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ANNUAL REPORT

2004-'05
2005-'06

Tropical Botanic Garden and Research Institute

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Tropical Botanic Garden and Research Institute
Karimancode P. O., Pacha-Palode, Thiruvananthapuram-695562, Kerala, India.
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Editors
P.G. Latha
N. Mohanan

Editorial Board
P. Padmesh
P. K. Suresh Kumar
Mathew Dan

Design and Layout
K. P. Pradeep Kumar

Printed and Published by
S. Ganeshan
Director
TBGRI

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Tropical Botanic Garden
and Research Institute
Karimancode P. O., Pacha-Palode
Thiruvananthapuram - 695562
Kerala, India.
Phone : 91 (0)472 2869226,
2869246, 2869626, 2869628
Fax : 91 (0)472 2869646
e-mail : tbgri@sancharnet.in;
btis_tbgri@rediffmail.com
website : http://www.tbgri.in

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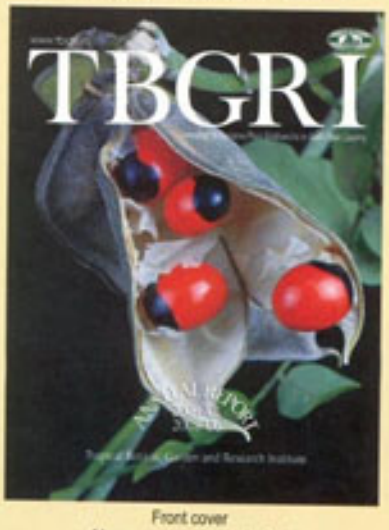

Front cover
Abrus precatorius L. in fruit
Back cover
The splendid waterfall over looking
Itty Achuthan Vaidyan Herbal Garden
Cover design and photo
Pradeep Kumar K. P.

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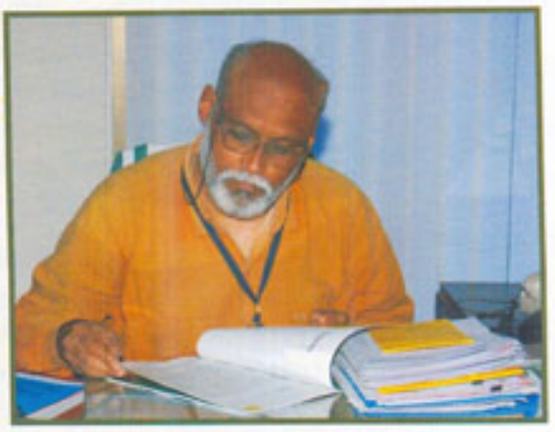


From the Director's Desk

The years 2004 -'05 and 2005 -'06 witnessed remarkable achievements in the garden development and R& D sector through programmes implemented by different R & D divisions of the Institute. These programmes were ultimately aimed at conservation and sustainable utilization of the rich and diverse plant resources of the state to the maximum advantage of the people.

During this period, 105 medicinal plant species, 20 bamboos, 13 palms, 133 orchids and 32 tree species were introduced into the garden. By conventional breeding methods two new attractive orchid hybrids have been developed, Arachnostylis "Silver Jubilee" and *Dendrobium* "Tropgarden Beauty" which was registered from the Royal Horticultural Society, London. Landscaping and beautification of pivotal areas of the garden was completed.

The Biotechnology group developed cryopreservation protocols for seeds of 13 orchid species, micropropagated 6 RET species of Zingibers and worked extensively on the genetic diversity of *Costus speciosus* and *Decalepis arayalpatra*. With the financial support of the Department of Biotechnology, Government of India, Web Server and Leased Line Internet Connection were installed at the Institute. A cream containing plumbagin was developed from *Plumbago rosea* for dermal application.

A well established Mushroom Herbarium with 8520 collections is maintained in the Microbiology Division. A high yielding strain of Oyster mushroom was located and popularized among the mushroom growers. 5 new genera, 98 species and 13 varieties of Microfungi were identified.

The Phytochemistry group prepared Pharmacoepial Monographs of 5 plants for ISM, New Delhi. An antiarthritic drug was developed from *Sida* species. The phytochemical studies of *Pittosporum viridulum*, *Gymnacranthera canarica* and *Lagenandra ovata* were completed.

The systematic documentation of IK of plants related to food and medicine of four districts of Kerala were completed. A model of Prior Informed Consent was developed. A documentary film of Indigenous Knowledge was produced by the Ethnomedicine and Ethnopharmacology group. A new polyherbal nutraceutical formulation has been developed for osteoporosis based on traditional knowledge obtained from Kani and Malapandaram tribes. The protective effect of *Spilanthes ciliata* on ethanol induced liver damage has been confirmed. A book entitled "Stars and Trees" was published.

The mutualistic interactions between *Cullenia exarillata* and the vertebrate population in its vicinity was established by the Conservation Biology group.

The Plant Systematics and Evolutionary Science group identified18 endangered balsams

of Western Ghats. 900 RET species were enumerated based on literature and herbarium survey and reconnaissance field studies. Insect-pests associated with the *Goniothalamus rhynchantherus* and *G. wightii* were collected and identified. A taxonomic study on the economically important genus *Cinnamomum* (Lauraceae), a difficult group of habitat specific and highly polymorphic plants was undertaken to delimit the number of species actually occurring in the wild.

The library acquired 415 books during this period, increasing the collection to 7888 books and 3000 back volumes and subscribed to 75 journals. Several training and extension programmes were conducted. Conservation education is one of the mandates of TBGRI. Two of the remarkable achievements was the organization of the National Meet on Taxonomy and Biodiversity from 29-31 December, 2004 and the Mushroom Fair during 14-16 February, 2006.

The Institute received grants for 71 externally supported projects funded by various National agencies like ICMR, DBT, MoEF besides support received from the Government of Kerala One book, 23 book chapters and 71 research papers were published. The scientists also participated in several National and International conferences to present their findings besides giving invited lectures.

I am proud to present before you the report for the period, 2004-'05 & 2005-'06.

S. Ganeshan

Horticulture & Garden Development

The Division works as 5 Units such as Arboretum, Palmetum and Central Nursery, Bambusetum, Medicinal, Aromatic and Spice Plants, Orchid Biology, Education and Extension and Ornamental Plants and Plants Distribution, for effective execution of the developmental programmes.

The Palmetum - a picturesque view

Arboretum, Palmetum & Central Nursery

The Unit is involved in the development and maintenance of the Arboretum, the Palmetum and the Conservatory for rare and endemic plants of the Garden. The Unit also manages activities of the Central Nursery. Besides the day-to-day activities in these sections, the Unit also operates a few R & D projects.

During the report period, 32 species were newly introduced, which include very rare endemic species such as *Aglaia bourdillonii*, *Buchanania barberi*, *Syzygium lanceolatum*, *Syzygium travancoricum*, *Vateria macrocarpa*, *Cassine kedarnathii* and *Semicarpus kathalekanensis*. About 50 saplings belonging to 20 species of trees were planted at the

a. *Salacia beddomei* fruits
b. *Syzygium zeylanicum* in fruiting
c. Palmetum Mist house

a. A casual visitor to the garden! a phenotypic mutant of the monkey *Macaca radiata* (Geoffroy)
b. New to the garden. *Abelmoschus rugosus* Wall. ex Wight & Arnold
c. *Jasminum fruticans* L. cv. Yellow Jasmine bloomsing in the garden
d. Developed in the garden.... new variegated mutant of *Stachytarpheta jamaicensis* (L.) Vahl
e. A view of the *Jasminum* germplasm in the garden.
f. Bio control....? the predatory bug killing the caterpillar on *Aristolochia tagala* Cham

Arboretum. 950 trees at the Arboretum were labelled. The regular maintenance continued. The weeding of the whole Arboretum area was a major work carried out during the report period. Under extension programme, Arboretum supplied saplings of selected trees on request to Kerala Forest Research Institute, Department of Eco-Tourism, Government of Kerala, IIHR, Bangalore and several NGOs and interested public.

Regular maintenance of the Palmetum continued. 11palm species were collected and introduced to the Palmetum. 25 seedlings were planted. 1000 seedlings belonging to 10 species were raised at the nursery for sale. 400 palms grown at the Palmetum were labelled.A new mist house was built for raising seedlings.

Nepenthes khasiana Hook. f. an insectivorous cum ornamental plant, clonally propagated

The Unit also involved in a multi divisional in-house programme on 'Production and supply of quality planting materials'. About 3600 seedlings belonging to five selected economic trees and 3000 seedlings of palms were raised for this purpose.

Central Nursery mainly takes care of the propagation, multiplication, establishment and distribution of planting materials required for different units including sales programmes of the institute. Nursery has raised 200 accessions covering 40000 clonal materials. Upkeep and maintenance at Central Nursery continued. About 130 accessions covering 4300 established plants were distributed to different garden units/sales unit. In collaboration with the Plant Systematics and Evolutionary Science Division the central nursery worked on the propagation and restoration of 15 rare endemic medicinal trees of Western Ghats in the Medicinal Plant Conservation Areas developed by FRLHT and Forest Department. Under this programme over 900 saplings of 18 endemic/ threatened plants were restored to Peppara WLS. Development and maintenance of *Jasminum* Germplasm was continued. As part of conservation based programmes clonal propagation studies were undertaken in 4 endemic spp. viz; *Myristica malabarica, Calophyllum calaba, Kunstleria keralensis* and *Aporusa lindleyana* of the Western Ghats.

The in-house project "Development of propagation profile and restoration of economically important endemic plants of Western Ghats, Kerala" aims at development of propagation techniques in 8 rare endemic tree species for Western Ghats and multiplication for conservation purposes. Propagation trial of species such as *Gymnacranthera canarica* and *Humboldtia vahliana* were initiated.

In the NBPGR funded project on "Exploration, documentation and *ex-situ* conservation of the wild crop relatives of Western Ghats" a total of 67 accessions under 59 species of Wild Crop Relatives were collected. The important wild relatives collected are *Amorphophallus* (3 species), *Cinnamomum* (5 species), *Garcinia* (5 species), *Myristica* (2 species), *Piper* (7 species) and *Syzygium* (7 species). The collection includes 25 rare and endemic species of Western Ghats. 58 accessions are maintained in the *ex-situ* conservatory of the Garden.

A new project on the 'Collection, propagation, reintroduction and popularisation of ten endemic tree species of Western Ghats' approved under Western Ghats Development Programme was initiated during the Report period. Preliminary work on data collection was initiated. Seeds of the target species such as *Buchanania lanceolata, Buchanania barberi* and *Humboldtia decurrens* were collected and germination trials were initiated.

Special postal cover released on the inauguration of the IAAT conference, 2004

Bambusetum

20 bamboo offsets and saplings of 10 species, collected from Arunachal Pradesh were planted in the bambusetum in 2004 and 46 saplings in 2005. 3 offsets of *Ochlandra* sp.were collected from Kottoor, Kerala and 13 offsets from Wayanad. *Gigantochloa* sp., *Guadua sp., Phyllostachys sp., Dendrocalamus asper etc.* were the new additions.

As a new venture, rainwater harvesting was attempted in the bambusetum by taking pits. These pits were found useful not only for collection of water but also for preventing soil erosion. The natural water pond was beautified by pitching stones. As part of the development of bambusetum, 1 meter wide footpaths were developed for a length of 852 meters. Stone pitched walls were made along the entire length of footpath.

The Bamboo Museum

Production of saplings through clonal multiplication using low cost techniques were carried out in *Arundinaria* sp., *Bambusa bambos, B. vulgaris, Dendrocalamus brandisii, D. giganteus, Gigantochloa nigrociliata, Ochlandra* sp., *Thyrsostachys siamensis,* etc. During the period, 22,700 easy-to-carry polybag saplings were produced and 12,500 saplings were distributed. An easy propagation technique for self incompatible bamboos called "offset size reduction method" was developed. In this method, saplings of 'seedling size' are developed first. Subsequently, the tillers (individual thin culms along with rhizome) of the proliferated sapling are separated (by rhizome division) and planted as individual propagules. New tillers arise from these propagules in a few weeks. When they reach a 3-5 tiller stage, they are again subjected to tiller separation and planting. By repeating the process, a large number of saplings can be made .The cost of production by this method is less than Rs 5/- per sapling. The method has several advantages: (i) propagules from parent clumps are required only in the initial stages, (ii) regenerated plantlets can be repeatedly grown and split to generate additional plantlets, (iii) parent clumps are saved from damage due to continuous extraction of offsets, cuttings, etc, (iv) production of saplings of uniform size and age, (v) optimum survival of saplings in nursery and plantation,(vi)low cost of production and management ,(vii) protocol is simple and easy to practice. This method, therefore, is well suited to farmers, NGOs etc. *Down To Earth*, in the December 15, 2005 issue, published a commentary on the above method that attracted wide attention of farmers and industrialists.

Infrastructure facilities like potting shed, office cum work place and bamboo museum were developed.

Medicinal, Aromatic & Spice Plants Unit

As a part of the *ex situ* conservation of germplasm of medicinal, aromatic and spice plants, 20 plant explorations were conducted to different parts of peninsular India. As a result of these trips, 625 accessions of 105 species of medicinal, aromatic and spice plants were collected, introduced and maintained in the nursery of the Herbal Garden/Field Gene Bank of the Unit. 105 species and 50 accessions of 10 species were planted out in appropriate locations in the Herbal Garden and Field Gene Bank respectively. The programme of development of Model Medicinal Plant Garden was successfully launched with the support of BGCI, for educating students and public on conservation of herbals by familiarizing with them in their natural habitat. A pond ecosystem was also developed. Three attractive 'Kottiambalam' style entrances were erected in the Conservation Education Model Herbal Garden, the 'Itty Achuthan Vaidyan's Garden', which gave it a major face lift and attracted lot of visitors.

Intraspecific variability studies were carried out on *Centella asiatica*, *Andrographis paniculata*, *Gloriosa superba*, *Bacopa monnieri*, *Ocimum gratissimum* and *Costus speciosus*.

In *Centella asiatica*, 24 accessions were collected and introduced to the field gene bank raising the total number of accessions of the species to 45. Data on 24 morphological characters including qualitative and quantitative characters of 20 accessions were collected as part of characterisation and intraspecific variability assessment studies. In order to assess the extent of variability with respect to percentage of asiaticoside in 15 accessions of *Centella*, *fresh plants of the accessions were shade dried, powdered and methanol extract prepared for HPTLC analysis.*

Palynological studies on three accessions and cytological studies on two accessions of *Gloriosa superba* were conducted. Data on 23 morphological characters (8 qualitative and 15 quantitative) of 3 accessions of *Bacopa monnieri* were collected as part of characterisation. Data on 14 morphological characters (4 qualitative and 10 quantitative) from 4 accessions of *Costus speciosus and* 13 morphological characters (5 qualitative and 8 quantitative) of 3 accessions of *Ocimum gratissimum* were collected as part of characterisation of the accessions.

Ornamental Plants & Plant Distribution Unit

Major programmes carried out during the period include landscaping of the front area of the Guest House with Korean grass, Bottle-Palms and Ixoras, enhancement of the Topiary and extension of cacti and succulents to other areas in the rock garden. The front area of the Main Building was relandscaped with 3 terraces and a broad footpath connecting the office building with the Arboretum road leading to the Biotechnology laboratory. This location was beautified with an attractive *Hibiscus* collection holding 50cvs. Hedge planting was accomplished with *Polyscias*, 'miniature bamboo' and *Phyllanthus*. An ornamental shrubbery was developed facing the animal house holding 150 plants belong to 40 species. New ornamental shrubs and climbers including *Poinsettia* sp. (different varieties), *Euphorbia milii*, *Hibiscus* cv., *Yucca* spp., *Strongoldon macrobotryus* etc were purchased from Bangalore and introduced in the newly landscaped area in front of the main building.

The shrubbery was reconstructed with eight annual beds of *Celosia, Zinnia, Amaranthus, Marigold, Salvia, Phlox, Gomphrena and Dhalia*. More than 45 spp. (*Acalypha, Hibiscus* cvs., *Hamelia, Poinsettia, Tecoma* etc.) were also planted to the

A picturesque view of the garden facing the Office Complex

shrubbery area. 100 budded varieties of roses were planted in rose garden.

The systematic and aesthetic evaluation of 470 species of garden plants was achieved. An Identification Key was prepared for easy identification. Aesthetic performance of these plants including the wild ornamentals as seasonal landscape components was documented. The aesthetic parameters studied were groups such as accent/specimen plants, ground cover, structural plants, plants that increase/decrease the apparent depth of the landscape scene and functional groups such as shade trees, screens, transition plants and other special groups like drought resistant plants etc. Influence of exotic species in the garden as well as natural flora by escape was also evaluated. Photographic documentation and herbarium specimen preparation were completed.

A new Fern House was constructed near the Pinetum and collections were transferred. Some of the terrestrial ferns were planted on the ground and others displayed in pots. Epiphytes were mounted on drift wood. More than 170 species of Ferns and Fern allies under 74 genera and 30 families are displayed and maintained of which, 30 species feature in the rare, endangered and threatened category. About 100 plants were labelled.

The Gymnosperm collection represents 38 species under 15 genera belonging to 7 families. Cycad collection (living fossils) is also one of the largest collections in India and represents 7 out of 11 known genera. *Cycas beddomei*, the endangered cycad was multiplied and propagated through suckers.

Six plant exploration trips were conducted to the high ranges of Bonaccord, Chemunji, Ponmudi Hills and *Myristica* swamps of Kulathupuzha forests of Western Ghats. During these trips, 40 species including *Asplenium incisum, A. crinicule, A. formosum, A. grevillei, A. polyodon, Athyrium hohenackaranum, Bolbitis prolifera, Cyathea gigantea, Botrychium daucifolium, Davallia bullata, Lygodium circinnatum, Ophioglossum reticulatum, Selaginella ganguliana, and S. vaginata* were collected. *Adiantum concinnum, Asplenium grevillei* and *Pronephrium thwaitesii* were the new additions.

About 25 species of Ferns and Fern allies were identified after critical studies. Ten species of ferns collected from Andaman Islands by DBT field gene bank staff were also identified. *Asplenium grevillei,* an endangered 'spleen wort', collected from *Myristica* swamps of Kulathupuzha is a rediscovery after the lapse of 33 years. 1000 saplings of the horticulturally potential wild "Club Moss" viz. *Selaginella inaequalifolia* and *S. wildenovii* were raised for sale.

100 species of cacti and and more than 160 species of other succulents are represented in the garden including interesting plants like *Pachypodium, Cephalocereus, Hatiora, Adenium, Pereskia* etc. They are displayed in the rock garden and glasshouse.

The orchard covers an area of 15 acres and holds 110 species of edible fruit plants and varieties of selected cultivated edible species. New additions of edible fruit plants includes *Durio zibethinus, Syzygium lanceolatum*, Jack var. 'Chembaruthi varika', Aonla var. 'Kanchan', Guava var. 'Allahabad Safed' and Guava var. 'Lucknow 49'. About 11000 saplings of fruit plants were raised for sale. Revenue of approximately 3 lakhs has been generated through sale of plants.

a *Nepenthes rafflesiana*
b Arachnostylis Silver Jubilee
c *Dendrobium* Tropgarden Beauty


a


b

Orchid Biology, Education & Extension

Taxonomic study on Indian orchids was continued. A summary of the genus *Renanthera* was prepared for possible funding from Singapore Botanic Gardens. *Vanda merrilli* from Philippines flowered for the first time in the collection. *Panisea tricallosa* and *Ceratostylis himalaica*, both collected from Arunachal Pradesh also flowered. Preliminary studies on *Orchid Icones of William Roxburgh* were made in collaboration with Dr. M. Sanjappa of Botanical Survey of India. Roxburgh (1832) published 57 binomials of orchids under 8 genera (*Orchis, Pterygodium, Epipactis, Malaxis, Cymbidium, Limodorum, Aerides* and *Dendrobium*). A detailed taxonomic reassessment of these taxa based on Roxburgh's paintings, descriptions and new collections is being undertaken with a view to interpret the correct identity and scan all the images for reproduction.

Several novelties have been collected as part of the collection trips to different areas. Manuscripts on *Bulbophyllum kannurensis* and *Oberonia munnarensis* are awaiting publication.

As part of identification of orchid species sent in from elsewhere, an interesting *Pteroceras* from Pune (Sachin Punekar, Agharkar Institute) collected from North Kanara proved to be new and related to the recently described *P. monsooniae* from Kerala. Two *Eulophia* spp. from Maharashtra (Suresh Jagtap, RC-MPCC) after critical studies proved to be new species. In addition, several photographs and spirit collections of orchid species received for identification proved to be new to science. Many manuscripts on orchid taxonomy were reviewed.

Exploratory surveys were conducted to different parts of India and many accessions of 133 species of orchids were collected for conservation. Excess planting materials (1500) of monopodial orchids were given to the Puthenthope Center, planted and monitored under our supervision.

As a part of reproductive biology studies samples of *Ipsea malabarica* were collected from Meppadi, Wayanad District and self and cross pollination studies were conducted. The cross with *Spathoglottis plicata* produced pods.

As part of the breeding programme, 171 crosses were made using different materials available in the orchidarium. Of these 14 crosses resulted in pods which were cultured *in vitro* and seedlings raised.

Five of the new orchid hybrids made at the Institute produced flowers. The first flowered hybrids "Arachnostylis Silver Jubilee "and "*Dendrobium* Tropgarden Beauty" were given registration by Royal Horticultural Society, London. These incidentally happen to be first orchid hybrids from TBGRI to receive international registration. Attempts are on to get international registration for the remaining three hybrids.

The Carnivorous Plants Collection is widely appreciated by teachers and students, thanks to the strange and curious nature of the displays. The collection holds two *Nepenthes* sp. (*N. khasiana* and *N. rafflesiana*) and a hybrid. Tissue cultured seedlings of *N. rafflesiana* found in Singapore and adjoining countries were received as a gift from Mr Natarajan of Chennai.

Biotechnology

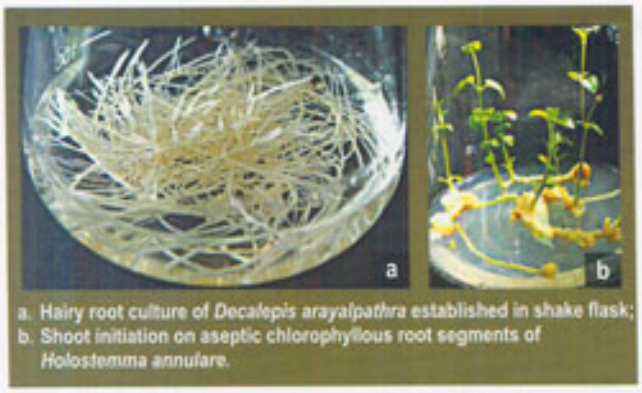
Research activities of Plant Biotechnology Division in TBGRI are programmed in such a way that the available expertise in the field of biotechnology is employed to tune research activities into application mode, keeping in view the requirements of the state as regards commercialization as well as developing new technology for sustainable utilization of natural resources.

Over exploitation of plant genetic resources resulted in rarity of many of the economically important plants and some are on the verge of extinction. The Division is actively engaged in developing effective regeneration protocols for many species to help in conservation, ecorehabilitation and sustainable utilization through biotechnological approach. This includes wild diploids, land races and primitive/lesser known Musas of southern Western Ghats. *In vitro* multiplication protocols for Poonkadali and Rasakadali were developed. Clonal plants so raised were field-tested and growth, bunch characters including the yield were found to be uniform. The Division maintains an *in vitro* Meristem Bank which was enriched with four more species. The cryopreservation of zygotic embryos was successful in three arborescent species and somatic embryo cryopreservation of *Kaempferia galanga* and optimization of protocol is in progress. Cryopreservation studies in Orchids include seeds of 13 species from Western Ghats where *in vitro* germination was observed in pollinia of 12 species. The cryopreseved pollen used for the pollination induced the formation of viable seeds.

a. Multiple shoot formation in *Hornstedtia fenzlii*; b. Multiple shoot formation and anthraquinone production from the roots of *Rubia cordifolia*.

Germination and development of cryopreserved embryos of a. *Coscinium fenestratum*, b. *Myristica malabarica* and C. *Nothapodytes nimmoniana*

Micropropagation of RET species of Zingiberaceae viz *Bossenbergia pulcherrima*, *Paracautleya bhatii* and *Ammomum pterocarpum* was achieved. Cultures of three other species viz. *Ammomum cannicarpum*, *Alpinia abundiflora* and *Curcuma vamana* are also initiated. Micropropagated and hardened plants of the endemic rattan palms of the Western Ghats viz. *Calamus nagabettai* and *C. travancoricus*



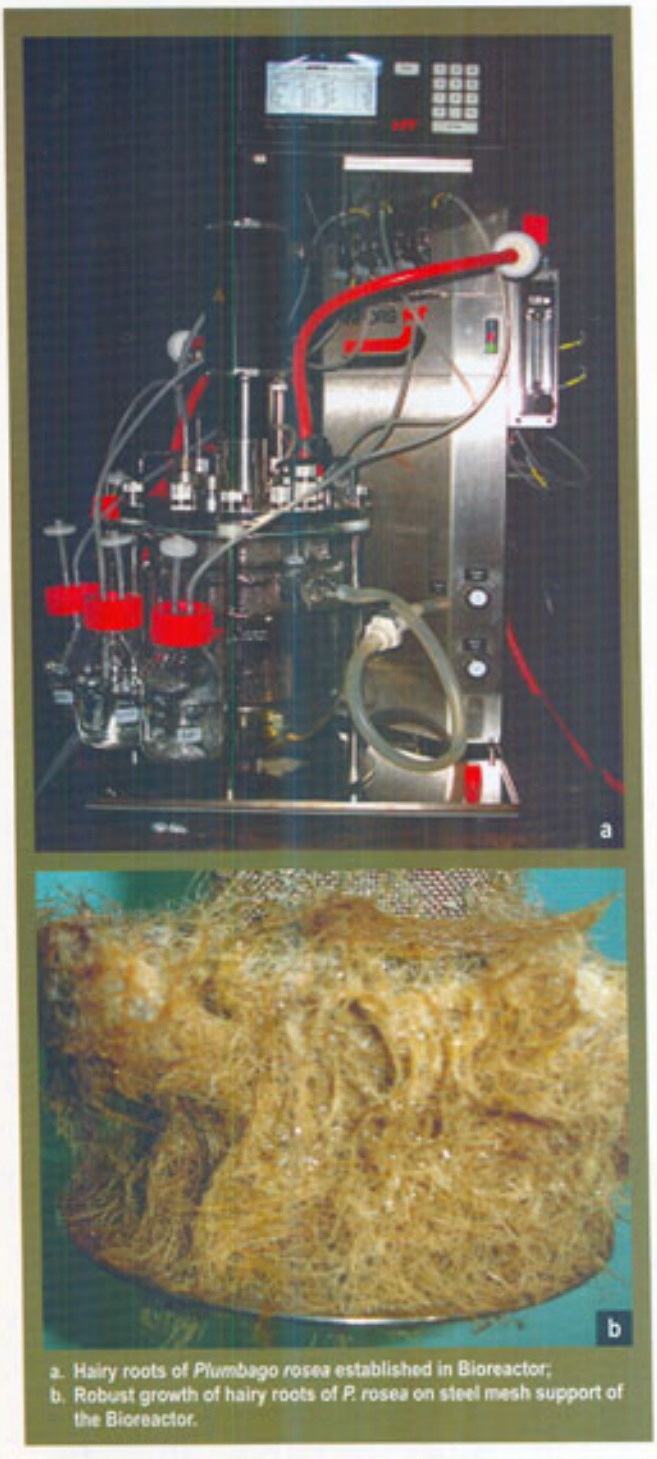
a. Hairy root culture of *Decalepis arayalpathra* established in shake flask;
b. Shoot initiation on aseptic chlorophyllous root segments of *Holostemma annulare*.

reintroduced/translocated into the forest segments of Peppara, Sanghili and Aryankavu in Thiruvananthapuram and Kollam districts showed 80-89% establishment with normal growth and morphology.

In Seed Bank, more than 250 accessions of active types, including the replacement of existing ones were added raising the total accessions to 720. As part of the National Gene Bank Programme, seed biological studies on *Aegle marmelos, Myristica malabarica and Garcinia gummigutta* were completed. In yet another project on RET species, funded by the Ministry of Environment and Forests, desiccation studies on the seeds of *Buchanania barberi, Humboldtia decurrens, Hydnocarpus macrocarpa* and *Piper barberi* were completed. In addition, seed storage conditions were standardizesd in 13 species. 3200 seedlings of 56 plant species were supplied to various units of TBGRI

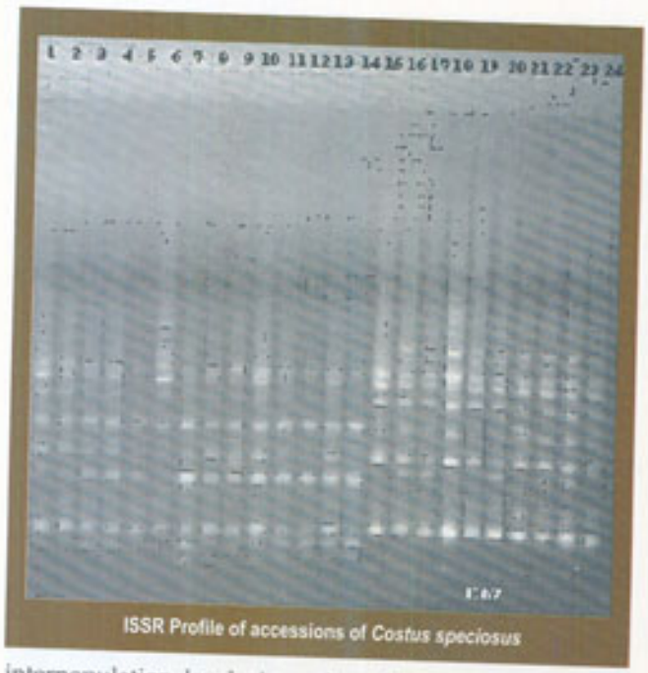
Hairy root cultures were established from aseptic seedlings and shoot cultures of *Decalepis arayalpathra* for extracting 2, hydroxy-4-methoxy benzaldehyde. Improved procedure for the shoot regeneration from aseptic chlorophyllous normal root segments of *Holostemma annulare* was achieved. Species of *Ophiorrhiza* as a possible source of the anticancer compound camptothecin (CPT) is being investigated. Scaling-up the production of plumbagin from hairy roots of *Plumbago rosea* using Reaction Kettle Flask was achieved. Hairy roots of *P.rosea* was also well established in 2.5 lit. working volume air-lift Bioreactor and robust growth was obtained. A cream containing plumbagin from the root/hairy root cultures of *Plumbago rosea* was developed for dermal application to treat bacterial infections. Preliminary data obtained from volunteers are encouraging as evidenced from healing of warts and wounds. It is presently undergoing pharmacological evaluation.

Genetic diversity studies were conducted on *Costus speciosus* and *Decalepis arayalpathra* as part of the National Gene Bank for Medicinal and Aromatic Plants. Analysis of 24 accessions of *C. speciosus* collected from different parts of Kerala and Andaman Islands showed high genetic



a. Hairy roots of *Plumbago rosea* established in Bioreactor;
b. Robust growth of hairy roots of *P. rosea* on steel mesh support of the Bioreactor.

variability (GS = 0.77) by both RAPD and ISSR markers. Though both the markers were able to discriminate the Andaman and Kerala accessions, better resolution of the phenogram was achieved with ISSR markers. A total of 21 accessions of *D. arayalpathra* were collected from three different locations (Kurusumalai, Makki and Vellarada). Mean coefficient of genetic similarity index (GS) suggests high levels of genetic variation in this species at the



ISSR Profile of accessions of *Costus speciosus*

interpopulation level. Accessions from Kurusumalai are found to be genetically more diverse (Mean GD = 0.15) and therefore are recommended for *in situ* conservation.

The Bioinformatics Centre of the Division functioning at the Extension Centre, Puthenthoppe established Web Server and Leased Line Internet Connection with financial support of DBT, New Delhi. Structured Network Connection was also established at the Centre. The centre has developed a Web portal site connecting all bioinformatics centres distributed throughout India under Biotechnology Information System Network, Department of Biotechnology, Govt. of India. Currently the web portal site is hosted in TBGRI Web Server and maintained by the Bioinformatics Centre. URL:http//:www.tbgri.in/bioinfopub.

The CD version of LitFriend Version 1, a software package for keeping and retrieving personal reference collection was released during the inaugural session of the National Workshop on "Biodiversity Informatics and Interlinking of Databases" held on 24th October, 2005. This can be downloaded free of cost from the web site www.tbgri.in

Fungal Database Meliolales was made available on the Web. URL: http//:www.tbgri.in/fungi. The Database - Sacred Groves of Kerala was designed and created. Model data of two Sacred Groves was made available on the web URL: http//:www.tbgri.In/. Sacredgroveonline. Software. sacredgrove. Data validation and authentication of 50 sacred groves of Thrissur district with 40 photographs was completed. Route maps of the sacred groves were also prepared and incorporated. Data validation and authentication of 40 Wild Ornamental plants was completed

a. *In vitro* multiplication of *Amomum hypoleucum*
b. Microplants of *Amomum hypoleucum* establishing in greenhouse
c. Micropropagation of *Ochlandra wightii*

with the support of Prof. N. Ravi, formerly Head, Department of Botany, S. N. College, Kollam. Photographs of these plants were also incorporated into the database.

As part of the project 'Women empowerment and self-income generation through medicinal plant cultivation' sponsored by the Department of Biotechnology, Govt. of India, 75 selected women beneficiaries of Kanjikuzhi Panchayat in Alapuzha district, Kerala were imparted training in medicinal plant propagation techniques and medicinal plant cultivation. A fullfledged nursery with irrigation facility and a model demonstration garden were established with the support of the local Panchayat officials. The identified medicinal plant species of economic importance were propagated, supplied to the beneficiaries along with garden implements and manure and cultivation was started in their own farmlands. The programme is fine tuned in such a way that the women will develop leadership

Training on hardening techniques of tissue cultured medicinal plants to the women beneficiaries of Kanjikuzhi Panchayat

Distribution of economically important selected medicinal plants to the women beneficiaries of Kanjikuzhi Panchayat

quality, get empowered economically and run a cooperative society supplying raw materials for local drug industry on sustainable basis.

In yet another extension project on medicinal plants, funded by the Department of Science & Technology, Govt. of India, micropropagated plants of *Alpinia calcarata, Kaempferia galanga, Kaempferia rotunda, Curcuma aromatica, Plumbago rosea* and *Holostemma annulare* were produced for distribution to selected tribals for cultivation. A total of 26 tribals were selected as the beneficiaries of the project and they were given a two-day demonstration on medicinal plant cultivation.

Multiplication of 5 varieties of commercially important Anthuriums (SS Gold, Salmon Orange, Mauritius Red, Agnihothri and Medorie) and two popular varieties of banana namely "Nendran" and "Red Banana" were multiplied and 8500 plants were transferred for acclimatization. In addition, 3500 *Vanilla* plants, a few hundred *Nepenthes khasiana* and selected varieties of *Philodendron* were also stocked. Sale of plants earned an income of Rs. 2,87,176/-. A special Plan project for production and supply of quality planting materials to farmers of the state was launched in June 2005 in association with scientists of the Garden Division. Plants selected are economic trees, ornamentals, fruit crops, rattan palms, palms, *Vanilla, Musa* etc., Based on conventional and non-conventional technologies developed at the Institute.

A collaborative programme between the Vellore Institute of Technology and TBGRI for technical consultancy and collaboration in areas of biotechnology, garden establishment and bioproduction of plant based molecules useful in pharma industry is to be launched shortly. Discussions were held with ABL Biotechnologies Ltd., Chennai to mass produce the bamboo seeds for commercial application through biotechnological intervention. The experimental production of bamboo seeds through a combined *in vitro* flowering and *ex vitro* seeding process developed at the institute is to be upgraded to hybrid seed production followed by multi-location trials for assessing their commercial potential under public/private participatory project (Small Business Innovative Research Initiative) of the DBT, Govt.of India.

Chittar River - picturesque view facing the Medicinal Plant Garden

Microbiology

Macrofungi

As part of ongoing studies of the agaric flora of Thenmala Forest Division of Kerala, mushrooms were collected from different forest ranges. Apart from Thenmala Forest Division, mushrooms were also collected from other areas like Munnar, Devikulam, Chinnar, Wayanad, Kulathupuzha and TBGRI campus. Three Sacred Groves, Iringole (Perumbavoor), Kolani (Thodupuzha) and Sarnga (Pathanamthitta) were also surveyed for mushrooms. Collected materials were subjected to microscopic studies in the laboratory and were assigned to their respective families and genera. All of them were dried and added to the existing mushroom herbarium. A high yielding strain of oyster mushroom was located and popularized among the mushroom growers of the state.

- Total collections made 2600
- Collections identified to genus 2600
- Families represented 34
- Genera represented 110
- Collections identified to species 760
- New records for India 06
- New species recognized 02
- Wild edible species collected 38

A well-established mushroom herbarium with 8520 collections is being maintained in the Microbiology Division. Parts of collections of new species, records etc., were also deposited at the Kew Herbarium, England.


Chlorophyllum molybdites (Meyer ex Fr.) Massee


Agaricus endoxanthus Berk. & Br

Microfungi

Collection trips were made to the evergreen forests of Pathanamthitta (Moozhiar, Kakki Dam, Pampa and Periyar Tiger reserve), Ponmudi, Kallar and identified 5 new genera, 98 species, 13 varieties, 1 new generic record to India, 12 new records to India and 1 new record to Western Ghats.

More than 2000 identified and documented Foliicolous fungal exsiccate are well preserved in the herbarium of the division under TBGT and part of them are at the Herbarium Cryptogamae Indiae Orientalis (HCIO), IARI, New Delhi.

New genus

Basavamyces Hosag.

New species

Amazonia gordoniicola Hosag., C.K. Biju & Abraham
Amazonia vaccinii Hosag., C.K. Biju & Abraham
Appendiculella gaultheriae Hosag., C.K. Biju & Abraham
Appendiculella shettyi Hosag., C.K. Biju & Abraham

Lentinus squarrosulus Mont.

Appendiculella vacciniacearum Hosag., C.K. Biju & Abraham
Appendiculella vivekananthanii Hosag., C.K. Biju & Abraham
Armatella actinodaphnes Hosag., C.K. Biju & Abraham
Armatella apolloniadis Hosag., C.K. Biju & Abraham
Armatella caulicola Hosag., C.K. Biju & Abraham

Colonies of Meliola toddaliae Doidge

Asteridiella gaultheriae Hosag., C.K. Biju & Abraham
Asteridiella glycosmidis Hosag., C.K. Biju & Abraham
Asteridiella wyanadensis Hosag., C.K. Biju & Abraham
Asterina cannonii Hosag. & C.K. Biju
Asterina euryae Hosag. & C.K. Biju
Asterina gamsii Hosag. & C.K. Biju
Asterina girardiniae Hosag. & C.K. Biju
Asterina glycosmidis Hosag. & Rajkumar
Asterina glyptopetali Hosag. & C.K. Biju
Asterina hydrocotyles Hosag. & C.K. Biju
Asterina lauracearum Hosag. & C.K. Biju
Asterina lobeliacearum Hosag. & C.K. Biju
Asterina phyllanthigena Hosag.
Asterina plectranthi Hosag., Manoj. & H. Biju
Asterina toxocarpi Hosag. & C.K. Biju
Basavamyces litseae Hosag., C.K. Biju & Abraham
Clasterosphaera indica Hosag. & Manoj.
Echidnodella manilkarae Hosag. & T. Sabu
Irenopsis gordoniae Hosag., C.K. Biju & Abraham
Meliola hydei Hosag., C.K. Biju & Abraham
Meliola knoxiicola Hosag., C.K. Biju & Abraham
Meliola ligustricola Hosag., C.K. Biju & Abraham
Meliola neanotidis Hosag., C.K. Biju & Abraham
Meliola rajamalaensis Hosag., C.K. Biju & Abraham
Meliola ravii Hosag., C.K. Biju & Abraham
Meliola strobilanthicola Hosag., C.K. Biju & Abraham

a. Thyriothecium of Lembosiaceae
b. T.S. of Thyriothecium *Eupelte amicta* Sydow

Meliola suttonii Hosag., C.K. Biju & Abraham
Meliola teramnicola Hosag., C.K. Biju & Abraham
Meliola themedicola Hosag., C.K. Biju & Abraham
Meliola vittalii Hosag., C.K. Biju & Abraham
Meliola vivekananthanii Hosag., C.K. Biju & Abraham
Meliola actephile Hosag., C.K. Biju & Abraham
Meliola banasuranii Hosag., C.K. Biju & Abraham
Meliola cassiae-fistulae Hosag. & Manoj.
Meliola desmodii-triangularis Hosag. & Manoj.
Meliola desmodii-triquetri Hosag. & Manoj.
Meliola glanduliferae. Hosag., C.K. Biju & Abraham
Prataprajella rubii. Hosag., C.K. Biju & Abraham
Prillieuxina elaegni Hosag. & C.K. Biju
Questieriella malloti Hosag. & C.K. Biju
Questieriella passiflorae Hosag. & C.K. Biju
Questieriella sarcococcae Hosag. , Manoj. & H. Biju
Questieriella strychni Hosag.
Sarcinella catharanthi Hosag. & H. Biju

New Generic Record to India

Clasterosphaeria Sivan.

New Records to India

Clasterosporium flagellatum (Sydow) Ellis

Meliola memecyli var. *microspora* Hansf.
Asterina cissi Hughes
Lembosia perseae Orejuela

New Varieties

Meliola capensis var. *dimocarpi* Hosag. Manoj.
Asterina jasmini var. *indica* Hosag.
Amazonia psychtriae var. *microspora* Hosag., C.K. Biju & Abraham
Asteridiella cyclopoda var. *vernoniae* Hosag., C.K. Biju & Abraham
Asteridiella entebbeensis var. *glochidii* Hosag., C.K. Biju & Abraham
Asteridiella tribola var. *momordicae* Hosag., C.K. Biju & Abraham
Meliola cadigensis var. *toddaliae* Hosag., C.K. Biju & Abraham
Meliola groteana var. *maesae* Hosag., C.K. Biju & Abraham
Meliola henryi var. *oldenlandiae* Hosag., C.K. Biju & Abraham
Meliola jasmini var. *microspora* Hosag., C.K. Biju & Abraham
Meliola memcyli var. *microspora* Hosag., C.K. Biju & Abraham
Meliola oldenlandiae var. *indica* Hosag., C.K. Biju & Abraham

New Record to Western Ghats

Asteridiella pygei Hansf. var. *microspora* Hosag.

Mycorrhiza

As part of the screening of Arbuscular mycorrhizal fungi for potential symbionts, rhizosphere samples of selected endemic trees (*Vateria indica, Hydnocarpus pentandra., Calophyllum apetalum* and *Garcinia gummi-gutta)* were collected and studied.

Actinomycetes

10 potential strains of *Streptomyces* derived as a result of secondary screening for antifungal properties were subjected to 16s rDNA analysis. Sequencing of the 16s rDNA region and standardisation of culture conditions for maximum production of the antifungal metabolites are in progress.

Phytochemistry

As part of the development of standards of medicinal plants macroscopic and microscopic analysis, TLC and other chemical tests were performed on *Oroxylum indicum, Curculigo orchioides, Melia azadirach, Azadirachta indica and Gmelina arborea* and monographs prepared on them for ICMR, New Delhi.

Pharmacopeal monographs of *Acacia pennata, Calamus rotang, Gardenia gemmifera, Gisekia phannaceoides* and *Maranta arundinacea* were prepared for ISM, New Delhi.

In the DST funded project on 'Development of scientifically validated nutraceuticals from selected medicinal plants of Western Ghats', 5 species of *Sida* namely *S. acuta, S. alnifolia, S. rhomboidea, S. rhombifolia* and *S. cordifolia* were screened for secondary metabolites and anti-inflammatory, analgesic and diuretic activities in *in vivo* models for the development of a nutraceutical for prenatal care. The immunomodulatory, toxicity and shelf life studies on the active fraction are in progress. An antiarthritic drug has been developed from the ethanol extract of the roots of commonly available *Sida* species. The effect suggests that it is due to the prevention of prostaglandin biosynthesis via. cycloxygenase blockade. The fraction also showed marked analgesic activity as evaluated by acetic acid induced writhing test and diuretic activity

Phytochemical investigations on *Pittosporum viridulum, Gmynacranthera canarica* and *Laganendra ovata* have been completed and structural elucidation of the isolated compounds are in progress. The essential oils obtained by hydrodistillation of the fresh leaves and mature fruits of *Pittosporum viridulum* were analyzed by GC and GC - MS. Fifteen components comprising 85.4% of the leaf oil and twenty-six components comprising 94.5% of the fruit oil have been identified. The major components of the leaf oil were spathulenol (28.4%), caryophyllene oxide (17.6%), and δ-cadinol (9.0%), whereas germacrene D (28.6%), δ-cadinol (13.0%) and δ-cadinene (9.4%) were the major components in the fruit oil. The oils showed moderate antibacterial activity against the Gram-positive bacteria *Staphylococcus aureus* and *Salmonella typhi*.

Essential oils were isolated form the rhizomes and leaves of *Amomum hypoleucum* They were hydrodistilled and characterized by GC-FID and GC-MS. Cryptone, β-pinene and caryophyllene oxide were the major constituents in rhizome oil and nerolidol and β-caryophyllene were found in the leaf oil. β-pinene was the major constituent of *Amomum pterocarpum* rhizomes and leaves and β-pinene and copaene were isolated from *A. muricatum* whereas β-terpineol and β-pinene were obtained from *A. cannicarpum*. Volatile oil from the rhizomes of *Zingiber nimmonii* (J.Graham) Dalzell was isolated, characterized by analytical gas chromatography and gas chromatography-mass spectroscopy. Sixty-five constituents accounting for 97.5% of the oil were identified. *Z. nimmonii* rhizome oil is a unique caryophyllene-rich natural source with isomeric caryophyllenes, β-caryophyllene (42.2%) and β-humulene (α-caryophyllene, 27.7%), as its major constituents along with traces of isocaryophyllene. The rhizome oil contained 71.2% sesquiterpenes, 14.2% oxygenated sesquiterpenes, 8.9% monoterpenes, 1.9% oxygenated monoterpenes and 1.3% non-terpenoid constituents. The antimicrobial activity of the oil was tested against human and plant pathogenic bacteria and fungi. The oil showed significant inhibitory activity against the fungi, *Candida glabrata, C. albicans* and *Aspergillus niger* and the bacteria *Bacillus subtilis* and *Pseudomonas aeruginosa*. No activity was observed against the fungus *Fusarium oxysporum*.

From the South Indian *Hedychium* species *H. venustum, H. spicatum, H. cornarium* and *H. flavescens*, 1,8-cineole, β-pinene and linalool were isolated which showed significant antimicrobial properties. 1,8-Cineole was the single major constituent in *H. venustum* (45.4%), *H. spicatum* var. *acuminatum* (44.3%) and *H. coronarium* (48.7%) rhizome oils. α - Pinene (43.6%) was the major component in the rhizome oil of *H. flavescens*. The numbers and percentages of individual components in the rhizome oils of *H. venustum, H. spicatum* var. *acuminatum, H. coronarium* and *H. flavescens* were 57 (99.1%), 41 (98.9%), 24 (99.7%) and 27 (98.8%),

respectively. The percentages of sesquiterpenes in these oils were *H. venustum* (24.0%), *H. spicatum* var. *acuminatum* (22.1%), *H. coronarium* (3.1%) and *H. flavescens* (1.3%). Oil yields from the rhizomes of *H. venustum*, *H. spicatum* var. *acuminatum* and *H. coronarium* were comparable (0.13-0.16%), but that from the rhizomes of *H. flavescens* was substantially low (0.05%). *H. venustum* and *H. spicatum* var. *acuminatum* are morphologically similar and significantly different from *H. flavescens*. The chemical data on essential oils are in good agreement with the relative morphological features of these four *Hedychium* species.

Volatile oils from plants of Rutaceae, Piperaceae, Myristicaceae, Lauraceae and other families were isolated and characterized by GC-FID and GC-MS. The antibacterial activities of these oils were studied by the disc diffusion method. The volatile oil from leaves of *Clausena austroindica* contained the phenyl propanoids elemicin and myristicin besides sesquiterpenes and aliphatic compounds. The flower oil of *Evodia lunuankenda* contained evodione, β - ocimene, isolycodolin and alloevodionol. Severe fungal infection was observed on the leaves of *Pamburus missionis* (Wight) Swingle (Rutaceae). This infection was due to the fungus, *Meliola toddaliae* Doidge. Chemical variation and antifungal activity of essential oils isolated by hydrodistillation from the fungal infected and uninfected leaves of *P. missionis* was observed. These oils were analyzed by gas chromatography-mass spectroscopy. β -pinene and β -phellandrene were the major constituents in both these oils. Monoterpenes constituted 96% and their profiles were very similar in these leaf oils, whereas sesquiterpenes in these oils were only less than 4%. Antimicrobial analysis on these leaf oils against Gram-positive and Gram-negative bacteria and fungi *Candida albicans* and *C. glabrata* were carried out by the disc diffusion technique. This showed the absence of inhibition zones for both these oils against *Candida albicans* and *C. glabrata*. The absence of antifungal metabolites in the infected and uninfected leaf oils supports the continued growth of *M. toddaliae* as a 'parasitic symbiont' on the leaves of *P. missionis*.

GC-MS studies on leaf oils of 4 species of *Cinnamomum* viz. *C. chemungianum*, *C. sulphuratum*, *C. fillipedicellatum* and *C. heyneanum* showed the presence of sesquiterpenoids, β - selinene, intermedeol, longiborneol, benzyl benzoate, cryptone, p - cymene, cuminal, limonene and saffrole. The fruits of *Neolitsia foliosa* on hydrodistillation gave elemol, β - eudesmol, β - elemene, and γ - eudesmol which showed antibacterial effects whereas the fruits of *N. cassia* gave β - phellandrene, α - cadinol and epi - α - cadinol. Essential oils from leaves and bark of *Neolitsea scrobiculata (Meisn.)* Gamble were obtained by hydrodistillation and analyzed by GC and GC-MS. 33 components comprising 79.5% of the leaf oil and 19 components, comprising 95.57% of the bark oil have been identified. α - Terpineol (55.5%) was the major component in the bark oil followed by linalool (10.6%) and 1, 8 cineole (7.4%), whereas the major constituents in the leaf oil were δ -cadinol (16.1%) followed by β - phellandrene (10.7%), α -amorphene (8.1%) and p-cymene (5.6%). The oils showed strong antibacterial activity against the Gram-positive bacteria *Staphylococcus aureus*, *Bacillus subtilis* and *B. cereus* and against the Gram-negative bacterium *Proteus vulgaris*.

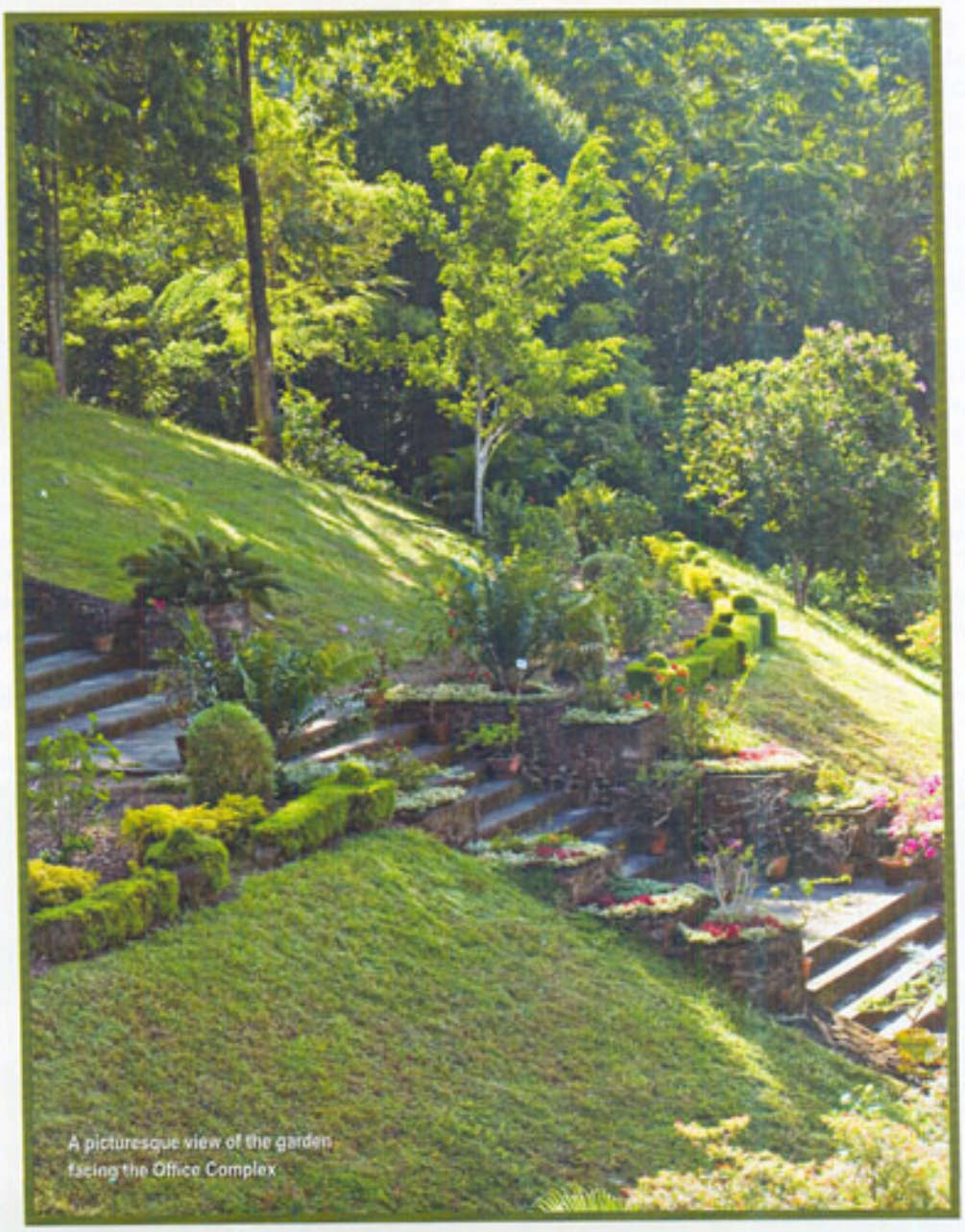
GC-MS studies on *Piper galeatum* gave linalool, bi cyclogermacrene and β - caryophyllene whereas from *P. longum* leaf oil apiole, myristicin, nerolidol were obtained. A population of wild *Piper nigrum* having unique lemony scented leaves and highly pungent fruits was located in the wild, in the Kerala sector of the Western Ghats and detailed morphological and chemical characterization of the newly discovered intraspecific form of the species has been carried out. Since this plant type exhibited distinctiveness, uniformity and stability with respect to its characters, genotypic status has been assigned and it was named as *Piper nigrum* L. 'PMM'. Chemical analyses of the volatile oils from the leaves and piperine content of the fruits have revealed that the unique lemony scent of the leaves and high pungency of the fruits of the genotype are due to the presence of aroma chemicals such as citral derivatives and bicyclogermacrene in the leaves and high piperine content in the fruits respectively. Appreciable percentage of the characteristic aroma chemical compounds and high piperine content (9.9%) present in the genotype have not been reported hitherto in any other wild/cultivated forms of the species. Therefore, *Piper nigrum* L. 'PMM' possessing the unique attributes is a potential genotype, particularly in the context of genetic improvement of this spice crop, with respect to the aroma and piperine content.

Hydrodistillation of the stem bark of *Garcinia imberti* Bourd. afforded. 0.62 % (v/w) essential oil. Analyses of the oil by GC-FID and GC-MS techniques revealed the presence of 4 constituents, humulene (52%), β - caryophyllene (43%), caryophyllene oxide (2.3%) and humulene oxide (1.4%). The oil showed moderate activity against Gram positive and Gram negative bacteria.

Volatile oils from the root, stem and leaves of *Schefflera stellata* (Gaertn.) Harms were isolated by hydrodistillation and characterized by analytical gas chromatography and gas chromatography-mass spectroscopy. Sixty-nine (98.3%), seventy-eight (97.9%) and sixty-seven (98.0%) constituents were identified from the root, stem and leaf oils, respectively. Sesquiterpene hydrocarbons were the most abundant compounds in the root (73.8%), stem (68.8%) and leaf (63.4%) oils, followed by oxygenated sesquiterpenes, monoterpene hydrocarbons and oxygenated monoterpenes. Isomeric caryophyllenes (β - caryophyllene,

α - humulene), germacrene D, germacrene B and *epi* - α - cadinol were the major constituents in these oils. Antimicrobial activity of the leaf oil was tested against common human pathogens by the disc diffusion technique. The leaf oil showed significant antifungal activity against *Candida albicans* and *C. glabrata*, but the antibacterial activity of the leaf oil was very low. Twenty-eight compounds constituting 99.1% of the analyzed sample were identified.

The oil was characterized by the predominance of monoterpenes (61.2%) with limonene (50.3%) as the major constituent. α-humulene (13.3 %), β-caryophyllene (8.8%) and linalool (3.2%) were the other major components. The oil displayed significant antibacterial activity when tested against *Bacillus cereus* and moderate activity against *Serratia marcescens* and *Escherichia coli*.



A picturesque view of the garden facing the Office Complex

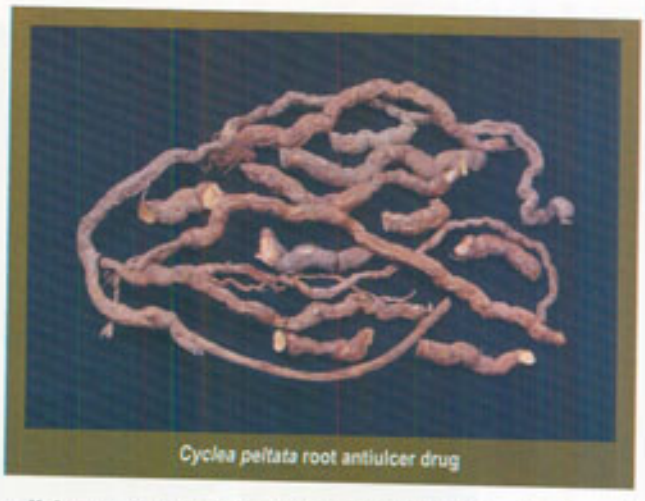
Ethnomedicine & Ethnopharmacology

Two ethno-medico-botanical explorations were conducted at Achankovil Forest Division in connection with the declaration and incorporation of the proposed Gene Pool Conservation Areas (GPCA) into the Working Plan of the Kerala Forest Department. 80 plant species which includes information on 30 medicinal plants, 24 edible plants, 6 animal products and 23 plant species used for other purposes were documented.

Random field surveys were conducted at 23 selected Vanasamrakshana Samithees (VSSs) located in 7 districts of Kerala for obtaining opinions, suggestions and recommendations from the members of VSSs / Forest officials to prepare a mega project titled. 'Vanasamrakshaneeyam' (Save the Forest and Save Life) as requested by the Kerala Forest and Wild Life Department.

During the reporting period the systematic documentation of Indigenous / Traditional Knowledge of plants related to food and medicine in five selected panchayaths, each in Kasargod, Kannur, Palakkad and Alappuzha districts of Kerala was completed. A model of prior informed consent form was developed. A documentary film of 30 minutes duration on Indigenous Knowledge entitled 'from Haze to Light' has been produced with a view to provide awareness at the grass root level.

As per KSCSTE direction, an inter-institutional collaborative research programme (TBGRI, KFRI and RGCB) on herbal drug development has been initiated. A new polyherbal/nutraceutical formulation has been developed for osteoporosis based on traditional knowledge obtained from Kani and Malapandaram tribes and it has been recommended for detailed ethnopharmacological studies.



Cyclea peltata root antiulcer drug

The protective effect of *Spilanthes ciliata* on ethanol induced damage has been confirmed in rats from biochemical and histopathological studies. *Decalepis*

Lady tribal healer from Paniyar tribal community, Kozhikode, Kerala

Mavilan tribal healer treating snake bite

arayalpathra (Periplocaceae) *and Cyclea peltata* (Menisspermaceae) root tubers increased gastric wall mucus and reduced pepsin output in experimental rats. *D. arayalpathra* significantly reduced gastric lesions induced by ethanol in the stomach wall of rats *Trichopus zeylanicus* leaf extract activated macrophages in culture and induced changes in cell signaling. A compound has been isolated from *Hemidesmus indicus* root which can increase the absorption of water and electrolyte from rat jejunum and colon which points to the likelihood of improving the efficacy of ORS solutions with the new isolate.

Macroscopical studies of 4 species of *Sida* viz. *S. alnifolia, S. rhombifolia, S. rhomboidea* and *S. cordifolia* has been completed. The pharmacognostic studies of *Acrotrema arnottianum* is under way as also comparative anatomical studies on two species of *Alangium* (*A. salvifolium and A. hexapetalum*). *Rhinacanthus nasuta* (Acanthaceae) root showed significant antiallergic effects as evidenced by significant protection of mast cell degranulation induced by egg albumin in mice.

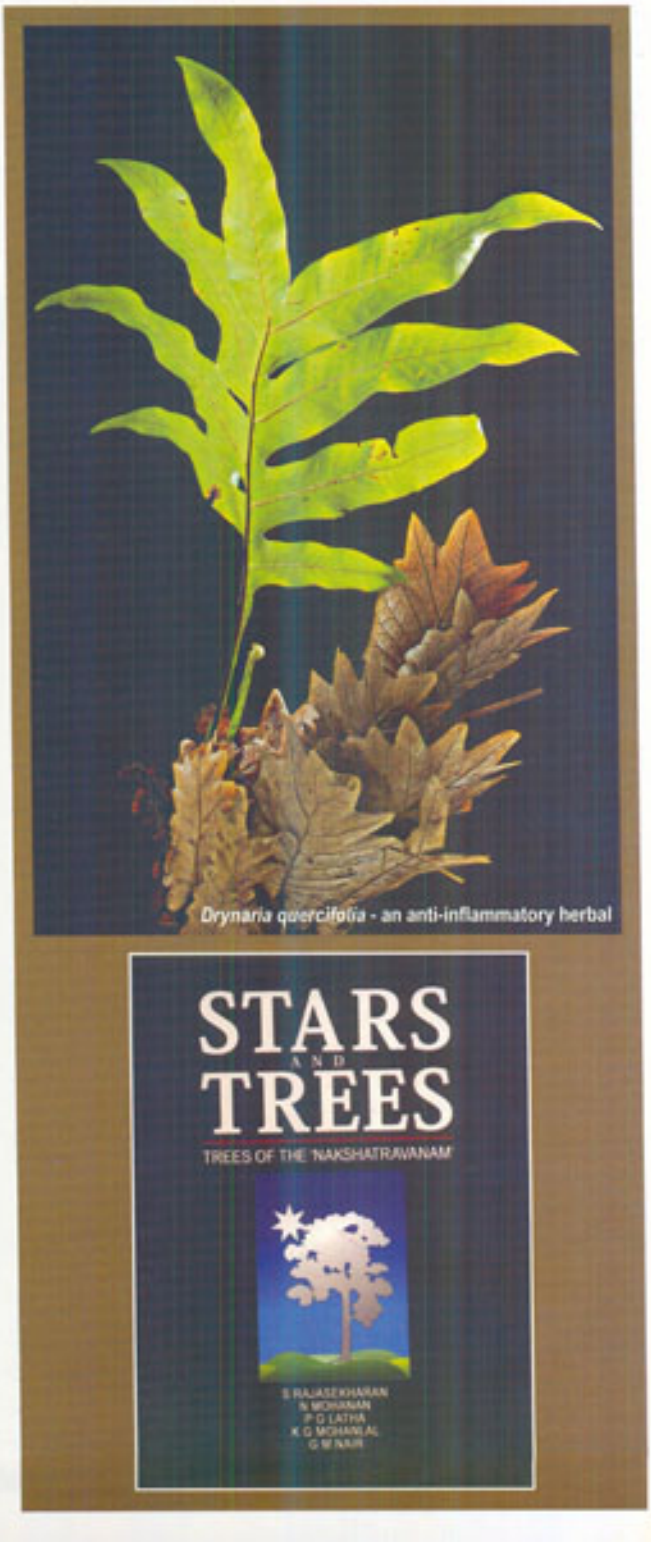
A book entitled 'Stars and Trees' has been published. This book is a treasure trove of exciting information on the symbiotic relationship prevailing between man and trees. The book is dedicated to the common man whose mind it is intended to ignite, towards the cause of biodiversity conservation. The software on 'Stars and Trees' has already been developed.

Pittosporum neelgherrense stem bark and *Sida acuta* root showed significant protection from D-Galn / paracetamol / overdose induced liver damage in rats as evidenced by significant lowering of serum enzyme levels and supported by histopathological studies. *P. neelgherrense* significantly induced hexobarbitione induced narcosis in mice.

Rhinacanthus communis and *Ocimum sanctum* showed *in vitro* anti-coxsackie anti-polio, anti-measles and anti-herpes simplex virus activities.Both plants exhibited remarkable *in vivo* anti-Coxsacki viral activity in suckling mice charged with the virus.

Antiinflammatory and analgesic activity of *Drynaria quercifolia* has been confirmed in rats and found to be comparable to that of the known antiinflammatory drug compound, indomethacin.

For the first time an anti-fungal steroid was isolated from the liverwort, *Pallavicenia lyellii*. The isolate gave excellent protection from pathogenic *Aspergillus fumigatus* challenge in mice. Its efficacy was comparable to commonly used anti-fungal agent, ketoconazole. This isolate is a potential material for anti-fungal medicine development. It is of interest to note that the isolate from *P. lyellii* is devoid of any conspicuous toxic symptoms as judged from the preliminary toxicity evaluation on mice. A flavanoid which reverses thymus involution and shows remarkable anti-lipid peroxidation activity at nanogram levels was isolated from the water extract of the fern, *Selaginella involvens*. It should be noted that in folk medicine this plant is used with the belief that it could prolong lifespan. In this context, it is an attractive material for further studies leading to the development of therapies for the aged.



Drynaria quercifolia - an anti-inflammatory herbal

Conservation Biology

Mutualistic interaction between plants and animals in the tropics is a least attended field of research though it is vital to know the stability of an ecosystem. Such an interaction between *Cullenia exarillata*, an endemic tree species found in tropical forests and the vertebrate community in Silent Valley tropical rain forest ecosystem has been studied for the last five years. Many plants depend on animals for pollination and seed dispersal and in turn animals derive food from such interaction. *Cullenia exarillata* is a tree which provides food to animals during food scarcity period in the Western Ghats

The results showed that animal mediated pollination was basal in *Cullenia exarillata* and furred animals were the most effective pollinators. Pollination mutualism observed between the vertebrates and *Cullenia exarillata* is facultative and not obligatory. There is no substantial evidence to prove the presence of mutualistic interaction between *Cullenia exarillata* and its seed dispersers. The study provided a strong indication that if the *Cullenia* population is not conserved the vertebrates which depend on this species for food, especially during critical food scarcity periods, may also decline in their population and those like Lion Tailed Macaque and Nilgiri Langur with narrow range of food species may become locally extinct if they are not capable of undergoing territory and dietary shifts.

a. *Palaquium ellipticum* (Dalz.) Baillon (Sapotaceae); b. Fruiting twig of *P. ellipticum*; c. Pollen of *Careya arborea* Roxb. (Lecythhidaceae); d. Pollen of *Cassia fistula*

Plants which have efficient gene flow system will have better chances to flourish in an ecosystem. So it is essential to study this system to explore the reason for dwindling or spread of population of a species. This involves a good knowledge on breeding system, pollinators and the pattern of gene flow within metapopulations of a species. Plant-pollinator interactions, sexual systems and level of gene flow in two endemic species in the Western Ghats of Kerala were studied. The present work was undertaken to address these issues with reference to *Palaquium ellipticum*, a common species and *Cassine kedarnathii*, a rare species in Silent Valley National Park. Twentyfour field trips were conducted to Silent valley in order to study the phenology, pollination mechanism and seed

dispersal of *Palaquium ellipticum* and *Cassine kedarnathii*. Phenological observations showed that *Palaquium ellipticum* flowered from December to March, fruiting occurred from March to June and leaf flushing from October to November. *Cassine kedarnathii* was in flower from January to March, in fruit from April to August and in flush from September to November.

Pollination experiments were carried out for autogamy, xenogamy and geitenogamy in both the species. The results showed that *Palaquium* is predominantly xenogamous and *Cassine* an outcrossing species. Their floral characters, anthesis, anther dehiscence, pollen viability and stigma receptivity were studied to know the sexual systems and pollination mechanisms. Insects and vertebrates that visited the plants were studied to know their role in pollination and seed dispersal. Seed dispersal study in *Palaquium ellipticum* showed that bats were the major dispersors and Malabar Giant Squirrel acted as seed predator. In *Cassine kedarnathi* no seed dispersors were found but high rate of seed predation by insects and rodents were observed.

Our plant explorations are mainly delimited by political boundaries and phytogeographical zones have rarely been the basis for our floristic studies. With the result, we hardly have any comprehensive account on flora of phytogeographical areas like the Western Ghats, though for the Western Ghats, many assumptions have been made by botanists. With this in view a Database on the Western Ghats flora was undertaken to bring out a comprehensive account on the current status of the flowering plants of Western Ghats. Data regarding the plants occurring in the Kerala part of the Western Ghats have already been documented. About 250 species from Tamil Nadu and 100 species from Karnataka areas of the Western Ghats were systematically gathered and analyzed. The work focuses on: legitimate name, important synonyms, reference to good descriptions and illustrations, distribution in the World, India, the Western Ghats, nativity, endemicity, exotic nature and uses.

Knowledge on dispersed pollen has applications in many traditional fields of research. The Division makes use of this knowledge to have an understanding on food plants of animals by scat analysis, identification of plants visited by larger animals, especially pollinators, by fur analysis, pollen flow among different populations through air by aeropalynological studies etc. In view of this and taking into account the prospects of its application in other fields like forest history and vegetation, pollen of the Western Ghats trees are being studied. As part of this programme, polliniferous materials of 130 tree species were collected from the herbaria of KFRI and CALI. A total of 226 pollen slides belonging to 58 tree species were prepared. Detailed LM analysis of 56 tree species belonging to 28 genera were carried out. SEM analysis of 36 species was completed.

Pollen and spores are the important source of allergy among human populations. Allergenic pollen and spores can be identified only through standard aerobiological survey. The study on the airborne pollen and spores of Kerala was conducted by the Division as part of a MoEF funded programme. Analysis of airborne pollen grains and spores of southern and central Kerala was completed. Seventy two pollen types from southern and 34 pollen types from central parts of Kerala were recorded. Detailed pollen morphology of 16 species was studied by LM analysis.

Plant Systematics & Evolutionary Science

As part of the enrichment of Flora of Kerala herbarium as well as floristics of specific groups, 55 field trips were conducted to different forest types of Thiruvananthapuram, Kollam and Idukki districts. This resulted in collection of 7864 specimens belonging to 1760 species. The collections include 140 endemics and 25 RET species of the Western Ghats. Notable among them are *Acranthera anamallica, Aglaia barberi, Anacolosa densiflora, Aporusa bourdillonii, Begonia aliciae, B. trichocarpa, Ceropegia elegans, Cinnamomum keralaense, C. macrocarpum, Cynomerta bourdillonii, Exacum anamallayanum, Goniothalamus wynaadensis, Hedyotis devicolamensis, Humboldtia bourdillonii, H. vahliana, Impatiens anaimudica, I. travancorica, I. wightiana, Ischaemum quilonense, I. fisheri, Kendrickia walkerii, Kunstleria keralensis, Litsea stocksii, L. travancorica, Memecylon royenii, Nothopegia aureo-fulva* (Extended distribution), *Ormosia travancorica, Orophea malabarica, Osbeckia brachystemon, Phlebophyllum lawsonii, Piper barberi, P. hapnium, Pothos keralensis, Pterospermum reticulatum, Salacia malabarica, Strobilanthes dupenii, S. foliosus, Vepris bilocularis, Vernonia beddomei, Willisia selaginoides* etc. The species such as *Litsea travancorica, Orophea malabarica, Vernonia beddomei* etc are additions to TBGT. Besides two new species (*Cinnamomum sahyadricum and Arundinella ravii*), two new records for India (*Memecylon royenii and Eugenia toddalioides*), 8 rediscoveries after type (*Begonia aliciae, Cinnamomum perrottetii, Didymocarpus lyrata, Impatiens dendricola, I. pandata, I. platyadena, Sonerila devicolamensis* and *S. sadasivani*) were recorded.

a. *Impatiens grandis* Heyne ex Wallich; b. *Impatiens tangachee* Bedd.; c. *Garcinia imberti* Bourd.

Special groups of plants collected during this period include 14 species and 4 varieties each of *Dioscorea oppositifolia* and *D. pentaphylla*. Their taxonomic characters were worked out.

400 specimens representing 100 species of climbers were collected from Trivandrum district. Notable RET climbers among them are *Ampelocissus indica, Aristolochia tagala, Asparagus fysonii, Chonemorpha fragrans, Coscinium fenestratum, Decalepis hamiltonii, Embelia ribes, Piper barberi,* and *Salacia reticulata*.

The study on Balsams delimited about 92 species of which 82 are remarkably endemic to Western Ghats. A field gene bank under the programme has been established to grow *ex-situ*

and to standardize propagation methods to popularize rare and ornamental balsams. The collection includes 70 wild species and 30 cultivars. Among the wild species 24 are found to be potential ornamentals, of which *Impatiens fruticosa, I. grandis, I. campanulata* and *I. verticillata* are being taken up for multiplication. Further, the study identified 18 endangered balsams of Western Ghats which include *I. acaulis, I. auriculata, I. coelotropis I. floribunda, I. campanulata, I. dendricola, I. jerdoniae, I. kulamavuensis, I. parvifolia, I. pandata, I. phoenicea, I. platyadena, I. stocksii, I. tangachee* etc. The analysis of flowering phenology indicated that about 62% of species flower during July to December, 16% April to June and 15% from January to March.

In the project on Ecological studies of RET species, 2 rare and endemic species viz., *Goniothalamus rhynchantherus* and *G. wightii* were investigated for vegetative and reproductive dynamics, seed storage, vegetative propagation etc. The study identified that over 50% of fruits were predated by the species of *Lepidoptera* and *Coleoptera* at the time of development. The remaining fruits dropped down below the tree due to poor dispersal of which nearly 30% were damaged by beetles and this reduced the soil seed bank. Seedlings from the remaining seeds were destroyed by grasshoppers resulting in poor recruitment. All these factors either alone or in combination lead to rarity in distribution in natural habitat. 900 RET species were enumerated based on literature and herbarium survey and reconnaissance field studies.

15 endemic and RET medicinal plants of Western Ghats were selected to develop viable populations in the long run. The study centered on population structure, dynamics, environmental effects, extinction risks, growth performance, conservation strategies etc. The candidate species were *Coscinium fenestratum, Canarium strictum, Dysoxylum malabaricum, Embelia ribes, Garcinia morella, Knema attenuata, Myristica dactyloides, Myristica malabarica, Ochreinauclea missionis, Persea macrantha, Piper barberi, P. longum, P. mullesua, Trichopus zeylanicus* ssp. *Travancoricus* and *Vateria indica*. The study identified both intrinsic and extrinsic factors responsible for inducing rarity in the populations. As part of the conservation programme, 7000 seedlings of these species have been produced and reintroduced in 6 MPCAs for assessing their growth performance. The notable achievements in the programme are development of novel clonal propagation techniques and ideal seed storage practices for all the species for the first time.

Insect-pests associated with the *Goniothalamus rhynchantherus* and *G. wightii* were collected, identified and the insect interactions at various stages of their life cycle were analysed. The identification was made in consultation with Department of Zoology Calicut University, ZSI Kolkata and Kerala Agricultural University Thiruvananthapuram. The insect-pests were *Cryptorrhyncus* sp. and *Ochyromerra* sp. (Curculionidae), *Polyrrhachis furcata* and *Technomyrmex albipes* (Hymenoptera), *Digitipes coonoorensis* (Chilopoda) and *Olios* sp. (Arachnidae).

In the course of ecological study some of the shoot tips of *Goniothalamus wightii* plants in the population were found to be seriously diseased, clustering together into broom like formations with very much reduced leaves. Symptoms indicated Witch's broom disease caused may be by virus/Mycoplasma Like Organism (MLO). The pathogenic activity was so intense that ultimately it leads to the death of the plants. TEM studies at Sree Chithira Thirunal Institute of Medical Science and Technology, Thiruvananthapuram confirmed the causative organism as MLO. Investigations are being continued to trace the nature and intensity of the disease in the population.

A taxonomic study on the economically important genus *Cinnamomum* (Lauraceae), a difficult group of habitat specific and highly polymorphic plants was undertaken to delimit the number of species that actually occur in the wild. 130 specimens belonging to 11 species were collected from different parts of Western Ghats. Important among them are *Cinnamomum dubium, C. heyneanum, C. perrottetii* etc. Fresh descriptions based on field and microscopic study were completed. A new species of the genus has been communicated based on the study.

The genus *Sonerila*, a beautiful annual herb mostly confined to higher altitudes of Western Ghats, also needs to be evaluated taxonomically due to their complicated morphological structure and habitat specificity. So far 80 specimens representing 7 species have been collected, which include 2 rediscoveries, *Sonerila devicolamensis* and *S. sadasivanii*.

Eventhough the members of the the 'Yam' genus *Dioscorea* (Dioscoreaceae), have manifold economic importance, they are not taxonomically well studied in India due to their various phyllotaxy, dioecious nature, difficulty in collection of underground tubers. A study has been initiated to collect fresh specimens from Western Ghats with the objective of bringing out a monograph on this important group. So far 12 species and 4 varieties each of *Dioscorea oppositifolia* and *D. pentaphylla* were collected. Detailed morphological and anatomical studies were conducted. All the collections were introduced into the garden for assessing their performance.

A study has been initiated to catalogue RET species of Western Ghats which are facing extinction risk as per the guidelines of IUCN. Perusal of secondary data and field collection enumerated nearly 900 species of conservation importance. These species were further classified as Extinct, Extinct in the Wild, Critically Endangered, Endangered,

Vulnerable and Least Concern based on the extent of occurrence, area of occupancy, biology, potential value for trade etc. Some important RET species of Western Ghats are *Adhatoda beddomei, Aglaia malabarica, Atuna travancorica, Capparis fusifera, Ceropegia beddomei, C. bourdillonii, Dialium travancoricum, Garcinia imberti, Humboldtia bourdillonii, Impatiens anaimudica, Janakia arayalpathra, Paphiopedilum druryi, Piper barberi, Poeciloneuron pauciflorum, Syzygium bourdillonii, S. travancorium, Vernonia shevaroyensis* etc. This status report will be of immense use in developing suitable strategies for both *in situ* and *ex situ* conservation.

Thottea barberi (Aristolochiaceae) is an endangered plant found in the evergreen forest of Thiruvananthapuram and Thirunelveli hills of Southern Western Ghats. A population of the species was located in Agasthyamala. In order to understand the causes of low seed production and narrow distribution, reproductive biology of this species was studied. Pollen fertility, viability and *in vitro* and *in vivo* pollen germination were determined. The degree of sterility was 31%. Maximum pollen germination of 14.6% was obtained in Brewbaker's medium supplemented with 10% sucrose. The percentage of pollen germination on the stigmatic surface was 8.72%. Pollen tubes grow only ¼ of the length of pistil and subsequently ceased to grow resulting in unfertilized ovules. Pollen sterility, low fertilization and fruit set are the major reasons for low populations in the wild.

Reproductive biology studies were also conducted in 2 rare and endemic balsams namely *Impatiens henslowiana* and *I. verticillata*. Both the species were poorly distributed in the wild mainly because of habitat loss, narrow environmental niche, low percentage of seed germination etc. The investigation included phenological studies, pollination mechanism, pollen-pistil interaction, reproductive efficiency, standardizing vegetative propagation and establishment of *ex-situ* field gene bank. It was observed that *I. henslowiana* reproduced by cross pollination and in the natural condition 76% fruit set was observed while artificial cross pollination enhanced the fruit set to 84%. *I. verticillata* reproduced by rooting at nodes in natural condition and there was no fruit set.

A study to assess the quantum of availability of NWFPs in Southern Kerala including habitat analysis, distribution pattern, quantification, current methods of harvesting, regeneration status of various species of this category was undertaken to establish the ecological sustainability of NWFPs in future. The survey had been completed to an extent of 1648 km^2 in 12 forest divisions under Trivandrum, Kollam, Pathanamthitta, Idukki and Ernakulam districts. The study quantified the growing stock of 82 NWFPs out of 123 species recognized officially by the State Forest Department.

Myristica swamps are one of the fresh water wetland ecosystems of the Western Ghats, presently vanishing due to anthropogenic pressures. At present these swamps are scattered in and around Shendurney, Kulathupuzha and Anchal forest ranges of Southern Kerala. A study was carried out to prepare status report of these swamps focusing on floristic, habitat and vegetation analysis along with the climatic and edaphic factors, conservation value etc. The study revealed that these swamps have a high distribution of arborescent species and undergrowth was found to be poorly developed. The vegetation is evergreen comprising of about 58 angiosperms belonging to 54 genera and 39 families of which about 50% are tree species. The average tree density is 410 per hectare. Among the floristic indices, the average Simpson's index is 0.8808, the average Shannon-Weinner index value is 0.2830 and average equitability value is 1.0353. These indices indicate that the diversity is comparatively high especially of trees. A large number of floristic and faunistic associations were also observed in this ecosystem. The GBH and frequency distribution revealed the absence of large stands of *Myristica malabarica* and *Knema attenuata* along with invaded growth of non-swamp species such as *Vateria indica, Xanthophyllum* sp., *Elaeocarpus* sp. etc, indicating deteriorating trend of the swamps. In a typical swamp, the undergrowth is predominated by *Lagenandra ovata* while in changing conditions it is replaced by *Pandanus* species which in turn indicate the trend of succession in the near future that the swamp will be converted into evergreen vegetation.

Ethnobotanical studies undertaken in North Kerala has resulted in the identification of 260 species of medicinal plants used as single drugs, 72 species in compound drugs, 116 edibles, 43 plants used in artefacts, 6 fiber yielding plants and 15 used in construction by tribals. In addition, 66 taxonomically important species growing as natural associates were also collected and identified.

Under the Biosphere Reserve Programme, the Institute was designated as lead centre for Agasthyamalai, Nilgiri and Gulf of Mannar Biosphere Reserves. Based on collection and synthesis of physical, chemical and biological resources of Nilgiri and Gulf of Mannar Biosphere Reserves, 2 status reports were prepared, based on which the UNESCO recognized both the Reserves and posted them in the Network of World Biosphere Reserves. A Compendium on Nilgiri Biosphere Reserve was brought out, which serves as Ready Reckoner to forest managers, scientists, policy makers and stake holders for evolving management mechanism for conservation and utilization of natural resources. Presently TBGRI is recognized for its expertise in BR management programme co-ordination and the Ministry of Environment and Forests has entrusted TBGRI with the preparation of the status report of other biosphere

reserves. Recently, the MoEF had sanctioned the 2nd phase including Agasthyamalai BR for co-ordination up to 2008.

The herbarium (TBGT) is well organized. The new herbarium building constructed with the financial assistance from the Ministry of Environment and Forests, Govt. of India to the tune of Rs. 25 lakhs is now ready for occupation.

The herbarium at a glance.

1	Specimen number in Herbarium as on December 2005	18595
2	Number of specimen processed	11750
3	Mounted for filing	2350
4	Unmounted for reference	9400
5	Number of specimens incorporated	500
6	Number of Nomenclature correction carried out	600
7	Indexing of General Herbarium specimens	500
8	Number of sheets renovated	750
9	Maintenance of general Herbarium specimens (fumigation)	43400
10	Number of enquiries attended	185
11	Number of classes/training conducted	40

Library

The Library continued to support the research programmes of the Institute with its valuable resources. It is computerized for both house keeping activities and information retrieval purpose by using Library software. Internet connection is available in the Library. The Library also caters to students, researchers and scientists from outside. It has a collection of 7888 books and 3000 back volumes and subscribes to 75 journals. Free online access is available for 5 titles. Library acquired 415 books during 2004-2006. All these books have been technically processed and maintained in the concerned collections ready for use by members.

Service provided

Indexing
Selective Dissemination of Information
Current Awareness
Conference Alert
Newspaper Clippings
Photocopying
Internet

Media interactions

S. Rajasekharan 2004. An interview on the medicinal plant 'Neem' (Veppu) under the programme 'Oushdasasyangale aduthariyuka', broadcasted on 25th July.

S. Rajasekharan 2004. An interview on 'Fast Food and Health' in the 'Niramala' programme broadcasted by AIR, Thiruvananthapuram on 24th October.

S. Rajasekharan 2005. Participated as a panelist in a live programme 'Samvadam' on Patent Amendment Bill, 2005 on 30th March by Doordarshan Kendra, Thriuvananthapuram.

Awards / Honours / Memberships / Ph. D. Awarded

V. Babu was awarded Ph. D. by University of Kerala (2004) under the guidance of Dr. A. Subramoniam.

B. S. Geetha was awarded Ph. D. by University of Kerala (2004) under the guidance of Dr. Latha P. G.

Joseph Mathew, UGC-FIP fellow from Mar Ivanios College, Thiruvananthapuram was awarded Ph. D. by University of Kerala (2005) under the guidance of Dr. V. George.

C. Sathish Kumar accepted Dr. B. P. Pal National Environment Fellowship of MoEF, GOI on 18th January 2005 and since then he has been relieved of his official duties to work exclusively on the project for a period of two years.

The Malayalam Edition of India Today has selected. C. Sathish Kumar as one among the 25 most influential Keralites for the year 2005 (He ranks 18th in the list)

IAAT during its Executive Council on 30 December 2004 selected C. Sathish Kumar as a Fellow of the Society.

C. Sathish Kumar has been selected for Dr. V. V. Sivarajan Gold Medal for the year 2006 by the IAAT during its 15th meeting at Nagpur during 20-21 October 2005.

A. Subramoniam was elected as Member, Executive Committee, Indian Association of Biomedical Scientists (2004).

S. Rajasekharan was nominated as Expert in the District level Special Advisory Committee in the group Forestry and Bio-resource Management under the Rashtriya Sram Vikas Yochana, Govt. of India.

S. Rajasekharan was nominated as a Team Co-ordinator of PRITHVI a Global Eco Meet (International Seminar, Exhibition and Business Meet) on Eco-friendly Life Style and Products organized by Swadeshi Science Movement of India in association with Govt. of Kerala.

S. Rajasekharan was nominated as a Core Committee Member for improving Kerala Statistical System (Environment and Forest, Water Resource Sectors) under the UNDP project.

S. Seeni was nominated as a Member, Biotechnology Board of the Vellore Institute of Technology.

The Department of Agriculture, Govt of Kerala has nominated Dr. S. Seeni an External Expert for assessing their floricultural programme.

P. N. Krishnan was awarded First Prize for the oral presentation on "Plant info-software for the management of biodiversity information". (Sreekumar, S. Biju, C.K. and PN Krishnan) in the ICAR National Symposium held at KAU, Thrissur 2005.

P. N. Krishnan was nominated as a Member, Board of Studies in Bioinformatics, Calicut University.

Mr. S. Suresh won Special Mention in The Sanctuary

ABN Amro Wildlife Photography Contest held in 2004 for his photograph Green Vine Snake and Mating Coffee Locusts: Sanctuary Asia 24(6) : 137

Mr. Raju Antony, Technical Officer has been listed as a pteridologist by International Association of Pteridologists, USA and he is included in their Annual Review of Pteridological Resarch (ARPR), Directory for communication among Pteridologists.

Invited Talks

Mathew P J delivered a talk on 'Assessment of intraspecific variation in Black Pepper to the trainees attending the Training Programme on Wild Relatives of Crop Plants and Post collection Care of Germplasm, conducted by NBPGR Regional Station, Trichur 5 to 8 Oct. 2004.

Mathew P J delivered a talk on Conservation of NTFP yielding Plants at Forest Training School, Arippa on 17-11-2004.

Mathew P J and Mathew Dan presented invited talks in National Seminar on Conservation and Utilization of Medicinal and Aromatic Plants at Devamatha College, Kuravilangad on 14-10-2004.

Mathew P J delivered a talk on 'Conservation and Cultivation of Medicinal Plants' in the Seminar on Cultivation of Medicinal Plants conducted on 09-09-2005 at YMCA Ernakulam organized by Agri. Export Zone, Dept.of Agriculture, Govt.of Kerala.

Mathew Dan delivered a lecture on 'Scope for the Cultivation of Medicinal Plants' at Krishi Bhavan, Konni on 19-11-2004.

Mathew Dan delivered a lecture on 'Importance of Medicinal Plants' in Skill cum Technology Up gradation Programme organized by KITCO at Malappuram on 4-12-2004.

Mathew Dan delivered an invited talk on 'Essential oils as NTFP' at Forest Training School, Arippa on 17-11-2004.

Mathew Dan delivered a talk on 'Medicinal Plants Cultivation at Krishi Vigjan Kendra, Mithranikethan on 23-11-2005.

Mathew Dan delivered a talk on 'Importance of Medicinal Plant Conservation' at State Training Centre, The Kerala State Bharath Scouts and Guides, Palode on 25-11-2005.

Mathew Dan delivered a talk on 'Identification of Medicinal Plants and its Cultivation' in Job Training to VHS Students at KVK, Mitranikethan on 09-11-2005.

Mathew Dan delivered a talk on 'Heavy Metals in Ayurvedic Formulations' in One Day Seminar on Ayur Vision organized by Dept. of ISM, Pathanamthitta Dt. On 10-11-2005.

Mathew Dan delivered a talk on Medicinal Plant Cultivation at Vinobanikethan, Thiruvananthapuram at a Training Programme for Rural Women on 15-12-2005.

Mathew Dan delivered a talk on 'Conservation and Cultivation of Medicinal Plants' at Rehabilitation Plantations Ltd. Kulathupuzha on 20-12-2005.

Mathew Dan delivered a talk on 'Agricultural Practices and Conservation of Important Medicinal Plants' in connection with AEZ Training for Medicinal Plants at RATTC, Kazhakuttam on 22-12-2005.

Rajasekharan S delivered a talk on Cultivation of Medicinal Plants' in a seminar organized by Kerala Ayurveda Manufacturers Association at Alappuzha on 24th April 2004.

Rajasekharan S delivered a talk on Medicinal Plant Cultivation and Herbal Drug Development at a workshop organized for the farmers and healers by KITCO at Malappuram on 25th June 2004.

Rajasekharan S. delivered a lecture on Conservation and sustainable Utilisation of Medicinal and Aromatic Plants at Agricultural College Vellayani on 20th November 2004, in connection with All India Winter School Training Programme.

Rajasekharan S Presented a concept paper on Vanasamrakshaneeyam' (Save the Forest and Save Life) at Forest Headquarters, Thiruvananthapuram on 7th August 2004.

Latha P G delivered and invited talk on 'Glimpses of Ethnopharmacology at TBGRI on 27th March 2006 at 5th National Seminar on Medicinal Plants organized by ARI, Poojapura'

Rajasekharan S attended a workshop organized under the GPCA organized by Kerala Forest Dept. at Kottayam on 20th September 2004.

Rajasekharan S delivered a talk on Ethnomedicobotany at Spectrum 2004' organized by Academic Committee on S. N College, Chempazhanthi, Thiruvananthapuram on 1st November 2004.

Sathishkumar C delivered a lecture on 'Orchids of India' during the Annual General Body Meeting of Kerala University Botany Alumni Association on 25 May 2005.

Sathiskumar C presented a talk on "Prospects and Problems of Orchid Cultivation in Kerala" in the meeting of Wayanad District Cut-flower Growers Association at Sultan Battery on 10th November 2005.

Sathiskumar C attended the National Seminar on Biodiversity Conservation organized by Department of Botany, NSS Hindu College, Changanacherry and delivered a lecture on "Many Worlds of Orchids" on 20th December 2005.

Subramoniam A delivered a talk on 'Uses of Pharmacological Research on Forest Medicinal Plants'. Organized by Navadarshini Mahilasamajam on 28th November.

People and TBGRI

Members of Diary Development Department, Trivandrum.
Students of Govt. UPS, Vanchiyoor
Students of Sree Budha College of Engineering, Pandalam
Students of Agricultural University, Trivandrum
Students of AL-Ameen College, Aluva
Students of Bishop Moore College, Mavelikkara
Students of B. R. M High School, Elavattom
Students of S. V. H. S. S, Parassala
Members of Zoological Society of Kerala, Kottayam
Members of Ayurveda College, Kottakkal
Students of S. B. College, Bharathannoor
Students of P.S.G College of Arts & Science, Coimbatore
Members of Oushadhi, Trichur
Students of St. Joseph's College, Trichinappalli
Students of Little Flower College, Guruvayoor
Students of Parasakthi college, Courtallam
Students of S. K. V. Vocational Higher Secondary School, Kottarakkara
Students of N. S. S. College, Nilamel
Students of Alagappa University, Karaikudi
Students of Kerala Forest School, Arippa
Students of Mitranikethan Peoples College, Trivandrum.
Members of Bethany Academy, Thiruvalla
Students of Govt. Higher Secondary School, Kadakkal
Members of Santhi Sadan Nature Case, Pathanamthitta
Students of Govt. H. S. S. Kollam
Members of Agriculture, Horticulture Society, Kuthuparambu
Students of Ayurveda Mahavidyalaya, Nashik
Students of Concordia Lutheron H.S, Thiruvananthapuram
Students of Ramniranjan Jhunjhunwala College, Mumbai
Students of Christ Nagar Secondary School, Trivandrum
Students of Shree Gulabkunverba Ayurveda Mahavidyalaya, Jamnagar
Students of Saradakrishna Homeo College, Kanyakumary
Students of St. Berchman's College, Changanacherry
Students of Mar Gregorious School, Pathanamthitta
Students of Kuvempu University, Shimoga
Students of Shalom Public School, Pathanamthitta
Members of St.Thomas Evangelical church, Kottayam
Students of Govt. Vocational H. S. ,Trivandrum
Students of S. V. G. V. H. S., Pathanamthitta
Members of St. Thomas Evangalickal church, Kottayam
Students of Govt. Vocational School, Trivandrum
Students of S. V. G. V. H. S., Pathanamthitta
Students of Govt. U. P. School, Sreekariyam
Students of Govt. Siddha Medical College, Chennai
Students of Victory Vocational H. S, Nemom
Students of Kavyattu English Medium School, Pirappancode
Members of Crescent Teacher Training Institute, Panangode
Students of Agricultural University, Padannakkadu
Students of Higher Secondary School, Maranalloor
Memebrs of Kerala State Service Pensioners Union, Kollam
Students of Govt. Higher Secondary School, Chavara
Students of M. C. H. S. S, Kottukkalkonam
Memebrs of Vellanadu Child Development Centre, Trivandrum
Students of St. Antony's U. P. S, Kotakkal
Students of St. Xavier's High School, Peyadu
Students of Bapuji Ayurvedic Medical College, Shimoga
Students of G. B. Pant University,Uttaranchal
Students of Christian College, Kattakkada
Students of Dr.G. R. Public School, Neyyattinkara
Students of S. M. V Govt. High School, Trivandrum
Students of Nalanda Public School, Trivandrum
Students of St. Xavier's High School, Peyadu
Students of Sree Narayana College, Cherthala
Students of Govt. H. S. S., Malayinkeezhu
Students of C. M. S. College of Science, Coimbatore
Students of Govt. School of Visually Impaired , Trivandrum
Students of Venus Tuition Centre, Kallara
Students of Govt. U. P. S., Jawahar Colony, Pacha
Students of Govt. U. P. S., Ambalathara
Students of Govt. Model H. S., for Girls, Pattom
Students of Sarvodaya Vidyalaya, Nalanchira
Students of Indian Central School, Peroor
Members of Viswadarshini Teachers Training Institute, Trivandrum
Students of Dr. Yashwant Singh Parmar University, Solan
Students of Govt. U. P. S, Peringamala
Students of St. Antony's L. P. S., Trivandrum
Members of R. C. L. P. S., Keezharoor
Students of D. V. L.P. School, Pallickal
Students of Govt. U. P. S., Attingal
Members of Asan Memorial Teachers Training Institute, Trivandrum
Students of Nalanda College Computers, Bharathannoor
Students of Govt. Ayurveda College, Trivandrum
Members of Block Resource Centre, Kaniyapuram
Students of Govt. Model L. P. S , Quilon
Students of Shri. Vodyadhiraja Memorial H. S., Kollam
Students of Govt. L. P. S., Nedumangadu
Students of Janatha Higher Secondary School, Attingal
Students of Iqbal English Medium L. P. S., Palode
Students of Govt. U. P. S.,Enathu
Students of Govt. U. P. S. , Thirumala
Students of M.G.U. P. S., Thottakkadu
Students of Sir Syed College, Thaliparampu
Students of Govt. TownU. P. S, Kilimanoor
Students of Govt. U.PSchool, Anchal
Students of St. Joseph's College of Engineering, Chennai

Students of Govt. U. P. School, Thirumala
Students of Govt. L. P. School, Chithara
Students of Govt. U. P. S., Palkulangara
Students of Lutheran U.P.S, Parassala
Staff of University College of Teacher Education, Kottayam
Members of Vegetable and Fruit Promotion Council, Kerala, Trivandrum
Students of J. S. English Medium School, Aramana
Students of St. Theresa's U. P. School, Kattakada
Students of Jamal Muhammed College, Thiruchirappalli
Students of Sree Narayana Trust Central School, Kollam
Members of Sreenagar Association, Manacaud.
Students of Vocation Bible School, Kulathupuzha
Members of Kerala State Chalachithra Academy, Trivandrum
Members of Agriculture, Horticulture, Society, Kuthuparamba
Members of Centre forOrganized Research in Education, Trivandrum
Students of Vocational Training Centre, Poojappura
Members of Promotion of Excellence among Gifted Children, Trivandrum
Members of Krishi Vigjan Kendra, Kayamkulam
Members of A.P.R.M Teachers Training Institute, Kollam
Students of Child Development Centre, Palode
Members of Madhava Mahila Mandir, Trivandrum
Students of Regional Institute of Medical Sciences, Kottayam
Students of Many's School, Manappally
Students of St.Theresa's College, Kochi
Members of L.M.S Residents Association, Attingal
Students of Vaidyaratnam P.S. Varier Ayurvedic College, Kottakkal
Kerala Mahila Samakhya Society, Trivandrum College of Forestry, Trissur
Students of St. Theresa's College, Ernakulam
Students of M. G. Higher Secondary School, Thumpaman
Students of St. Stephens College, Pathanapuram
Students of Govt. B. H. S. S & V. H. S. S, Attingal
Students of Gujarath University, Ahmedabad
Students of R. V. S. M. Higher Secondary School, Oachira
Students of S. B. College, Bharathanoor
Students of Shri. Parmakalyani College, Alwakurichi
Students of Kerala Agricultural University, Padanakkadu
Students of Gulbarga University, Gulburga
Students of Rajiv Gandhi Education Foundation, Kadakkal
Students of Nousari Agricultrual University, Navassari
Students of K. R. College of Arts & Science, Kovilpaddi
Staff of Centre for Development of Advanced Computing, Trivandrum
Students of P. S. G. College of Arts & Science, Coimbatore
Students of St. Mary's College, Thutukudi
Students of S. F. R. College of Women, Sivakasi
Students of Govt. College, Kottayam
Students of Madanapalle Institute of Technology & Science, Chittor
Students of St.Thomas Central School, Trivandrum
Students of N. S. S. College, Nilamel
Students of Women's Christian College, Nagercoil
Students of Smt. Chandibai Himathul Mansukani College, Maharashtra
Students of Pazhassiraja N. S. S College, Mattannur
Students of M. V. College of Science , Mumbai
Students of Sanrasthra College, Madurai
Students of Marey College, Palakkadu
Students of Mar Athanasius College, Kothamangalam
Students of Govt. Girls Higher Secondary School, Kottayam
Students of Kerala Agricultural University, Trissur
Students of Farook College, Calicut
Students of Devamatha College, Kuruvilangadu
Students of Mahathma Gandhi Memorial College, Udupi
Students of Sathya College, Mumbai
Students of Shanmukha Vilasom Higher Secondary School, Kollam
Students of Model B.H.S.S , Kollam

Externally Funded Projects

Sl. No.	Code	Project	Name of funding agency
1	A-1	"Development of standards of selected therapeutically important Indian medicinal plants and preparation of monographs thereof"	Indian Council for Medical Research
2	A-2	"Genotyping of bio-diversity and for conservation and prospecting of biological wealth in South-Western and North-Eastern parts of India"	Department of Biotechnology
3	A-3	"Rescue and restoration of ret medicinal plants of Agasthyamala, Kulamavu and Wayanadu MPCAs"	FRLHT
4	A-4	"Establishment of database for Nilgiri and Gulf of Mannar biosphere reserves",	Ministry of Environment & Forests Govt. of India

5	A-5	"National Agricultural Technology project on sustainable management of plant biodiversity"	ICAR
6	A-6	"Taxonomic data organization of wild species of piper and curcuma in India and DNA finger printing studies of selected endemic species"	Department of Biotechnology
7	A-8	"Tissue culture assisted floriculture for self employment and income generation of economically weaker women in selected village panchayaths of Kerala"	Department of Biotechnology
8	A-9	"Non Wood forest Produce including medicinal plants"	Forest Department, Govt. of Kerala
9	A-10	"Black mildew disease on wattles (Accacia spp.) in Kerala State"	Forest Department, Govt. of Kerala
10	A-11	"Ornamental resources at Shola forests of Kerala"	Forest Department, Govt. of Kerala
11	A-12	"Collection, evaluation and documentation of mushroom germplasm of The Western Ghats"	Forest Department, Govt. of Kerala
12	A-13	"All India Coordinated Research Project on Orchids"	Ministry of Environment & Forests, Govt. of India
13	A-14	"National Gene Bank for Medicinal and Aromatic Plants"	Department of Biotechnology
14	A-15	"Regenaration of plants from Agrobacterium Rhizogenes induced Hairy Roots and comparative field performance of conventional, Tissue culture and Hairy Root derived plants of *Plumbago Rosea* L"	Science, Technology & Environment Department, Govt. of Kerala
15	A-16(1) 16(2)	"Value Added Cottage Industry"	Planning & Economic Affairs Department, Govt. of Kerala
16	A-17	"Strengthening of Ayurvedic pharmacopiel standards of Ism drugs "	Ministry of Health & Family Welfare, Govt. of India
17	A-18	"Protoplast studies in Anthurium Andraeanum"	Science, Technology & Environment Department, Govt. of Kerala
18	A-19	"Establishment of Sub-Distributed Information centre at TBGRI under Bio informatics Programme"	Department of Biotechnology
19	A-20	"Consultancy Service on implementation of pilot participatory programme of conservation and sustainable utilization of medicinal and aromatic plants" (World Bank Consultancy Programme)	Forest Department, Govt. of Kerala
20	A-21	"Study on mutualism between Cullenia exarillata and verteberate community in the tropical forests of Silent Valley, Kerala"	Ministry of Environment & Forests, Govt. of India
21	A-22	"Pharmacopiel screening of selected traditional medicinal pteridophytes of Western Ghat Region of Kerala and molecular characterization of promising species"	Forest Department, Govt. of Kerala
22	A-23	"Conservation of selected rare and economic Rattan palms of the Western Ghats through in vitro multiplication and re introduction"	Ministry of Environment & Forests, Govt. of India
23	A-24	'Puyankutty Hydro Electric Project"	KSEB
24	A-25	"An integrated approach for the sustainable development of mushroom industry with active participation of the tribals and weaker section in selected localities of Kerala"	Department of Biotechnology
25	A-26	"Hepatoprotective studies on selected Medicinal Plants of the Western Ghats, Kerala"	Science, Technology & Environment Department, Govt. of Kerala
26	A-27	"Investigation on the Macrofungal Diversity in the Thenmala Forest Division of Western Ghats of Kerala"	under WGDP, Planning &Economic Affairs Department, Govt. of Kerala
27	A-28	"National Gene Bank for Medicinal and Aromatic plants" (III phase)	Department of Biotechnology
28	A-29	"Collection , Micropropagation and Reintroduction of some endemic Zingibers of Western Ghats, Kerala"	under WGDP, Planning & Economic Affairs Department, Govt. of Kerala

29	A-30	"Bamboo and Reed Resource Enhancement in Kerala"	Department, Govt. of Kerala
30	A-31	"Establishment of a Milieu-Based Sanctuary & Conservation Education Centre of Medicinal Plants of the Western Ghats"	under WGDP, Planning & Economic Affairs Department, Govt. of Kerala
31	A-32	"Industrial Development and Economic Upliftment of Weaker Sections through Biofertilizer Manufacturing"	under WGDP, Planning & Economic Affairs Department, Govt. of Kerala
32	A-33	"Ex-situ Conservation and Sustainable Utilisation of Rare, Endemic and High-Value Medicinal Plants of Southern Western Ghats through *In Vitro* Multiplication and Evaluation of Quality Retention-A Lab to Land Programmme"	under WGDP, Planning & Economic Affairs Department, Govt. of Kerala
33	A-34	"Anti-cancer studies on selected medicinal plants used in traditional medicines of Kerala to treat cancer/cancer like symptoms",	Forest Department, Govt. of Kerala
34	A-35	"Chemical Prospecting and DNA Finger Printing of Andrographis paniculata"	Department of Biotechnology
35	A-36	"Conservation through Micropropogation & reintroduction of rare and endemic plants in Ayurveda"	Department of Biotechnology
36	A-37	"Establishment of Germplasm collection of Palms and Peninsular India and Development of Palmetum"	Department of Biotechnology
37	A-38	"Eco-taxonomic studies of the grassland vegetable of Kerala"	CSIR
38	A-39	"Induction and Phytochemical investigations of normal and hairy root cultures of Decalepis arayalpathra, a critically endangered medicinal plant	Science, Technology & Environment Department, Govt. of Kerala
39	A-40	Microbial Biomass and litter decomposition	Forest Department, Govt. of Kerala
40	A-41	"Economic, financial and managerial evaluation and upgradation of existing scenario in rural and urban small scale mushroom cultivation and processing units in Kerala"	Dept. of Science and Technology, Govt. of India
41	A-42	Establishment of seed bank, propagation and ex situ conservation of endemic and threatened species of W. Ghats	Ministry of Environment and Forests, Govt. of India
42	A-43	"Studies on anti-viral properties of some known medicinal plants vis-à-vis phytomedicine development",	Department of Biotechnology, Govt. of India
43	A-44	"Micropropagation and cultivation of most sought after medicinal herbs used in Ayurveda and allied systems with people's participation"	Dept. of Science and Technology, Govt. of India
44	A-45	"Establishment of seed and Pollen Cryobank for ex-situ conservation and sustainable utilization of orchids of Western Ghats"	Department of Biotechnology, Govt. of India
45	A-46	"Networking of mushroom production and processing units for effective employment generation and uplifting the socio-economic status of women, tribals weaker sections"	Department of Biotechnology, Govt. of India
46	A-47	Screening and isolation antifungal microorganisms from the Sacred groves of South Kerala	Science, Technology & Environment Department, Govt. of Kerala
47	A-48	Indigenous Knowledge Related to Medicinal Plants A Survey in the Districts of Thiruvananthapuram, Kollam and Pathanamthitta	State Planning Board, Govt. of Kerala
48	A-49	Isolation and characterization of genes involved in the regulatory stps leading to the biosynthesis of hericin using transcript profiling technology and metabolic engineering of andrographolides accumulation in Andrographis paniculata Nees by modulation of the isoprenoid precursor pool with expression of plasticidal Deoxyxylulose phosphate synthase and cytosolic HMG CoA reductase	Department of Biotechnology, Govt. of India
49	A-50	Metabolic engineering of Andrographolioles Accumulation in Andrographis paniculata Nees by modulation of the isoperenoid	Department of Biotechnology, Govt. of India

		precursor peal with expression of palastidial Deoxyxylulose phosphate synthase and cytosolic MMG CoA reductase	
50	A-51	Nutraceuticals from indigenous edible mushrooms	Department of Biotechnology, Govt. of India
51	A-52	Seed Biology	Forest Department
52	A-53	Cultivation of high value medicinal and aromatic plants through conventional and non-conventional methods for empowerment of rural women in the selected localities of Kerala A novel participatory programme for income generation	Department of Biotechnology, Govt. of India
53	A54	"Nakshthravanam"	Thenmala Eco-Tourism promotion Society
54	A55	Collection, propagation, reintroduction and popularization of Ten endemic trees species of western ghats.	Planning & Economic Affairs Department, Govt. of Kerala
55	A56	Tissue culture multiplication for mass production of selected economically important bamboos.	Planning & Economic Affairs Department Govt. of Kerala
56	A57	Cultivation, conservation, and sustainable utilization of medicinal plants through peoples participation	Planning & Economic Affairs Department, Govt. of Kerala
57	A58	Consultancy on Implementation of Pilot Participatory Programme for Conservation and Sustainable use of Medicinal and Aromatic Plants	Forest Dept., Govt. of Kerala
58	A59	Development of Scientifically validated Nutraceuticals from selected medicinal plants of Western Ghats	Department of Biotechnology, Govt. of India
59	A60	Red Data Book on Indian Orchids B.P. Pal National Environmental Fellowship	Ministry of Environment and Forests, Govt. of India
60	A61	Hepatoprotective studies on three selected medicinal plants of Kerala	Department of Biotechnology, Govt. of India
61	A62	Studies on Reproductive Biology of selected rare, endemic and horticulturally promising balsams from W. Ghats	Dept. of Science and Technology, Govt. of India
62	A63	Conservation strategies and pharmacological evaluation of *Utleria salicifolia* bedd. Ex Hook. f. an endangered ethnomedicinal plant of W. Ghats	Dept. of Science and Technology, Govt. of India
63	A64	Infectivity and effectiveness of Arbuscular mycorrhizal fungi on some medicinal plants of W. Ghats	Forest Dept., Govt. of Kerala
64	A65	Plant Crab Association in the Mangrove Ecosystems of Kerala	Ministry of Environment and Forests, Govt. of India
65	A-66	Establishment of MMPG at TBGRI, Palode.	NBRI, Lucknow
66	A-67	"Ex-situ conservation of Arborescent crop relatives of Western Ghats, giving emphasis to endemic and RET species"	NBRI, Lucknow
67	A68	"Studies on the Eco-Mycorrhizal fungal diversity in different forest types and their association with endemic, indigenous and exotic species in the Western ghats forests of Thiruvananthapuram district, Kerala.	Ministry of Environment and Forests, Govt. of India
68	A69	Lead Coordination institution for Agasthyamalai, Nilgiri and Gulf of Mannar Biosphere Reserves	Ministry of Environment and Forests, Govt. of India
69	A70	KSEB Programme on Biodiversity Documentation : Indigenous Knowledge Component	Kerala Forest Research Institute, Peechi
70	A71	Survey, Collection, Propagation of selected, threatened palm species of S. Ghats & Electronic Herbarium Database preparation of palms in Kerala	Planning & Economic Affairs Department, Govt. of Kerala
71	A72	Toxic and Hallucinogenic Mushrooms of Kerala	Planning & Economic Affairs Department, Govt. of Kerala

Facilities/Equipments

HPLC Shimadzu LC- 10AS
Lyophiliser Hetosic Model FD. 2.5 with Vacuum pump (Pfeiffer-Bz43)
Gas Chromatograph Nikon 5765 with FID detector
Analytical Balance - Sartorius Basic (Readability - .0001 g)
Circulating Water Bath with Temp. control- Heto model DT1
Infrared Spectrophotometer, Buck Scientific Model 500
MPLC Buchi with UV Vis Filter Photometer Detector and Fraction Collector
Turbocap Zymark turbo Vap II
Cross Beater Mill RETSCH Model SK-1
Rotavapour Buchi Model R-114
Automatic Polarimeter-Rudolf Research Analytical Autopol IV
Automatic Refractometer Rudolf research Analytical J-257
Cultural Collections (Micro and Macro fungi, actinomycetes etc)
Mushroom Spawn Production Unit
Mushroom Cultivation Unit
Tropbactrin Production Unit
BOD Incubators
Incubated Shaker
Ertical Thermal Cyclers (PCR Machine)
Electrophoresis (V & Submarine)
Gel Documentation Unit
Deep Freezer
Microscopes with Photodocumentation Facility
Micro centrifuge
Flame Photometer
Nikon Optical Microscopes with Micro Photographic attachment
Nikon Camera and accessories
Leica Stereo Microscope
Research Centrifuge
Digital Camera
GPS
Super cold refrigerators (-200 C)
De-humidifiers
Midterm Storage Room (150 C/15% RH)
Seed Germinators
Conductivity Meter
Moisture Analyzer
Seed Grader
Seed Blower
Centrifuge
Deep Freezer
Desiccators
Distillation Unit
Garment Cubicle
Homogenizer
Inverted microscope
LN2 Plant
Microwave oven
Gas Chromatographic System
Controlled Rate Freezer
Controlled Environment Incubators
Vacuum Pump
Shaker NBS
PCR Machine
Gel Documentation System
High Speed Refrigerated Centrifuge
Refrigerated micro centrifuge
Liquid Scintillation Counter
Submarine Gel Electrophoresis
Ice Flaking Machine
Transilluminator
Radio-isotope Study (in Bio-chemical Pharmacology and Cell Biology)
Animal house Facility (for Rodents) for Pharmacological Studies
Water Jacketed CO2 Incubators
UV- visible Spectrophotometer
Kalwega All Purpose Machine
Tableting Machine Single Punch
Blister Packing Machine
Cadmill Pulveriser
Rota - vapour Assembly
UV Chamber
Web Server
Server
Automated DNA Sequencer
HPTLC
Fully Automatic Bioanalyser (Italy)

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Seminars / Workshops/ Conferences / organised / attended

TBGRI organized the 16 Annual Conference and National Seminar on New Frontiers in Plant Taxonomy and Biodiversity Conservation on 29-31 December 2004.

TBGRI organized Mushroom Fair from 14-16 February at Trivandrum

Ajikumaran Nair, A., Shylesh, B. S., Gopakumar B and Subramoniam A. Anti hyperglycemic activity of *Helionitis artifolia* (alcohol extract) in rats. Presented at the Southern Regional Conference of Pharmacologists (Indian Pharmacological Society), Amrita Institute of Medical Sciences, Kochi, Kerala, October 5-6,2004.

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Gayathri, V. Asha V.V and Subramoniam. A. Identification and separation of thymus gland growth stimulatory factor from *Selaginella invovens*. Presented at the Southern Regfional Conference of Pharmacologists (Indian Pharmacological Society), Amrita Institute of Medical Science, Kochi, Kerala, October 5-6, 2004.

George, V. Recent Advances in Phytochemistry, National Seminar on Herbal Technology, Quidad-e-Millet College for Women,Chennai, 7th January 2005.

George, V., Epistemology of Traditional Medicine Especially Ayurveda in the Light of Modern Chemistry and Pharmacology, Invited Lecture, Govt. Ayurveda college, Thiruvananthapuram on 15the February 2005.

George, V. Search for Angiotensin Converting Enzyme Inhibitors from Plants Based on Ethnomedical Leads, Invited Lecture delivered in the session on Traditional Medicine in the International Seminar Prithvi 2005, Thiruvananthapuram, 19-28th February 2005.

Jose, P. A Attended the Workshop on Assessment of Ecological/Environmental Sensitivity of Hill Stations in Kerala on 10th October 2005 at KFRI, Thrissur.

Jose, P. A. attended and helped to organize Poster sessions of XIV National Seminar of IAAT conducted at TBGRI on 29-31st December 2004.

Jose, P. A. attended one-day seminar on 'State Level Awareness Camp for Sustainable Water Resource Development through Rainwater Harvesting at Thiruvananthapuram on 21st October 2004.

Jose, P. A. attended and presented paper in XV National Conference of IAAT conducted at Nagpur University Nagpur during 20th -21st October 2005.

Joseph, E., Sivadasan M A and Pandurangan A.G.2004. Taxonomic studies of the family Dioscoreaceae in Kerala. Abstracts of National Seminar on New Frontiers in Plant Taxonomy and Biodeversity Conservation, XIV Annual Conference of IAAT, Thiruvananthapuram.

Koshy, K.C. participated in the Awareness Training Cum Workshop organized by Western Ghats Cell, Planning and Economic Affairs Department, Government of Kerala held at Govt, Guest House, Thycaud, Thiruvananthapuram on 19.01.2006 and presented a paper titled Bamboo Research and Extension Activities at TBGRI implemented under the Western Ghats Development Programme.

Latha, P. G., Geetha, B. S., Remani, P., Rajasekharan S. and Managalam Nair S. 2005 Induction of apoptosis in tumour cells by deoxyelephantophin from *Elephantopus scaber L.* Poster presented at International Symposium on Translational Research: Apoptosis and Cancer: 18-21 December 2005, Thiruvananthapuram. Pp 195.

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Mariamma Cherian, Geetha, B.S., Latha, P.G and Remani P.A comparative study on the anti-cancer properties of four species of Lamiaceae in murine cell lines *in vitro*. Poster presented at International Symposium on Translational Research: Apoptosis and Cancer 18th 21st December 2005, Thiruvananthapuram. pp 154.

Mathew, P. J. attended the meeting of Farm and Home Consultative Panel held at Vazhappally Service Cooperative Bank, Changanacherry conducted by All India Radio,

Thiruvananthapuram on 02-12-2005.

Mathew P.J. attended the seminar on 'Chromosome and Gene Pathology' held at Dept. of Botany, University of Kerala on 19-08-2005.

Mathew, P.J. presented a paper on Establishment of Milieu Based Sanctuary of Medicinal Plants of the Western Ghats in the Workshop on Conservation and Sustainable Use of Resources organized by WGDP, Planning and Economic Affairs Department, Govt. of India at Thiruvananthapuram on 17-19 January, 2006.

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Radha, R.K., Decruse, S.W., Krishnan, P.N and Nair G.M 2004 Cryopreservation of zygotic embryo axes of *Nothopodytes nimmoniana* an endemic medicinal plant of Western Ghats. Abstracts of National Seminar on New Frontiers in Plant Taxonomy and Biodiversity Conservation, XIV Annual Conference of IAAT, Thiruvananthapuram. P: 134-135.

Radhakrishnan, K. Mangroves of Lakshadweep Islands India. Training Workshop on Conservation of Mangroves organized by the Ministry of Environment and Forests, Government of India and Kerala Forest Department at Kannur from 25-27 June 2005.

Radhakrishnan, K. The relevance of ethnobotanical records with reference to Kerala State, India. National Seminar on Biodiversity Conservation, organized by Department of Botany, S D College, Alappuzha from 8-10 October 2004.

Rajasekharan, S. 2005 Conservation and Sustainable Utilization of Medicinal and Aromatic Plants (Invited lecture) at Govt. Ayurveda College, Thiruvananthapuram. On 12th February 2005.

Rajasekharan, S. Regional Workshop on "Strides of Sustainability to Foster Prosperity: Criteria and Indicator Systems for Sustainable Forest MK Management" jointly organized by Indian Institute of Forest Management, Bhopal and Kerala Forest Dept 26-27 May 2004.

Rajasekharan, S. Conservation and Sustainable Utilisation of Medicinal and Aromatic Plants. (invited talk) UGC course at Staff College, University of Kerala, Karyavattom 5th August 2004.

Rajasekharan, S. Indigenous Knowledge and IPR of Medicinal Plants (invited lecture) at KFRI in connection with the training course orgainsed by the IFS officials from different states of India on 24th September 2004.

Rajasekharan, S., George, V., Latha P.G. and Nair G.M. 2005. Scientific Documentation of Indigenous Knowledge and protection of Intellectual Property Rights, International Seminar Prithvi 2005. pp 20-23.

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Reji, J.V., Padmesh, P and Seeni S.2004. Analysis of genetic diversity in reed bamboos using RAPD and ISSR markers. Abstracts of National Seminar on New Frontiers in Plant Taxonomy and Biodiversity Conservation, XIV Annual Conference of IAAT, Thiruvananthapuram. pp 43-44.

Sathiskumar, C. attended the Review Meeting of the AICOPTAX Project during 19-21 May 2005 at Coimbatore and presented highlights of the orchid project.

Sathishkumar, C attended the 15th IAAT Meeting at Nagpur during 20-21 October 2005.

Sathishkumar, C. attended the Frontier Lecture Series of Calicut University on 7 November 2005 by Prof. H. Y. Mohan Ram who talked on Seeds of Change.

Sarajith, V.S, S.Ajeesh Kumar, S. W. Decruse, A . Gangaprasad G.M Nair 2004. Seed cryopreservation is effective for the *ex situ* conservation of wild orchids of Western Ghats. Abstracts of National Seminar on New Frontiers in Plant Taxonomy and Biodiversity Conservation, XIV Annual Conference of IAAT, Thiruvananthapuram.P:133-134.

Seema G. Gopal attended and presented paper in XV National Seminar of IAAT conducted at Nagpur University, Nagpur during 20-21st October 2005.

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Sibi, M. attended the 2nd National Training Workshop on Electronic Herbarium and Digital Database Preparation organized by the Department of Botany, Institute of Science, Mumbai from 10-11 February 2005.

Subhisha, S. and A. Subramoniam. Antifungal activities of *Pallavicinia lyellii*, a liverwort. Presented at the Southern Regional Conference of Pharmacologists (Indian Pharmacological Society), Amrita Institute of Medical Science, Kochi, Kerala State , October 5-6, 2004.

Subramonian, A. Conducted a session on recent Advances in the Pharmacology of Traditional Medicinal

Plants in the reorientation and training programme on 'Recent Advances in the Field of Medicinal Plant Research' organized by the Government Ayurveda College Thiruvananthapuram, 10th July 2005

Subramoniam, A. Anti cancer agents with reference to molecular targets (Invited Lecture). Organised by Amala Cancer Research Centre, Trichur in connection with Summer Training Course12th May 2004.

Subramoniam, A. 2004. An untapped source of anti-fungal agents (Invited Lecture). Annual Conference of Indian Association of Biomedical Scientist, October 7-10, 2004, University of Madras, Chennai.

Suja, S.R., Latha P.G and Rajasekharan S.2004 Evaluation of antihepatotoxic activity of *Rhinacanthus nasuta* root against D- galaclosamine induced liver damage in Wistar rats. Poster presented at 16th Kerala Science Congress, Kozhikode, January 2004.

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Ushakumari, J., Navas, M Mathew Dan and Rajasekharan S.2005. Nilampunna A Promising Ethnomedicinal plant and its Pharmacognosy. 4th National Seminar on Medicinal plants, March 16-17 2005, organized by Dept. of Pharmacognosy Govt. Ayurveda College Thiruvananthapuram.

Mathew, P. J. attended the International Seminar on Medicinal Plants held at Campinas, Brazil from 5th to 8th July 2004 and presented a paper entitled "Multivariate analysis in fifty cultivars/ landraces of *Piper nigrum* (Black Pepper) occurring in Kerala, India.

Mathew, P.J. and Thomas M.T. participated in the National Seminar on New Frontiers in Plant Taxonomyand Biodiversity Conservation organized by IAAT and TBGRI at Thiruvananthapuram from 20 to 31 December 2004.

Posters Presented

Bindu, S., Chitra, C.R., Santhosh Kumar, J., Anilkumar, C and Krishnan, P.N. 2004. Comparative carpology of peninsular Indian *Rauvolfia* L. species. National Seminar on New Frontiers in Plant Taxonomy and Biodiversity Conservation, XIV Annual Conference of IAAT Thiruvananthapuram.(Abstracts P:43-44)

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Mr P C Binoy	SSA (on leave)
Mrs Seema G Gopal	JSA
Mr T Sabu	Tech. Officer
Mr Joemon Jacob	Tech. Officer
Mr A Hussain	Tech. Officer
Mr A Sabeena	Tech. Officer
Mr K Narendran Nair	Gardener
Mr V Satheesan	Gardener
Mr K Vijayakumar	Gardener
Mr G Vijayakumaran	Gardener
Mr L Thulaseedharan	Gardener
Mr A K Azeem	Gardener
Medicinal, Aromatic and Spice Plants	
Dr P J Mathew	Scientist C, Head
Dr Mathew Dan	Scientist- A
Dr Sam P Mathew	JSA
Mr C Muraleedharan Unnithan	Tec. Officer
Mr S Baburaj	Gardener
Mr M Varkey	Gardener
Mr Sudarsanakurup	Gardener
Ornamental Plants and Plant Distribution	
Mr Cheriyan P Koshy	Scientist A, Head
Mr R Rajvikraman	Scientist A
Mr Raju Antony	Tech. Officer
Mr K J Lathan Kumar	Tech. Officer
Mr G Thulasidas	Tech. Officer
Mr K Selvaraj	Labour Supervisor
Mr J Michael	Garden Maistry
Mr B Jayakumar	Gardener
Mr P Manikandan Nair	Gardener
Mr B Harilal Kumar	Gardener
Mr C Sudarsanan	Gardener
Mr J Rajan	Gardener
Mr P Babu	Gardener
Mr P Prabhakaran	Gardener
Mr D Udayakumar	Gardener
Mr R Suresh Kumar	Gardener
Mr V Ranjan	Gardener
Mr N Pradeep	Gardener
Orchids, Education and Extension Unit	
Dr C Sathish Kumar	Scientist C, Head

Dr P K Suresh Kumar	Scientist B
Dr S Binu	JSA
Mr S S Dayal	Guide
Mr V Prem Kumar	Guide
Mr M Saleem	Tech. Officer
Mr S Mohammed Sherief	Tech. Officer
Mr T Jamaludeen	Garden Maistry
Mr N Venugopalan Nair	Gardener
Mr M Shajahan	Gardener

Bambusetum Unit

Dr K C Koshy	Scientist C, Head
Mr B Gopakumar	Tech. Officer
Mr K S Kalesh	Tech. Officer
Mr N Salahudeen	Gardener
Mr S Baburaj	Gardener
Mr. M. Varkey	Gardener
Mr. Asokachandran Nair	Gardener

Plant Biotechnology

Dr S Seeni	Deputy Director,Head
Dr P N Krishnan	Scientist E2
Dr K Satheesh Kumar	Scientist C
Dr S Mukuntha Kumar	Scientist C
Mr P Padmesh	Scientist B
Dr C G Sudha	Scientist B
Dr William Decruse	Scientist B
Dr C Anil Kumar	Scientist A
Mrs R K Radha	JSA
Dr K K Sabu	JSA (on leave)
Dr C K Biju	JSA
Mrs S Shailajakumari	Tech. Officer
Mrs C R Chithra	Tech. Officer
Mrs S Bindu	Tech. Officer
Mr K Gopakumar	Tech. Officer
Mr V Girish Kumar	Lab. Asst.
Mrs V S Sindhu	Lab. Attendant
Mrs S Syamala Kumari	Lab. Attendant
Mr P Shaji	Gardener

Commercial Tissue Culture Unit

Dr Bejoy Mathew	Scientist B, Head
Mrs B J Radhika	Tech. Officer
Mrs Kanakasundaram	Lab. Attendant
Mr G Manoharan	Gardener

Microbiology

Dr V B Hosa Goudar	Scientist C
Dr K B Vrinda	Scientist B
Dr K Vijayakumar	Scientist A
Mr S Shiburaj	JSA
Dr N S Pradeep	JSA
Mr H Biju	Tech. Officer
Mr K Anil Kumar	Gardener
Mr S R Kamalesh Kumar	Gardener
Mr R Valsaladevi	Helper

Ethnomedicine and Ethnopharmacology

Dr S Rajasekharan	Scientist F, Head
Dr P G Latha	Scientist E2
Dr A Subramoniam	Scientist E2
Mr A Subash Baby	Pharmacist
Dr T G Vinod Kumar	JSA (on leave)
Mrs B S Geetha	JSA
Mr M Navas	Tech. Officer
Mr S Ajikumaran Nair	Tech. Officer
Mr S Radhakrishna Pillai	Animal House Technician
Mr G Santhosh Kumar	Animal House Technician
Mr G Anilkumar	Animal House Assistant
Mrs A Leela	Helper

Phytochemistry

Dr V George	Scientist F, Head
Dr V Sabulal	Scientist B
Mr K B Ramesh Kumar	JSA
Mr Dhruvan Tandeykkal	JSA
Mr Gopanraj	Tech. Officer
Mr Anil John	Tech. Officer
Mrs Rajani Kurup	Tech. Officer
Mrs P Sasikala	Lab Attendant

Conservation Biology

Dr T S Nayar	Scientist E2, Head
Dr S D Biju	Scientist A
Mr P S Jothish	JSA
Mr S Suresh	Tech. Officer
Mr M Sibi	Tech. Officer
Mr G Madhu	Gardener

Plant Systematics and Evolutionary Sciences

Dr A G Pandurangan	Scientist E2, Head
Dr M Rajendra Prasad	Research Scientist
Mr K Radhakrishnan	Scientist A
Mr G Rajkumar	SSA
Dr A K Sreekala	JSA
Mrs V S Usha	Herbarium Assistant
Mrs M P Geethakumari	Tech. Officer
Mrs K P Deepthi Kumari	Tech. Officer
Mr R Thulaseedharan	Gardener

Library and Information Services

Mrs A Syamala Kumari	Librarian

Mrs V Sujatha	Junior Library Assistant
Mrs Leena Kumari	Helper
Mr C R Vinukrishnan	Helper

Art and Photography

Mr K P Pradeep Kumar	Artist/Photographer
Mr S Suresh Kumar	Asst. Artist
Mr C Suseendran	Photographer

Administrative Staff

Mr S Ram Mohan	Registrar
Mr P Raghavan	Registrar
Mr K G Ajithkumar	Asst. Adm. Officer
Mrs S Radhalekshmy Ammal	P. A. to Director
Mr K M A Rahman	Deputy Registrar
Mr Suresh Chandran	Section Officer (Purchase)
Mrs R Sarala Devi	Section Officer
Mrs C Syamala	Senior Accountant (Retired)
Mr Ravi Abraham	Accounts Officer (Retired)
Mrs S Meenakumary	Office Asst. Grade-III
Mr K Vijayan	Office Asst. Grade-III
Mr M Anilkumar	Office Asst. Grade-IV
Mr M Sulfikar	Office Asst. Grade-IV
Mrs B S Ajanthakumary	Office Asst. Grade-IV
Mrs S R Bindu	Office Asst. Grade-IV
Mrs N Rajalekshmi Ammal	Typist Grade-I
Mrs R Subha Sankar	Computer Operator
Mr K Mohammed Habeebulla	Typist/ Data Entry Operator
Mrs P S Shyladevi	Typist
Mrs C Gracy	Stenographer Gr. I
Mrs R Prasannakumary	Stenographer Gr. II
Mr K PElias	Store Assistant
Mr M Ramaswamy	Driver Gr. I
Mr V Rajendran Nair	Driver Gr. I
Mr R Gopinathan Nair	Driver Gr. I
Mr A Salim	Driver Gr. I
Mr D Mohanachandrakumar	Driver Gr. I
Mr T Mohanakumar	Driver
Mr P Rajendran	Driver
Mr C P Somasekharan Nair	Driver (Retired)
Mr V Sudheeshkumar	Driver
Mr S Chandran Chettiar	Helper Gr. I (Retired)
Mr C Sathyan	Helper Gr. I
Mr B Vijaya Kumar	Helper Gr. I
Mr G S Madhusoodhanan Asary	Helper
Mr B Jayalalkumar	Gardener (On other duty)
Mr M Shajahan Gardener	(on other duty)
Mr S Thulaseedharan	Gardener
Mrs Kumari Girija	Sweeper
Mrs K Lali Kutty	Sweeper
Mrs Baby Girija	Sweeper
Mr V Gangadhara Pillai	Sweeper/Cleaner

Engineering Section

Mr P P Markose	Tech. Officer
Mr S Ajith	Asst. Works Supervisor
Mr V S Suresh Kumar	Electrician
Mr P Ajith Kumar	Electrician
Mr Prabhakaran Nair R	Plumber
Mr M Madhusoodhanan Nair	Pump Operator
Mr A Thankappan	Painter
Mr P S Hanikumar	Label writer

Security

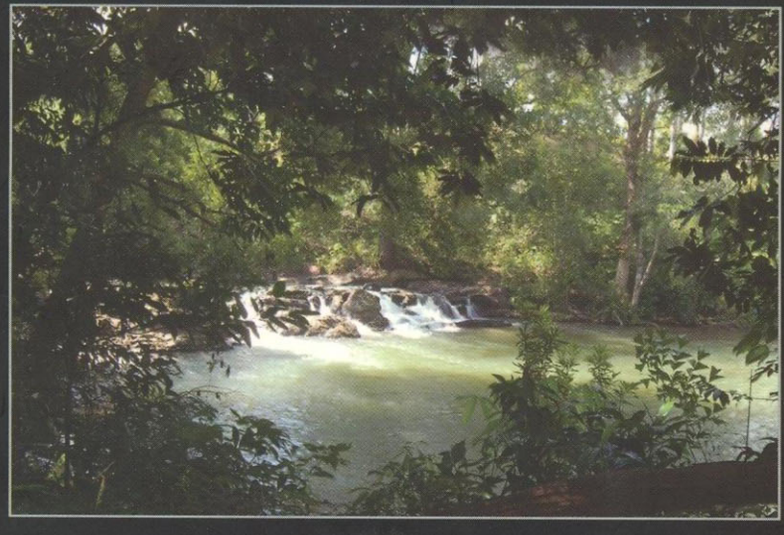
Mr V Jayadhar	Security Officer
Mr P RChandrasekharan Nair	Security Guard (Sergeant in-charge)
Mr S Chandran	Security Guard
Mr P Jain	Security Guard
Mr A Johnson	Security Guard (Retired)
Mr K Mohanan	Security Guard
Mr P Ramachandran Nair	Security Guard
Mr G Somasekharan Nair	Security Guard
Mr C Stanley	Security Guard
Mr K Krishnankutty Nair	Security Guard
Mr R Rajan	Security Guard
Mr K Ramachandran Nair	Security Guard
Mr V Sreedharan Nair	Security Guard
Mr A Subairkunju	Security Guard
Mr C Sukumaran Nair	Security Guard
Mr T Sukumaran Nair	Security Guard
Mr B Surendran Nair	Security Guard
Mr K Surendran Nair	Security Guard
Mr S Venugopalan Nair	Security Guard
Mr B Venukrishnan Nair	Security Guard
Mr P Vijayakumar	Security Guard
Mr G Viswambharan	Security Guard
Mr K Balakrishnan Nair	Security Guard
Mr M Bhuvanachandran	Watchman (Resigned)
Mr K Raveendran Nair	Watchman (Retired)

Puthenthope Extension Centre

Mr C Sunil Chandran	Estate Supervisor
Mr B Chandran	Gardener
Mr M Vijayan	Gardener
Mr R Anilkumar	Gardener

Bioinformatics Extension Centre

Dr S Ganeshan	Chairman
Dr P N Krishnan	Co-ordinator
Dr S Sreekumar	Information Officer
Dr C K Biju	Technical Assistant



Tropical Botanic Garden and Research Institute
Karimancode P. O., Pacha-Palode
Thiruvananthapuram - 695562
Kerala, India