, frequency, elevation, endemism and nativity.

For this programme polliniferous materials of 150 samples belonging to 70 species and 15 families were collected from the herbaria of TBGRI and BSI, Coimbatore. More than 200 pollen slides were prepared and about 70 photo micrographs were printed for the Atlas.

Scientists from the French Institute, Pondicherry visited TBGRI twice and a scientist of the Division frequented French Institute thrice during the period under report for assessing



Pollen of *Thespesia populnea* (Cheelanti)

progress of work at both ends and for planning future research programmes in fulfilling work on the Atlas.

#### C. Palynologists of India.

An exhaustive index of Indian Palynologists was prepared after extensive literature work on Indian Palynology with a view to strengthen the existing network and to establish effective communication among the palynologists in India. The work was carried out at the request of 'Palynological Society of India'.

#### D. Hallucinogenic Plants of India

Hallucinogenic plants are those group of plants that affect the nervous system in various ways when taken internally and create hallucinogenic effects due to chemical contents present in them. Plants as such or any one or more organs (flowers, fruits, leaves, roots etc.) or their products may produce this effect. These plants are of immense help to mankind especially in the medical field and open a potential field for further research. At present a comprehensive information about this group of plants in India is not available.

An extensive literature survey on Indian angiosperm flora revealed that out of 15,000 species occurring in India, about 200 species were narcotic or hallucinogenic. Detailed data on their pattern of distribution, taxonomic characters, plant parts used directly or indirectly for hallucinogenic and narcotic affects, chemical constituents contained etc. were gathered for 60 species for a comprehensive account on these plant group. When the work is completed, the results will be published in a monographic form.

#### E. Ethnobotanical Survey of Shabarigiri Hills

Tribes in Kerala constitute only 1% of the total population. They have a rich system of knowledge about plants and this is evolved through centuries by oral tradition. A major portion of this information is related to the use of medicinal plants in their vicinity for various types of healing purposes.

Shabarigiri Hill area is inhabited by about eight tribe communities but Malappandarum tribe constitutes about 80 % of the tribal population in the area. They have very good knowledge regarding medicinal plants of their vicinity. Scientists in the Division have been studying the ethnobotany of this area for the last two years. During the period under report many exploration trips were conducted to the area and information on the availability of 55 species of flowering plants were collected from the Malappandarum tribe. This includes details on diseases, mode of preparation and application of medicine and precautions to be observed.

*An extensive literature survey on Indian angiosperm flora revealed that out of 15,000 species occurring in India, about 200 species were narcotic or hallucinogenic*

Apart from the above, 20 plant species used by the tribes for food, fodder, dye, etc. were also collected for further scientific study and scrutiny.

#### F. Botanical Exploration

As part of the studies on plant diversity in the Western Ghats, three field tours were conducted this year to Udayagiri fort area (Kanyakumari Dist.), Palamalai hills (Coimbatore) and Bonnaccord and Chemungi (Thiruvananthapuram Dist.). The trips helped to have a preliminary understanding on the pattern of vegetational and floristic diversity of the area which comprised different forest types such as evergreen, semi evergreen, moist deciduous and shola. About 250 specimens of flowering plants were gathered for taxonomic studies.

#### G. Taxonomic studies

A plant species should bear only one correct scientific name as per the International Code of Botanical Nomenclature (ICBN). The species, its attributes and results of research on this species will remain otherwise as a source of confusion for the scientific community. There exists a lot of ambiguity regarding plant names and nomenclature specialists spend considerable amount of time to untie such problems. Nomenclature of two medicinal plants of the Western Ghats (*Trichopus zeylanicus* and *Atalantia monophylla*) was studied and their correct scientific names were established as per the rules of ICBN. Detailed nomenclatural history of 5 generic names of the family Rutaceae (*Chalcas*, *Dictamnus*, *Jambolifera*, *Murrayah* and *Ruta*) were also worked out in accordance with the ICBN rules.

#### H. AICRPE Co-ordination Unit

TBGRI is the Co-ordination centre of the AICRPE. All Indian Co-ordinated Research Project on Ethnobiology (AICRPE) is a multi institutional and multidisciplinary research project. This started functioning with the financial assistance of Ministry of Environment and Forests in 1982. About 24 centres were involved at various stages of this project and the Co-ordination Unit of AICRPE started functioning at TBGRI in 1991 after the Unit got shifted from RRL, Jammu. The Unit works as a connecting link between the Ministry of Environment and Forests and the Functional Working Units of the project for the efficient execution of work. Every year Co-ordination Unit brings out the AICRPE Annual Report which is an edited version of reports from all the Working Units. Report brought out this year consisted of information from 4 main centres viz. Universities of Nagpur and

*TBGRI is the coordination centre of the All India Coordinated Research Project on Ethnobiology (AICRPE). AICRPE is a multi institutional and multidisciplinary research project.*

Osmania, RRI, Poojappura and Co-ordination Unit at TBGRI. The Co-ordination Unit is also in the process of synthesizing national data base on Ethnobiology.

### I. Plant Diversity Conservation Programme at TBGRI

A comprehensive report on plant diversity conservation programme so far carried out at TBGRI was prepared as required by the Indian Institute of Public Administration (IIPA). Forty five species that face threat of extinction due to over exploitation, illegal trade and export were listed out from Indian flora after extensive literature work and appended with the report as desired by the IIPA for their information and future action.

#### Technical Reports Prepared

- a. Improvement of Environment -Suggestions and Guidelines for the Environment Committee of the State Legislature.
- b. Trainers' Training Programme on Biodiversity Conservation-A Summary.
- c. Biodiversity Conservation : State Environment Policy.

### DIVISION OF HERBARIUM, MUSEUM AND ECOEDUCATION

*Herbarium contains 7000 specimens belonging to 2177 species and 1014 genera representing 170 families. In addition, 20,000 duplicates are housed for providing research materials on request*

This Division was formed in 1993 as part of diversification of Institute activities in the spheres of plant taxonomy and ecoeducation. Several field trips to various forest areas of the state were undertaken to explore, collect, identify and document the plant wealth. The following works were carried out to achieve the main objectives identified by the Division.

#### A. Herbarium

Herbarium provides materials with abundant information at one place for research on flora and vegetation of a region. Eight exploration trips were conducted to various parts of the state and to Lakshadweep islands to enrich the herbarium. Now the herbarium contains 7000 specimens belonging to 2177 species and 1014 genera representing 170 families. In addition, 20,000 duplicates are housed for providing research materials on request.

Nomenclature of 1800 species was updated referring to recent publications. Four hundred numbers of century old collections were renovated as part of upkeep and maintenance of the herbarium. Fumigation was taken up to

control insect pests.

Facilities at herbarium (TBGT) are extended to students and researchers for furthering their knowledge. Herbarium has programme to loan sheets to individuals/organizations for their study and it encourages exchange of herbarium with National/International herbaria on a specimen for specimen basis.

Arrangement in the Herbarium is based on Bentham and Hooker's system of classification adopting suitable modifications from that of Hutchinson.

#### **B. Museum**

A small museum is established to educate school and college students and the public about how plants are important for our sustenance. The materials were collected and classified according to their nature and uses. Materials consist mainly of edibles like raw nuts, cereals and pulses, crude drugs, minerals and stones and scientifically important plant parts. Different kinds of tribal artifacts present in the museum are added attractions. Different wood/bamboo samples are also on display.

#### **C. Ecoeducation**

This programme is initiated with the aim of extending knowledge about various ecosystems and their functions to school and college students and the public. Dissemination of information is aimed at creating awareness and sense of involvement among student community in preserving our natural resources. It also aims at helping them and the public to develop a better perception on ecology and conservation.

#### **D. Floristic Wealth of Kerala**

Kerala state due to its geographical position favours different types of vegetation with high species diversity. The state harbours about 3000-3500 flowering plant species. Hence a programme has been initiated to collect plant specimens from all over Kerala so as to bring out a comprehensive flora of Kerala in future.

#### **E. Wild edible Plant Resources**

The Division is also concentrating on collection of wild/ lesser known vegetables, pulses, cereals, tubers and other edibles which are consumed by tribal communities. About 95 such species were collected for study and 25 promising species were introduced to the Garden for multiplication. These species can be popularised/domesticated in future after ascertaining their nutrient values.

*A small museum is established to educate school and college students and the public about how plants are important for our sustenance.*

*Services from Library include: Selective Dissemination of Information, Current awareness, Bibliography, Indexing, "Contents pages of Journal"*

#### F. Systematic Studies on Special Groups of Plants

Special emphasis was given to tap horticultural potential of wild ornamentals available in the state. The programme is to study and evaluate special groups such as Balsams, Begonias, Coleus, Lithophytes etc. So far about 50 specimens of Balsams were collected and introduced to the Garden.

#### G. Reproductive Biology/Ecology of Threatened Plants

The Division has undertaken a special project on survey, study and conservation of endangered plant species of the state. The Work is being conducted in order to understand exact causes of population reduction, rarity and reproductive biology/ecology apart from man made threats. Under this programme the following species viz. *Ceropegia beddomei*, *C. thwaitesii*, *C. ensifolia*, *Peucedanum anamallayens*, *Phaeanthus malabaricus* and *Goniothalamus wightii* were collected and introduced to the Garden.

### LIBRARY AND INFORMATION SERVICES

Library and Information Services play a vital role in achieving the aims and objectives of the Institute by providing timely and relevant information to scientists.

The holdings of the library are as under:

Books	4830
Journals	92
Research Reports	375
Reprints	87
Microfilm	52
Video cassettes	12

The following services cater to information needs of the scientists

- Selective Dissemination of Information
- Current awareness Services
- Bibliographical Services
- Indexing Services
- "Contents pages of journal" Service

Reference facility of the Library is initiated with the computerization of the Library Catalogue.



2014



# PEOPLE AND T B G R I



*Trainees at work in the open orchidarium*

*Each trainee was given a well written laboratory manual regarding details of all the work. A number of Orchids, Anthuriums and Philodendrons were also supplied free of cost.*

## EXTENSION ACTIVITIES

### A. Training

*1. Sustainable development of skilled human resource for the rural sector through training in micropropagation and field cultivation of commercially important horticultural.*

This project was funded by CAPART, New Delhi. It is essentially a training programme offered to 10 selected candidates for 10 months starting from March 1993. It consisted of both laboratory and field components. During the period under report a syllabus was evolved and a faculty was constituted for effective implementation of the project.

The first batch of 10 trainees was divided into two groups of five each and each group was given 5 month training in field and laboratory. The subjects taught in the laboratory included setting up of a cost effective tissue culture unit, laboratory maintenance, hygiene and surface decontamination of vessels and plant tissues, subculture of plant tissues and embryos and commercial consumption and acceptability of tissue cultured plants. Major emphasis in the field was deflasking and rearing of micropropagated plants, post transplantation growth in pots and field cultivation of high value Orchids, Anthuriums and Philodendrons. Besides, the trainees had an overall exposure to organizing lining collection and multiplication of bamboos, medicinal plants, trees, bonsai and other ornamentals. Special classes were arranged in flower arrangement, landscaping and gardening.

By and large this programme enabled building technical/skilled capability and confidence in young minds to find employment/self-employment opportunities. Towards end of the programme they were taken for a tour to botanic gardens and commercial tissue culture laboratories in Kolenchery, Nelliampathy, Ootacamund, Mysore and Bangalore. This provided a break from routine work and an opportunity to have a glance on developments elsewhere in the area of their training.

Certificates of participation were issued to all trainees of the first batch on December 30, 1993. A follow up programme was drawn to make them put up their own production unit or make them absorbed by industries. Each trainee was given a well written laboratory manual regarding details of all the work. A number of Orchids, Anthuriums and Philodendrons were also supplied free of cost.

### *2. Orchid and Anthurium Cultivation*

This was a STEC funded programme aiming at

creating self employment opportunities for educated unemployed men and women. Ten women belonging to low income group from rural areas were offered training for a week in culture and cultivation of Orchids and Anthuriums. At the end of the programme, free planting materials were supplied to encourage them to do successful cultivation.

### 3. Mushroom Cultivation

Mushroom cultivation can be taken up by any person without much capital investment. In order to promote self employment, trainings in mushroom cultivation were conducted in the Institute. A batch of 10 farmers was given training for a week in September 1993. The training included spawn production, mushroom cultivation and marketing. Another batch of 15 farmers were given an intensive training for 15 days in February 1994. Experts from the Institute visited cultivation units set up by these unemployed youths and gave suitable suggestions for improvement.

### 4. Orientation Course in Ethnopharmacology

An orientation course in Ethnopharmacology and related disciplines was conducted for the benefit of 12 Ph.D. students working at TBGRI.

Two M. Pharm students from the Royal Danish School of Pharmacy, Denmark were given training in Ethnopharmacology for a period of two months from 1-2-1994 to 30-03-1994.

## B. Exhibitions

### 1. Abroad

Exhibits on TBGRI were sent to Strausbourg Botanical Garden, France as apart of participation in its centenary celebrations.

### 2. India

- a. An exhibition was organised during the Foundation Day celebrations projecting various activities of the Institute especially plant collections and conservation activities, February 1992.

Institute participated in the following exhibitions:

- b. Agri/Horti Cattle Fair, Palode, Thiruvananthapuram, June 1992.
- c. Fruit and Vegetable Show Thiruvananthapuram, June 1992.
- d. Swadeshi Science Congress, Thiruvananthapuram Expo-1992.



*Pleurotus (Oyster mushroom) cultivated on paddy straw*

*An orientation course in Ethnopharmacology and related disciplines was conducted for the benefit of 12 Ph.D. students working at TBGRI.*



*TBGRI Stall at the first International Forum of Soil Taxonomists at Kanakakkunnu Palace, Thiruvananthapuram*

*Sale of plants provided an income to the tune of Rs.24,000/- during the period. Apart from this, regular sale of mericlone bottles and community bottled plants was continued at the garden site.*

- e. International Forum on Soil Taxonomy and Sustainable Land Management, December 1993.
- f. STEC EXPO-1993, CMS College, Kottayam, January 1993.
- g. Agri-Horticultural Exhibition at Mitra Niketan, August 1993.
- h. India-International Trade Fair 1993, New Delhi, November 1993.
- i. G-15 Gene Bank for Medicinal and Aromatic plants at Pragati Maidan, New Delhi, December 1993.
- j. Industrial Carnival Festival, Cochin, February 1994.
- k. Agri-Horti fair, Idukki, February 1994

### 3. Income from sale of plants

Tissue cultured plants of Anthurium, Philodendron, Orchids and Medicinal plants were put on display at various exhibitions and fairs in which TBGRI participated. Sale of plants provided an income to the tune of Rs.24,000/- during the period. Apart from this, regular sale of mericlone bottles and community bottled plants was continued at the garden site.

Our participation in India International Trade Fair 94 and G15 Summit at New Delhi and Industrial Carnival at Cochin were acclaimed praiseworthy by the academic community as well as the public. Through these fairs quality seedlings of horticulturals and wild edible fruit crops were distributed to the public at nominal price. We won two prizes for the best stalls at Palode and Kulathupuzha.

### C. Ecoeducation Programme

To spread the message of eco-awareness the Institute, apart from conducting exhibitions, arranges lectures on nature conservation.

#### 1. Development of Resource Material

Under this programme, Institute has started preparing course materials for different age groups. The work is nearing completion with respect to High School students. Several classes were taken by experts for school children visiting the Garden. About 1000 students were benefited under this programme.

#### 2. Development of Exhibits

About 50 resource materials of exhibit nature depicting flora, fauna, geology and different ecosystems have been developed for educational purposes.

### 3. Eco-guided Tours

Under this programme two specially trained staff are deployed to guide students and public visiting the Garden. First hand information are given to visitors about the Institute activities and steps taken by the Institute in conserving plant resources. During the period under report the Institute entertained 7500 visitors which include both urban and rural consisting of young and old, college and school students and research workers.

### 4. Deployment of staff as Resource Persons

Scientists from different Divisions served as resource persons to various academic institutions/science fora to deliver lectures. Eight lectures were given during the period under report.

### D. Supply of Plant Materials

Distribution of seedlings is a major part of extension activities of the Institute.

Economically important tree species were supplied to Hill Palace Tropical Arboretum, Tripunithura, Cochin, and 55 tree species to the Forest Department, Administration of Dadra and Nagar Haveli and National Botanic Research Institute, Lucknow. To create interest in cultivation of ornamental plants among public and to promote floriculture, the Institute supplied a large number of Orchids, Anthuriums and other ornamentals at concessional price. Out of the Agastymala collections, 60 saplings belonging to 35 species of rare/endemic plants were presented to M.S. Swaminathan Research Foundation, Madras for display in the Conservatory of rare plants.

Planting materials of a large number of medicinal plants were supplied to several organizations, Colleges, Universities and NGOs.

At a meeting held in Nehru Yuvachethana Arts and sports Club building, Karakulam Panchayat in January 1993 many seedlings were distributed to the public; also during Kerala Science Congress held at Kottayam in 1992 and Agricultural Exhibition held in February 1993 at Palode, Thiruvananthapuram.

Besides the above, plant materials were supplied to the following centers

1. Department of Biosciences, South Gujarat University.
2. Ramniranjan Thunjhuwala College Bombay.
3. Priyadarshini Institute of Pharmaceutical Sciences Thiruvananthapuram.
4. Joint Agricultural Director, Malappuram

*During the period under report the Garden entertained 7500 visitors which include both urban and rural consisting of young and old, college and school students and research workers.*

*Planting materials of a large number of medicinal plants were supplied to several organisations, Colleges, Universities and NGOs*

5. Regional Research Institute, Poojappura, Thiruvananthapuram.
6. Kerala Forest Department at Calicut.

#### **E. Earth Pledge at Grass Root Level**

*On the eve of the UNCED, TBGRI took the lead to make the "Earth Pledge" reach at grass root level in Kerala through many Government and Non Government organizations*

TBGRI conducted a public hearing in Thiruvananthapuram on 15 October 1991 in association with STEC on Environment and Development. The programme was sponsored by the People's Commission on Environment and Development (PCED), New Delhi. Dr. Karan Singh, Ex Cabinet Minister and Chairman, PCED presided over the function. The outcome was summarized and presented through PCED in the Earth Summit (UNCED) that took place in Rio de Janeiro in June 1992.

On the eve of the UNCED, TBGRI took the lead to make the "Earth Pledge" reach at grass root level in Kerala through many Government and Non Government organizations. Five thousand signatories joined with TBGRI to make this campaign reach the rural mass.

#### **F. Planting of Trees**

Honoured guests of TBGRI planted saplings of 70 trees belonging to 47 genera during their visits to the Garden during this period.

#### **G. Consultancy services**

*Consultancy services were rendered with regard to cultivation of medicinal plants, establishment of nurseries, herbal gardens and preparation of project proposals*

Consultancy services were rendered with regard to cultivation of medicinal plants, establishment of nurseries, herbal gardens and preparation of project proposals to M/s Nirmalgram Rural Development Programme, Boothathankettu, Kothamangalam; Travancore Tea and Rubber Estate, Kalthuruthy; CSI Church, Pallom; Mahatma Gandhi University, Kottayam and Bakal Tourism Resort Project, Bakal.

#### **H. Dispensary at TBGRI.**

A dispensary was started at TBGRI in modern and traditional medicines and as evening clinic at Staff Quarters,



T B G R I MISCELLANEOUS



## SPECIAL FINANCIAL ASSISTANCE

### A. British council

The Foreign and Commonwealth Office (FCO), UK provided a financial assistance worth 25,000 00 through British Council to promote plant propagation and conservation activities. Under this, three junior scientists were given training in horticulture at the Royal Botanic Gardens, Kew for two to three months' duration. The library procured 60 new books and the Biotechnology Laboratory obtained a laminar flow clean air work station and a high pressure autoclave. A propagation house with mist irrigation facility was commissioned at the Central Nursery with this fund. Fund for purchasing a moisture analyzer for the Seed Bank was also provided under the above FCO project.

*Three junior scientists were given training in horticulture at the Royal Botanic Gardens, Kew for two to three months' duration.*

### B. British High Commission

The British High Commission extended financial assistance to create a Polytunnel Propagation House during 1992- 93. This house is used to help rooting and developing of plants under controlled conditions and hardening of plants released from laboratory to field for introduction.

### C. Ministry of Environment and Forests, Govt. of India

- 1 The Ministry sanctioned Rs. 14/- Lakhs for rebuilding the flood hit Garden; also for developing an aquatic garden, conservatory for wetland plants and an orchidarium for rare orchids. Development of an island habitat conservatory, collection and cultivation of lost medicinal plants and orchids are also included in the programme.
- 2 An assistance of Rs. 25.3 Lakhs was received in March 1994 for building conservatories for Ferns and Cacti and Succulents, development of open rock garden, collection and cultivation of ferns and fern allies etc.
- 3 Ministry provided one time assistance (Rs. 7.5 Lakhs) under the programme of Assistance to Botanic Gardens. A portion of the fund was utilized to equip the Seed Bank with dehumidifiers and air conditioners and the Nursery with a shade pandal of over 200 sq.

## ON GOING RESEARCH PROJECTS

Conservation through micropropagation of rare and exquisite orchids of the Western Ghats (Ministry of Environment and Forests, Government of India)

Germplasm collection, evaluation of yield potential and exploration of fruit crops of the Western Ghats (Western Ghats Development Programme, Planning and Economic Affairs Department, Government of Kerala).

Survey, exploration, collection, evaluation, *ex-situ* conservation and propagation of lesser known/hitherto unknown wild plants of horticultural/ornamental value and some rare and endangered endemic plants of the Western Ghats of Kerala (Ministry of Environment and Forests, Government of India.)

Sustained development of skilled human resource in the rural sector through training in micropropagation and field cultivation of economically important horticulturals (CAPART, New Delhi).

All India Coordinated Research Project on Ethnobiology (AICRPE) : Coordination Unit (Ministry of Environment and Forests, Government of India).

*Ex-situ* conservation of rare and endemic plants of Agastyamala and the Western Ghats at TBGRI (Western Ghats Development Programme, Planning Board, Government of Kerala).

Ethnobotanical Survey of Shabarigiri hills (Science, Technology and Environment Committee, Government of Kerala)

Studies on the rhizosphere and mycorrhizal microorganisms of the trees growing in the natural forests of the Western Ghats and in the Arboretum of TBGRI (Science, Technology and Environment Committee, Government of Kerala).

Studies on the photosynthetic performance of selected trees and woody vines of the sacred groves of Kerala - an attempt to evaluate the optimum productivity of these ecosystems (Science, Technology and Environment Committee, Government of Kerala).

'Plants and plant derived drugs' (Department of Pharmacognosy, Royal Danish School of Pharmacy, Copenhagen, Denmark (DANIDA).

RECOGNITIONS
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**A. Coordination Centre for AICRPE**

All India Coordinated Research Project on Ethnobiology (AICRPE) was launched under the Man and Biosphere (MAB) programme of the Ministry of the Environment and Forests, Government of India in 1982. Still an ongoing project, it involves multiinstitutional and multidisciplinary research programmes and is aimed at undertaking indepth study and analysis of multidimensional perspectives of tribal life, culture, tradition and knowledge system. TBGRI serves as the Coordination Centre for AICRPE

The NAM Science and Technology Centre (Delhi) identified TBGRI as the Potential Centre of Excellence in Conservation Biology and Plant Science Research.

**B. Accreditation with UNCED**

TBGRI is accredited with United Nations Conference on Environment and Development (UNCED) and is actively engaged with the UNCED follow up programmes like the constitution of the Earth Council, Committee for Convention to Combat Desertification (INCD) and the South North Environment Campaign Coalition (SECC).

**C. Awards/Honours/Memberships**

Dr P. Pushpangadan, Director, has been serving/elected as/nominated to the following international and national bodies.

**Member**

Executive Board, Botany 2000 Asia, UNESCO.

**Member**

International Scientific Committee on Ethnobiology, Brazil.

**President**

National Society of Ethnopharmacology

**Chairman**

Task Force on Science and Technology for Women, Ministry of Science and Technology, Government of India.

**Member**

Governing Council and Executive Committee, Foundation for Revitalization of Local Health Traditions, New Delhi.

*The NAM Science and Technology Centre (Delhi) identified TBGRI as the Potential Centre of Excellence in Conservation Biology and Plants Science Research*

## VISITS/TRAINING ABROAD

Dr P Pushpangadan visited Bogor, Indonesia to participate in the International Conference on 'Strategy for Flora Conservation' from 20 to 23 July 1992; Brazil on an invitation from the Botanic Gardens Conservation International (BGCI) to participate in the Conference on 'Botanic Gardens in a Changing World' from 19 to 25 October 1992; Mexico to participate in the Third International Conference on Ethnobiology from 10 to 14 November 1992.

He visited Royal Botanic Gardens, Kew from 23 to 27 November 1992 through the courtesy extended by the British Council. During his sojourn at Kew, he held discussions with scientists of different Divisions including Dr. G.T. Prance, Director ; Dr Hans J. Fliegner, Assistant Curator and Mr Ian Weese, Principal, School of Horticulture, Kew Gardens regarding various collaborative programmes and deputation of scientists from TBGRI to Kew for training in Horticulture and Garden Management. The Kew Gardens have been extending technical advice by deputing their experts to TBGRI and training TBGRI scientists at Kew since the very establishment of the Garden at Palode in 1983. Dr. Pushpangadan also availed this opportunity to meet Professor Vernon Heywood, Dr Pater Wyse Jackson and Ms Julia Willison of BGCI.

Sri R. Rajvikraman of the Horticulture and Garden Development Division attended a two month training programme in Horticulture at the Royal Botanic Gardens, Kew, UK from April to June 1992. He worked in different sections of the Gardens and obtained technical knowledge in areas like management of greenhouse, cacti and succulents, orchids and plant propagation . His visit was supported by the British Council.

Sri P.A. Jose and Sri.P.C. Binoy working in the Horticulture and Garden Development Division underwent a three month training internship programme at the School of Horticulture, Royal Botanic Gardens, Kew, UK during April-June 1993 with financial support of the British Council.

## CONFERENCE/SEMINAR/WORKSHOP

### A. Workshop on Biodiversity Conservation

A one week long Workshop on Biodiversity Conservation was organised from 18 to 23, February 1993 at TBGRI at the behest of M S Swaminathan Research Foundations, Madras under the 'Trainers' Training Programme in Biodiversity Conservation. Twenty five resource persons dealt with 26 titles which covered different aspects of diversity in forest

*The Kew Gardens have been extending technical advice by deputing their experts to TBGRI and training TBGRI scientists at Kew*



*Inaugural function of the Trainers' Training Programme on Biodiversity Conservation*



*Dr M S Swaminathan addressing the Trainers' Training Programme at TBGRI*

*Nineteen themes dealing with various aspects of Biodiversity and Biowaste Management in Kerala were presented in the workshop for detailed discussion.*

vegetation, lower and higher animal and plant species, marine ecosystem and microbial forms and various methods of their conservation with special reference to Kerala State.

#### **B. First National Conference and Workshop on Ethnopharmacology.**

The conference was organised at Kanakakkunnu Palace from 24 to 26, May 1993 by TBGRI with the objective of bringing together key persons in the fields of ethnopharmacological studies.

The conference, which was the first of its kind in India, brought together 200 professionals from different parts of the country, whose area of activity consisted of such disciplines as traditional, Tribal and Modern Medicines, Pharmacology, Toxicology, Ethnobotany, Phytochemistry, Social Work etc. The conference was inaugurated by Sri K. Karunakaran, Hon'ble Chief Minister of Kerala. Among the distinguished speakers were Prof. M.G.K. Menon, Sri K.N. Johry, Prof. Ulf Nyman, Sri P.V. Chandrasekhara Varier, Prof. C.K. Atal, Dr. R.S. Kapil, Dr. Sukh Dev, Prof. R.D. Lale, Dr. I. Sanjeeva Rao, Prof. Sriman Narayan, Dr. R. Ravikumar and Dr. P. Pushpangadan.

The conference which was sponsored by DANIDA and co-sponsored by STEC evoked considerable interest among the participants on this new and emerging area of research. The tribal participants exhibited rare and valuable medicinal plants. They demonstrated efficacy of some of the drugs that they used in treatment.

The proceedings of the conference is now in press and is expected to be released by November 1994.

#### **C. Workshop on Environment Policy for Kerala**

A one day workshop was conducted by TBGRI on Biodiversity Conservation and Biowaste Management with respect to Kerala on 17, June, 1993 in order to make recommendations for the formulation of Environmental Policy for the state. Nineteen themes dealing with various aspects of Biodiversity and Biowaste Management in Kerala were presented in the workshop for detailed discussion. The outcome was consolidated in the form of recommendations and submitted to the Science, Technology and Environment Committee, Government of Kerala for favour of action. The workshop was sponsored by Science, Technology and Environment Committee, Government of Kerala.

#### **D. TBGRI Science Forum Seminars**

A Science Forum was constituted in the Institute with the aim to build up confidence among young scientists to present their findings in scientific conferences. Weekly seminars are

organised on Fridays. This provides participants (mostly the scientific staff of the Institute) with an open forum to interact with other scientists. During the period under report 20 such seminars were conducted. In addition, 5 lectures were delivered by eminent scientists working in other research laboratories.

#### DISTINGUISHED VISITORS

Shri John Joseph, IIS  
Former Principal, Civil Commission of Forests  
Jamil Nadeem & Associates, M.S. Swaminathan Research  
Foundation, Madras

Shri David  
British Deputy High Commissioner  
Madras

Dr Subramanian Iyer  
Director, Science and Technology  
Government of Orissa

#### FLOOD AND MASSIVE LOSS OF PLANTS

Two successive floods, first on 9 October and second on 13 November 1992 in the Chittar River flowing by the side of the Garden caused devastating damages to the central nursery, medicinal plant garden, plant introduction and conservation areas and the wild species open orchidarium. The total loss was roughly estimated at Rs. 30,00,000.

*Two successive floods,  
caused devastating dama-  
ges. The total loss was  
roughly estimated at Rs.  
30,00,000*

#### CIVIL WORKS

During the period under report construction of a few D-type quarters, landscaping in front of the office and laboratory complex, insulation of seed bank, store room for fruit crops project, pandals for medicinal plant garden and open orchidarium were completed.

A green house was constructed in the medicinal plant garden. Construction of toilets for the public was completed. Maintenance of permanent structures, painting of semi permanent building, nursery shed etc. were also carried out during this period.

**DISTINGUISHED VISITORS**

**Shri John Joseph, IFS**  
Former Principal Chief Conservator of Forests  
Tamil Nadu & Advisor, M.S.Swaminathan Research  
Foundation, Madras.

**Shri David**  
British Deputy High Commissioner  
Madras.

**Dr Sodananda Iorasia**  
Director (Science and Technology)  
Government of Orissa.

**Dr Daruando T. Khathing**  
Head, Regional Sophisticated Instrumentation Centre  
Shillong

**Dr (Mrs) I.K. Barthakur**  
Principal Advisor  
(Secretary to Government of India)  
Planning Commission  
New Delhi

**Dr P.C. Sharma**  
Assistant Director Incharge  
Jawaharlal Nehru Ayurvedic Medicinal Plants Garden  
and Herbarium, Pune.

**Shri Pandalam Sudhakaran**  
Minister of Sports and Youth Affairs  
Government of Kerala

**Smt. Lekshmi N. Menon**  
Ex Minister  
Govt. of India

**Dr Manorama Bawa**  
All India Women's Conference  
New Delhi.

### TBGRl GOVERNING BODY

- |  |                  |
|--|------------------|
| 1. Chief Minister, Kerala State  | Chairman         |
| 2. Chairman, State Committee on Science, Technology and Environment  | Vice Chairman    |
| 3. Secretary to the Government of Kerala, Planning & Economic Affairs Department   | Member           |
| 4. Secretary to the Govt. of India or his representative, Ministry of Environment and Forests, Paryavaran Bhavan, CGO Complex, Lodi Road, New Delhi          | Member           |
| 5. Secretary to the Government of Kerala, Finance Department   | Member           |
| 6. Vice-Chancellor, Kerala Agricultural University, Mannuthy, Thrissur   | Member           |
| 7. Principal Chief Conservator of Forests, Kerala State  | Member           |
| 8. Head, Department of Botany, University of Kerala, Kariavattom   | Member           |
| 9. Prof. H Y Mohan Ram, Department of Botany, University of Delhi, Delhi   | Member           |
| 10. Prof. A N Namboodiri, 15/1082, Ullloor Lane, Jagathy, Thiruvananthapuram 695 014   | Member           |
| 11. Dr M P Nayar, Ex Director, Botanical Survey of India, The Greens, T.C. 19/315, Vattavila, Thiruvananthapuram   | Member           |
| 12. Prof. B G Negavi, Principal, JSS College of Pharmacy, Sivratheeswara Nagara, Mysore 570 015  | Member           |
| 13. Sri Darshan Shankar, Director, Academy of Development Science, 4 Saras Bagh, Deonar, Bombay 400 088  | Member           |
| 14. Shri M Somanathan, Planter, Brindavan Estate, Meencut (P.O.) Via Chitrapura, Munnar, Idukki  | Member           |
| 15. Dr K S M Saxtri, Retired CSIR Deputy Director of Plant, Pathology & Microbiology, House No. 58, Ideal Homes Township, Rajeswari Nagar, Bangalore 560 039 | Member           |
| 16. Director, Tropical Botanic Garden and Research Institute, Palode, Thiruvananthapuram   | Member Secretary |

### EXECUTIVE COMMITTEE

- |  |                  |
|--|------------------|
| 1. Chairman, State Committee on Science, Technology & Environment                | Chairman         |
| 2. Secretary to the Government of Kerala, Planning & Economic Affairs Department | Member           |
| 3. Head, Department of Botany, University of Kerala, Kariavattom                 | Member           |
| 4. Director, Kerala Forest Research Institute, Thrissur                          | Member           |
| 5. Shri S Chand Basha, Chief Conservator of Forests                              | Member           |
| 6. Director, Tropical Botanic Garden and Research Institute                      | Member Secretary |

## T B G R I STAFF

Dr P Pushpangadan Director

## Plant Biotechnology

Dr S Soeni	Deputy Director and Head
Dr P N Krishnan	Scientist
Dr S William Decruse*	Scientist
Shri K Satheesh Kumar*	Research Associate
Dr S Mukunthakumar	Senior Scientific Assistant
Smt C G Sudha	Junior Scientific Assistant
Shri D Ajithkumar	Junior Scientific Assistant
Shri A Gangaprasad	Junior Research Fellow
Shri S Sreekumar	Junior Research Fellow
Shri M Rajendraprasad	Junior Research Fellow
Kum Lakshmi G Nair	Junior Research Fellow
Smt Reema Abraham	Junior Research Fellow
Shri P Ajith Kumar	Junior Research Fellow
Smt S Shallajakumar*	Laboratory Assistant
Smt Sajeena Beegom*	Laboratory Assistant
Shri G Gopakumar*	Field Assistant
Shri A Anilkumar*	Field Assistant
Shri Joemon Jacob*	Field Assistant
Smt S R Bindu*	Laboratory Assistant
Kum V S Sindhu*	Laboratory Attendant
Smt Kanaka Sundaram*	Laboratory Attendant

## Cryptogamic Botany

Dr C Bhadrn Nair	Deputy Director and Head (Deputation to KSIIPDC)
Shri Bejoy Mathew	Junior Scientific Assistant
Shri R Prathapachandran	Junior Research Fellow

## Microbiology

Dr T K Abraham	Deputy Director and Head
Dr K B Vrinda*	Scientist
Sri K Vijaya Kumar	Junior Scientific Assistant
Kum R K Radha	Junior Research Fellow
Shri C K Pradeep	Junior Research Fellow
Smt Swapna Enose	Junior Research Fellow
Smt Alphonsa Vijaya Joseph	Junior Research Fellow
Shri H Biju*	Laboratory Assistant
Shri S R Kamaleshkumar*	Field Assistant
Shri K Anil Kumar*	Field Assistant

## Ethnomedicine

Dr S Rajasekharan	Scientist and Head
Dr Prabhakar Joshi	Scientist
Sri S D Biju	Junior Scientific Assistant
Smt Ushakumari*	Laboratory Assistant
Smt Elsamra Joseph*	Laboratory Assistant

## Ethnopharmacology

Dr N P Pillai	Scientist (19.10.92 to 8.1.93)
Smt P G Latha	Scientist and Head
Dr D A Evans*	Scientist
Dr K Valsaraj	Junior Scientific Assistant
Shri S Radhakrishna Pillai*	Animal House Keeper
Shri G Anilkumar*	Field Assistant

**Phytochemistry**

Dr V George	Scientist and Head
Dr Om Vir Singh*	Scientist
Kum Brinda Somanathan	Junior Scientific Assistant
Kum Asha Sarah Koshy	Junior Project Fellow
Kum S Ambili*	Laboratory Assistant

**Conservation Biology**

Dr T S Nayar	Scientist and Head
Dr K Narayanan Nair	Scientist
Smt A Rasiya Beegam	Junior Research Fellow
Shri E S Anil Kumar	Junior Research Fellow
Shri K Jigash	Junior Research Fellow
Shri S Suresh*	Technical Assistant
Shri M Sibi*	Technical Assistant

**Herbarium, Museum and Ecoeducation**

Dr A G Pandurangan	Scientist and Head
Shri K Radhakrishnan	Junior Scientific Assistant
Smt G Valsala*	Junior Scientific Assistant
Shri S Santhosh Babu	Junior Project Fellow
Sri S S Dayal	Guide
Sri V Prem Kumar	Guide
Kum M P Geethakumary*	Herbarium Assistant
Smt Deepthy Kumari*	Herbarium Assistant

**Horticulture and Garden Development**

Dr Jacob Thomas	Scientist and Head
Sci N Mohanan	Scientist
Sri P J Mathew	Scientist
Dr K C Koshy*	Scientist
Dr C Sathish Kumar	Scientist
Shri A E Shanavaskhan*	Scientist
Dr S V Pradeed	Research Associate
Shri A Mohandas*	Senior Scientific Assistant
Shri P K Suresh Kumar	Junior Scientific Assistant
Shri C Anilkumar	Junior Scientific Assistant
Shri Mathew Dan	Junior Scientific Assistant
Shri P C Binoy	Junior Scientific Assistant
Shri K Rajvikraman	Junior Scientific Assistant
Shri S Bina*	Junior Scientific Assistant
Shri D R Balju*	Junior Scientific Assistant
Shri Sam P Mathew	Junior Project Fellow
Shri A Nazarudeen	Junior Project Fellow
Shri S Anilkumar	Junior Project Fellow
Shri C Muraleedharan Unnithan*	Technical Assistant
Shri K S Santhoshkumar*	Technical Assistant
Shri M Abdul Jabbar*	Technical Assistant
Shri S Mohammed Shareef*	Field Assistant
Shri M Saleem*	Field Assistant
Shri C Suseendran*	Project Assistant
Shri T Sabu*	Garden Assistant
Shri Saby Varghese*	Garden Assistant
Shri Cheriyan P Koshy	Garden Works Manager

Shri G K Udaya Das	Garden Maistry
Shri P Mony	Garden Maistry
Shri K Selvaraj	Garden Maistry
Shri J Mithayal	Garden Maistry
Shri U Hamsa	Gardener
Shri G Hari Kumar	Gardener
Shri T Jamaludeen	Gardener
Shri B Jayakumar	Gardener
Shri M Madhusoodhanan Nair	Gardener
Shri G Manoharan	Gardener
Shri M Ravendran Nair	Gardener
Shri N Salahudeen	Gardener
Shri K C Thomas	Gardener
Shri V Venugopalan Nair	Gardener
Shri C Muraly*	Gardener
Shri M Shajahan*	Gardener
Shri K Ashokkumar*	Gardener
Shri B Jayakumar*	Gardener
Shri S Ajayakumar*	Gardener
Shri P Marikantan Nair*	Gardener
Shri V Satheesan*	Gardener
Shri S Baburej*	Gardener
Shri S Thulaseedharan*	Gardener
Shri M Varkey*	Gardener
Smt S Syamalakumari*	Gardener
Shri A Thankappan	Painter

#### Library and Information Services

Smt A Syamalakumary	Librarian
Smt V Sujatha	Junior Library Assistant

#### Computer

Shri K Sabarish*	Scientist
Shri V Santhosh	Junior Scientific Assistant
Smt R Subha Sankar*	Computer Assistant

#### Art/Photography

Shri K P Pradeep Kumar	Artist
Shri S Sureshkumar*	Assistant Artist

#### Consultants

Prof. V Sankhy Menon*	Full time Consultant
Dr M N S Nayar*	Full time Consultant
Dr N S Mony*	Full time Consultant
Prof. A V Sankaran*	Part time Consultant

#### Administration

Shri Ravi Abresham*	Accounts Officer and Administrative Officer in charge
Shri C M George	Purchase Officer
Shri K G Ajith Kumar	Officer on Special Duty
Smt S Radhalakshmi Ammal	P.A. to Director
Shri Suresh Chandran	Section Officer
Smt R Sarala Devi	Section Officer
Smt C Syamala	Senior Accountant

Smt V Jayasree	Senior Grade Assistant
Shri K Vijayan	Assistant
Smt S Meena Kumary	Assistant
Shri K Mohammed Habeebulla*	Assistant
Shri K P Elias*	Store Assistant
Smt C Gracy	Stenographer
Smt R Prasannakumary	Stenographer
Smt A Santha	Typist
Smt G Subhadra	Typist
Smt N Rajalekshmi Ammal	Typist
Shri M Ramaswamy	Driver
Shri V Rajendran Nair	Driver
Shri D Mohanachandra Kumar	Driver
Shri A Salim	Driver
Shri R Gopinathan Nair	Driver
Shri V Sudheesh Kumar*	Driver
Shri A Abdul Nizar*	Driver
Shri R Bhargavan	Helper
Shri S Chandran Chettiar	Helper
Shri B Vijaya Kumar	Helper
Shri C Sathyan	Helper
Shri T Mohanakumar	Helper
Shri R Vinakrishnan*	Helper
Smt R Valsala Devi	Sweeper
Smt Kumary Girija*	Sweeper

#### Engineering

Shri P P Markose	Engineering Supervisor
Shri K C Tpen	Consultant
Shri S Ajith*	Assistant Engineering Supervisor
Shri V S Sureshkumar*	Electrician
Shri R Prabhakaran Nair*	Plumber

#### Security

Shri T M Abdulsalam	Security Officer up to 8-5 1993
Major P K Harikesh	Security Officer
Shri V Raveendran Pillai	Assistant Security Officer
Shri P R Chandrasekharan Nair	Security Guard
Shri P Jain	Security Guard
Shri K Ramachandran Nair	Security Guard
Shri A Johnson	Security Guard
Shri K Mohanan	Security Guard
Shri S Chandran	Security Guard
Shri G Somasekharan Nair	Security Guard
Shri C Stanley	Security Guard
Shri N Radhakrishnan Nair	Security Guard
Shri C P Somasekharan Nair	Security Guard
Shri S Viswambharan Nair	Security Guard
Shri P Ramachandran Nair*	Security Guard
Shri V Sreedharan Nair*	Security Guard
Shri K Balakrishnan Nair*	Security Guard
Shri P Krishnankutty Nair*	Security Guard
Shri M Bhuvanachandran	Watchman

\*Deputation/Project/Temporary Staff



*Aerides crispa* Lindl.



**Tropical Botanic Garden and Research Institute**