Tropical Botanic Garden and Research Institute
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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 Pharmacopoeial 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 identified 18 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 rhynchchanherus* 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
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. 11 palm 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.
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 lanzolota*, *Buchanania barbieri* and *Humboldtia decurrens* were collected and germination trials were initiated.
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.

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 nigrociiliata, Ochlandra sp., Thysostachys 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 BGCL, for educating students and public on conservation of herbs 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 relandscape 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 50 cvs. Hedge planting was accomplished with Polycia, 'miniature bamboo' and Phyllanthus. An ornamental shrubbery was developed facing the animal house holding 150 plants belonging 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. (Acalypa, Hibiscus cvs., Hamelia, Poinsettia, Tecom etc.) were also planted to the

A picturesque view of the gardens
Behind 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 Bonaccurd, Chemurji, Ponmudi Hills and Myristica swamps of Kulathupuzha forests of Western Ghats. During these trips, 40 species including *Asplenium incisum*, *A. crinicum*, *A. formosum*, *A. grevillei*, *A. polyodon*, *Athyrium hohenackeranum*, *Bolbitis prolifera*, *Cyanthea 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 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. ‘Chembaramuthi 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.
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 Icons 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 munnaresensis* 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 *Ipsa 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. *khassiana* 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 cryopreserved pollen used for the pollination induced the formation of viable seeds. Micropropagation of RET species of Zingiberaceae viz *Boschenbergia pulcherrima*, *Paracautleya bhatii* and *Ammomum pterocarpum* was achieved. Cultures of three other species viz. *Ammomum cinnicarpum*, *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*
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 barberr, Humboldtia decurrens, Hydrocarpus macrocarpa and Piper barberr were completed. In addition, seed storage conditions were standardized 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 aryalpathra 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 Ophiiorhiza 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 Prosopis 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 aryalpathra 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 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. aryalpathra 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
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.tb gri.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.tb gri.in.

Fungal Database Meliolales was made available on the Web. URL: http://www.tb gri.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.tb gri.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 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 full fledged 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
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.
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 Sarraga (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.

Microfungi

Collection trips were made to the evergreen forests of Pathanamthitta (Moozhuary, 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 Follicolous 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
Basanamyces Hosag.

New species
Amazonia gordoniiocola Hosag., C.K. Biju & Abraham
Amazonia vaccini Hosag., C.K. Biju & Abraham
Appendiculella gaultheriae Hosag., C.K. Biju & Abraham
Appendiculella shettyi Hosag., C.K. Biju & Abraham
Appendiculella vacciniacearum Hosag., C.K. Biju & Abraham

Appendiculella vivekamathanii Hosag., C.K. Biju & Abraham

Armataella actinodaphnes Hosag., C.K. Biju & Abraham

Armataella apolloniaidis Hosag., C.K. Biju & Abraham

Armataella caulicola Hosag., C.K. Biju & Abraham

Asteridiella gaultheriae Hosag., C.K. Biju & Abraham

Asteridiella glycosimis 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 glycosimis Hosag., & Rajkumar

Asterina glyptopetalii Hosag., & C.K. Biju

Asterina hydrotropales Hosag., & C.K. Biju

Asterina lauracearum Hosag., & C.K. Biju

Asterina lebelaearum Hosag., & C.K. Biju

Asterina phyllanthigena Hosag.

Asterina plectrantha Hosag., Manoj, & H. Biju

Asterina toxocarpi Hosag., & C.K. Biju

Bassaropyce ilseae Hosag., C.K. Biju & Abraham

Clasterosphaera indica Hosag., & Manoj.

Echidnophaga manilkarae Hosag., & T. Sabu

Irenopsis gordoniae Hosag., C.K. Biju & Abraham

Meliola hydei Hosag., C.K. Biju & Abraham

Meliola knoxicola Hosag., C.K. Biju & Abraham

Meliola ligustricola Hosag., C.K. Biju & Abraham

Meliola neeotaias Hosag., C.K. Biju & Abraham

Meliola rajamalaensis Hosag., C.K. Biju & Abraham

Meliola rupii Hosag., C.K. Biju & Abraham

Meliola strobilanthicola Hosag., C.K. Biju & Abraham

Colonies of Meliola toddaliae Doidge
**New Varieties**

*Meliola capensis var. dimocarpi* Hosag., Manoj.
*Asterina jasmini var. indica* Hosag.
*Amazonia psychotriae var. microspora* Hosag., C.K. Biju & Abraham
*Asteridiella cyclopoda var. vernoniae* Hosag., C.K. Biju & Abraham
*Asteridiella entebbeensis var. flochidii* Hosag., C.K. Biju & Abraham
*Asteridiella tribola* var. *momordicae* Hosag., C.K. Biju & Abraham
*Meliola cadigensis var. todaliae* Hosag., C.K. Biju & Abraham
*Meliola goteana var. maesa* Hosag., C.K. Biju & Abraham
*Meliola henryi var. oldenlandiae* Hosag., C.K. Biju & Abraham
*Meliola jasmini var. microspora* Hosag., C.K. Biju & Abraham
*Meliola memcylis var. microspora* Hosag., C.K. Biju & Abraham
*Meliola oldenlandiae var. indica* Hosag., C.K. Biju & Abraham

**New Record to Western Ghats**
*Asteridiella pugel* 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 Orexylum 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, Giseka phannaceoides and Maranta arundinacea were prepared for ISM, New Delhi.

In the DST funded project on 'Development of scientifically validated nutraeuticals from selected medicinal plants of Western Ghats', five 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 nutraeutical 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 cyclooxygenase blockade. The fraction also showed marked analgesic activity as evaluated by acetic acid induced writhing test and diuretic activity.

Phytochemical investigations on Pittosporum viridulum, Gymnanthera 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%), carophyllene 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 from the rhizomes and leaves of Amomum hyapaleucum. They were hydrodistilled and characterized by GC-FID and GC-MS. Cryptone, β-pinene and carophyllene oxide were the major constituents in rhizome oil and nerolidol and β-carophyllene were found in the leaf oil. β-pinene was the major constituent of Amomum percarpum rhizomes and leaves and β-pinene and copaene were isolated from A. muricatum whereas β-terpineol and β-pinene were obtained from A. canicarpum. 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 carophyllene-rich natural source with isomeric carophyllenes, β-carophyllene (42.2%) and β-humulene (α-carophyllene, 27.7%), as its major constituents along with traces of isocarophyllene. The rhizome oil contained 71.2% sesquiterpenes, 14.2% oxygenated sesquiterpenes, 8.9% monoterpene, 1.9% oxygenated monoterpene 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%).
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 australindia contained the phenyl propanoid elemicin and myristicin besides sesquiterpenes and aliphatic compounds. The flower oil of Evodia lunaunanda contained evodione, β-ocimene, isocaryoladin and alloevodolone. Severe fungal infection was observed on the leaves of Pamburas missionis (Wight) Swingle (Rutaceae). This infection was due to the fungus, Meliola todalilae 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 spectrometry. 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. todalilae as a ‘parasitic symbiont’ on the leaves of P. missionis.

GC-MS studies on leaf oils of 4 species of Cinnamomum viz. C. chinense, C. sulphuratum, C. fillipenicellatum and C. heimianum showed the presence of sesquiterpenoids, β-selinene, intermedeol, longiborneol, benzyl benzoate, cryptone, p-cymene, cuminal, limonene and sature. The fruits of Neolitsea 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 p-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 galatam gave linalool, β-cyclogermacrene and β-caryophyllene whereas from P. longum leaf oil aipole, myristicin, nerolidol were obtained. A population of wild Piper nigrum having unique lemon 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 perine oil content of the fruits have revealed that the unique lemon 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 bicyclergermacrene in the leaves and high perine oil content in the fruits respectively. Appreciable percentage of the characteristic aroma chemical compounds and high perine oil 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 perine oil content.

Hydrodistillation of the stem bark of Garcinia imberti Bourd. afforded 0.62% (v/v) 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 spectrometry. 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, monoterpane hydrocarbons and oxygenated monoterpenes. IsomERIC caryophyllene (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.
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 Samithi (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.

The protective effect of *Spilanthes ciliata* on ethanol induced damage has been confirmed in rats from biochemical and histopathological studies. *Decalepis*
arayalpathra (Periplocaceae) and Cycla peltata (Menispermaceae) 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.

Macroscopic 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. salgfolium 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 neelgerrense 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. neelgerrense significantly induced hexobarbitaline induced narcosis in mice.

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

Anti-inflammatory 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, Pallavicinia lyelli. 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. lyelli 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.
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.

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 kedarnathi*, 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 kedarnathi*. 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 kedarnathi* was in flower from January to March, in fruit from April to August and in flower 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 anamallicola, Aglaia barberi, Anacolosa densiflora, Aporusa bourdilloni, Begonia alciace, B. trichocarpa, Ceropogia elegans, Cinnamomum keralense, C. macrocarpum, Cyanomerta bourdilloni, Exacum anamalloyanum, Goniathalamus wynaadensis, Hedychium devicolamensis, Humboldtia bourdilloni, H. vahliana, Impatiens anamudica, I. travancorica, I. wightiana, Ischaemum quironense, I. fisheri, Kendrickia walkerii, Kunstleria keralensis, Litsea stocksii, L. travancorica, Memecylon rosenii, Nothopogon aureo-fulva (Extended distribution), Ormosia travancorica, Orophryma malabarica, Osbeckia brachystemon, Phloeophyllum lawsonii, Piper barberi, P. haininum, Pothos keralensis, Pterospermum reticulatum, Salacia malabarica, Strobilanthes dupeni, S. foliosus, Vepris bilocularis, Vernonie beddomei, Willisia

selaginoides etc. The species such as Litsea travancorica, Orophryma malabarica, Vernonie beddomei etc are additions to TBGT. Besides two new species (Cinnamomum sahyadricum and Arundinella ravi), two new records for India (Memecylon rosenii and Eugenia toddalioides), 8 rediscoveries after type (Begonia alciace, Cinnamomum perrottetii, Didymogrepus lyrata, Impatiens dendricola, I. pandata, I. platyadena, Sonerila devicolamensis and S. sadasivani) were recorded.

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 fujonii, Chanomorpha fragans, 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. aculeis, I. auriculata, I. coelotropis I. floribunda, I. campanulata, I. dendrica, I. jerdoniae, I. kalamavensis, I. pareifolia, I. pandata, I. pheonica, I. platyadena, I. stockii, I. tangacee 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 rynchanthus 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 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, Dryroxylon malabaricum, Embelia ribes, Garcinia morella, Knema attenuata, Myristica dactyloides, Myristica malabarica, Ochreaucula missionis, Persea macrantha, Piper barbieri, P. longum, P. mulluus, Trichopus zeylanicus spp. Transvencoricus 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 rynchanthus 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 Ochromerria sp. (Curculionidae), Polyphyllus furcula and Technomymex albipes (Hymenoptera), Digitipes coonoreaensis (Chilopoda) and Oliss 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. heynanum, 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 decivolamensis and S. sadawanianii.

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 phytolax, 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, Aegialia malabarica, Atruna trancorica, Caparxis fusifera, Ceropogia beddomei, C. bourdilloni, Dialium trancorica, Garcia imberti, Humboldtia bourdilloni, Impatiens anaimudica, Janakia arayalpathra, Papriophelifum druryi, Piper barbati, Poccileonur pauciflorum, Psyzygium bourdilloni, S. trancorica, Vernonia shreayogensis etc. This status report will be of immense use in developing suitable strategies for both *in situ* and *ex situ* conservation.

**Thottua barbati** (Aristolochiaceae) is an endangered plant found in the evergreen forest of Thiruvananthapuram and Thrimeelveli 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 1/4 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 hensloviana** 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. hensloviana* 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 km² 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-Weiner index value is 0.2830 and average equitability index 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 *Korea 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.**

<table>
<thead>
<tr>
<th>Description</th>
<th>Quantity</th>
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<tbody>
<tr>
<td>Specimen number in Herbarium as on December 2005</td>
<td>18595</td>
</tr>
<tr>
<td>Number of specimen processed</td>
<td>11750</td>
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<tr>
<td>Mounted for filing</td>
<td>2350</td>
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<tr>
<td>Unmounted for reference</td>
<td>9400</td>
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<tr>
<td>Number of specimens incorporated</td>
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<tr>
<td>Number of Nomenclature correction carried out</td>
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<tr>
<td>Indexing of General Herbarium specimens</td>
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<tr>
<td>Number of sheets renovated</td>
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<td>Maintenance of general Herbarium specimens</td>
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<td>Fumigation</td>
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<tr>
<td>Number of enquiries attended</td>
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<tr>
<td>Number of classes/training conducted</td>
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</table>

**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**


**Awards / Honours / Memberships / Ph. D. Awarded**

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

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 Kerala people 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 Naggur during 20-21 October 2005.

A. Subramonian 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 Yojana, 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. Seenii was nominated as a Member, Biotechnology Board of the Vellore Institute of Technology.

The Department of Agriculture, Govt of Kerala has nominated Dr. S. Seenii 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 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 Vigyan Kendra, Mithranikethan on 23-11-2005.


Mathew Dan delivered a talk on ‘Identification of Medicinal Plants and its Cultivation’ in Job Training to VHS Students at KVK, Mithranikethan 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, Thrissur on 5th October 2006. 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 RATT, 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 Vellarayi on 20th November 2004, in connection with All India Winter School Training Programme.

Rajasekharan S. Presented a concept paper on Vanasamrakshanayam (Save the Forest and Save Life) at Forest Headquarters, Thrissur 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, Chempazhanthy, Thrissur 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.

Sathishkumar 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.

Sathishkumar 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, Bharathanor
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, Thrivunalam
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, Thrivunathanapuram
Students of Ramrinijan Jhunjhunwalla College, Mumbai
Students of Christ Nagar Secondary School, Trivandrum
Students of Shree Gulakunvera Ayurveda Mahavidyalaya, Jamnagar
Students of Saradakrishna Homeo College, Kanyakumary
Students of St. Berchman's College, Changanacherry
Students of Mar Gregorious School, Pathanamthitta
Students of Kuvenmu 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 Evangelical 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, Maranallor
Members of Kerala State Service Pensioners Union, Kollam
Students of Govt. Higher Secondary School, Chavara
Students of M. C. H. S., Kottukkalkonam
Members 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, Kollara
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 Visswaradhini 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., Keezhaorur
Students of D. V. L.P. School, Pallickal
Students of Govt. U. P. S., Attingal
Members of Asian Memorial Teachers Training Institute, Trivandrum
Students of Nalanda College Computers, Bharathanor
Students of Govt. Ayurveda College, Trivandrum
Members of Block Resource Centre, Kaniyapuram
Students of Govt. Model L. P. S., Quilon
Students of Shri. Vodyadhira 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. Town U. P. S., Killimanoor
Students of Govt. U. P. School, 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, Aramantha
Students of St. Theresa's U. P. School, Kottakkada
Students of Jamal Muhammed College, Tiruchirappalli
Students of Sree Narayana Trust Central School, Kollam
Members of Sreenagar Association, Mankadaud
Students of Vocation Bible School, Kulathupuzha
Members of Kerala State Chalachithra Academy, Trivandrum
Members of Agriculture, Horticulture, Society, Kuthuparamba
Members of Centre for Organized Research in Education, Trivandrum
Students of Vocational Training Centre, Poojapura
Members of Promotion of Excellence among Gifted Children, Trivandrum
Members of Krishna Vigyan 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 Samakshya Society, Trivandrum College of Forestry, Trissur
Students of St. Theresa's College, Ernakulam
Students of M. G. Higher Secondary School, Thumpamom
Students of St. Stephens College, Pathanapuram

Students of Govt. B. H. S. S & V. H. S. S, Attingal
Students of Gujarat University, Ahmedabad
Students of R. V. S. M. Higher Secondary School, Oachira
Students of S. B. College, Bharathanoor
Students of Shri. Parakalayani College, Alwakurichi
Students of Kerala Agricultural University, Padanakkadu
Students of Guhagura University, Guhagura
Students of Rajiv Gandhi Education Foundation, Kadakkal
Students of Nousari Agricultural University, Navasseri
Students of K. R. College of Arts & Science, Kovilpadi
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 Pavanassiraja N. S. S College, Mattannur
Students of M. V. College of Science, Mumbai
Students of Sanrastra 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 Sathyaraghi College, Mumbai
Students of Shanthuika Vilasom Higher Secondary School, Kollam
Students of Model B.H.S.S, Kollam

Externally Funded Projects

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<th>Sl. No.</th>
<th>Code</th>
<th>Project</th>
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<tr>
<td>1</td>
<td>A-1</td>
<td>&quot;Development of standards of selected therapeutically important Indian medicinal plants and preparation of monographs thereof&quot;</td>
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<tr>
<td>2</td>
<td>A-2</td>
<td>&quot;Genotyping of bio-diversity and for conservation and prospecting of biological wealth in South-Western and North-Eastern parts of India&quot;</td>
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<td>3</td>
<td>A-3</td>
<td>&quot;Rescue and restoration of rare medicinal plants of Agasthiumala, Kulamavu and Wayanadu MPCAs&quot;</td>
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<tr>
<td>4</td>
<td>A-4</td>
<td>&quot;Establishment of database for Nilgiri and Gulf of Mannar biosphere reserves&quot;</td>
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Name of funding agency

- Indian Council for Medical Research
- Department of Biotechnology
- FRHT
- Ministry of Environment & Forests Govt. of India
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<tr>
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<tr>
<td>A-5</td>
<td>&quot;National Agricultural Technology project on sustainable management of plant biodiversity&quot;</td>
<td>ICAR</td>
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<tr>
<td>A-6</td>
<td>&quot;Taxonomic data organization of wild species of piper and curcuma in India and DNA fingerprinting studies of selected endemic species&quot;</td>
<td>Department of Biotechnology</td>
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<td>A-8</td>
<td>&quot;Tissue culture assisted floriculture for self employment and income generation of economically weaker women in selected village panchayaths of Kerala&quot;</td>
<td>Department of Biotechnology</td>
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<td>A-9</td>
<td>&quot;Non Wood forest Produce including medicinal plants&quot;</td>
<td>Forest Department, Govt. of Kerala</td>
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<tr>
<td>A-10</td>
<td>&quot;Black mildew disease on wattles (Accacia spp.) in Kerala State&quot;</td>
<td>Forest Department, Govt. of Kerala</td>
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<td>A-11</td>
<td>&quot;Ornamental resources at Shola forests of Kerala&quot;</td>
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<td>A-12</td>
<td>&quot;Collection, evaluation and documentation of mushroom germplasm of The Western Ghats&quot;</td>
<td>Forest Department, Govt. of Kerala</td>
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<td>A-13</td>
<td>&quot;All India Coordinated Research Project on Orchids&quot;</td>
<td>Ministry of Environment &amp; Forests, Govt. of India</td>
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<td>A-14</td>
<td>&quot;National Gene Bank for Medicinal and Aromatic Plants&quot;</td>
<td>Department of Biotechnology</td>
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<td>A-15</td>
<td>&quot;Regeneration 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.&quot;</td>
<td>Science, Technology &amp; Environment Department, Govt. of Kerala</td>
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<td>A-16(1)</td>
<td>&quot;Value Added Cottage Industry&quot;</td>
<td>Planning &amp; Economic Affairs Department, Govt. of Kerala</td>
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<td>A-17</td>
<td>&quot;Strengthening of Ayurvedic pharmacopoeia standards of Ism drugs&quot;</td>
<td>Ministry of Health &amp; Family Welfare, Govt. of India</td>
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<td>A-18</td>
<td>&quot;Protoplast studies in Anthurium andraeanum&quot;</td>
<td>Science, Technology &amp; Environment Department, Govt. of Kerala</td>
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<td>A-19</td>
<td>&quot;Establishment of Sub-Distributed Information centre at TBGRI under Bioinformatics Programme&quot;</td>
<td>Department of Biotechnology</td>
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<td>A-20</td>
<td>&quot;Consultancy Service on implementation of pilot participatory programme of conservation and sustainable utilization of medicinal and aromatic plants&quot; (World Bank Consultancy Programme)</td>
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<td>A-21</td>
<td>&quot;Study on mutualism between Cullenia exarillata and vertebrate community in the tropical forests of Silent Valley, Kerala&quot;</td>
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<td>A-22</td>
<td>&quot;Pharmacopoeial screening of selected traditional medicinal pteridophytes of Western Ghats Region of Kerala and molecular characterization of promising species&quot;</td>
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<td>&quot;Conservation of selected rare and economic Rattan palms of the Western Ghats through in vitro multiplication and re introduction&quot;</td>
<td>Ministry of Environment &amp; Forests, Govt. of India</td>
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<td>A-24</td>
<td>&quot;Puyankutty Hydro Electric Project&quot;</td>
<td>KSEB</td>
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<td>&quot;An integrated approach for the sustainable development of mushroom industry with active participation of the tribals and weaker section in selected localities of Kerala&quot;</td>
<td>Department of Biotechnology</td>
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<td>A-26</td>
<td>&quot;Hepatoprotective studies on selected Medicinal Plants of the Western Ghats, Kerala&quot;</td>
<td>Science, Technology &amp; Environment Department, Govt. of Kerala</td>
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<tr>
<td>A-27</td>
<td>&quot;Investigation on the Macrofungal Diversity in the Thenmala Forest Division of Western Ghats of Kerala&quot;</td>
<td>under WGDP, Planning &amp; Economic Affairs Department, Govt. of Kerala</td>
</tr>
<tr>
<td>A-28</td>
<td>&quot;National Gene Bank for Medicinal and Aromatic plants&quot; (III phase)</td>
<td>Department of Biotechnology</td>
</tr>
<tr>
<td>A-29</td>
<td>&quot;Collection, Micropropagation and Reintroduction of some endemic Zingibers of Western Ghats, Kerala&quot;</td>
<td>under WGDP, Planning &amp; Economic Affairs Department, Govt. of Kerala</td>
</tr>
</tbody>
</table>
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 WGDIP, Planning & Economic Affairs
Department, Govt. of Kerala

31 A-32 “Industrial Development and Economic Upliftment of Weaker Sections through Biofertilizer Manufacturing”
under WGDIP, 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 Programme”
under WGDIP, 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-a-vis phytomedicine development”
Department of Biotechnology, Govt. of India

43 A-44 “Micropropogation 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 steps leading to the biosynthesis of andrographolide using transcript profiling technology and metabolic engineering of andrographolides accumulation in Andrographis paniculata Nees by modulation of the isoprenoid precursor pool with expression of plastidial Deoxyxylose phosphate synthase and cytosolic HMG CoA reductase
Department of Biotechnology, Govt. of India

49 A-50 Metabolic engineering of Andrographolides Accumulation in Andrographis paniculata Nees by modulation of the isoprenoid metabolism
Department of Biotechnology, Govt. of India
<table>
<thead>
<tr>
<th>No.</th>
<th>Code</th>
<th>Project Description</th>
<th>Department/Office</th>
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<tr>
<td>50</td>
<td>A-51</td>
<td>Nutraceuticals from indigenous edible mushrooms</td>
<td>Department of Biotechnology, Govt. of India</td>
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<td>51</td>
<td>A-52</td>
<td>Seed Biology</td>
<td>Forest Department</td>
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<tr>
<td>52</td>
<td>A-53</td>
<td>Cultivation of high value medicinal and aromatic plants through</td>
<td>Department of Biotechnology, Govt. of India</td>
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<td></td>
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<td>conventional and non-conventional methods for empowerment of rural women in the</td>
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<td>selected localities of Kerala. A novel participatory programme for income generation</td>
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<td>53</td>
<td>A54</td>
<td>&quot;Nakshtravanam&quot;</td>
<td>Thenmala Eco-Tourism promotion Society</td>
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<td>54</td>
<td>A55</td>
<td>Collection, propagation, re-introduction and popularization of Ten endemic trees</td>
<td>Planning &amp; Economic Affairs Department, Govt. of</td>
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<td></td>
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<td>species of western ghats.</td>
<td>Kerala</td>
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<tr>
<td>55</td>
<td>A56</td>
<td>Tissue culture multiplication for mass production of selected economically</td>
<td>Planning &amp; Economic Affairs Department, Govt. of</td>
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<td>important bamboos.</td>
<td>Kerala</td>
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<tr>
<td>56</td>
<td>A57</td>
<td>Cultivation, conservation, and sustainable utilization of medicinal plants</td>
<td>Planning &amp; Economic Affairs Department, Govt. of</td>
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<td></td>
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<td>through peoples participation</td>
<td>Kerala</td>
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<td>57</td>
<td>A58</td>
<td>Consultancy on implementation of Pilot Participatory Programme for</td>
<td>Forest Dept., Govt. of Kerala</td>
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<td>Conservation and Sustainable use of Medicinal and Aromatic Plants</td>
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<td>58</td>
<td>A59</td>
<td>Development of Scientifically validated Nutraceuticals from selected medicinal</td>
<td>Department of Biotechnology, Govt. of India</td>
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<td>plants of Western Ghats</td>
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<tr>
<td>59</td>
<td>A60</td>
<td>Red Data Book on Indian Orchids B.P. Pal National Environmental Fellowship</td>
<td>Ministry of Environment and Forests, Govt. of India</td>
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<td>60</td>
<td>A61</td>
<td>Hepatoprotective studies on three selected medicinal plants of Kerala</td>
<td>Department of Biotechnology, Govt. of India</td>
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<td>61</td>
<td>A62</td>
<td>Studies on Reproductive Biology of selected rare, endemic and horticulturally</td>
<td>Dept. of Science and Technology, Govt. of India</td>
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<td>promising balsams from W. Ghats</td>
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<td>62</td>
<td>A63</td>
<td>Conservation strategies and pharmacological evaluation of Uteria salicifolia bedd.</td>
<td>Dept. of Science and Technology, Govt. of India</td>
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<td>Ex Hook. f. an endangered ethnomedicinal plant of W. Ghats</td>
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<td>63</td>
<td>A64</td>
<td>Infectivity and effectiveness of Arbuscular mycorrhizal fungi on some medicinal</td>
<td>Forest Dept., Govt. of Kerala</td>
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<td>plants of W. Ghats</td>
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<td>64</td>
<td>A65</td>
<td>Plant Crab Association in the Mangrove Ecosystems of Kerala</td>
<td>Ministry of Environment and Forests, Govt. of India</td>
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<tr>
<td>65</td>
<td>A-66</td>
<td>Establishment of MMPG at TBGRI, Palode.</td>
<td>NBRI, Lucknow</td>
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<tr>
<td>66</td>
<td>A-67</td>
<td>&quot;Ex-situ conservation of Arborescent crop relatives of Western Ghats, giving</td>
<td>NBRI, Lucknow</td>
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<tr>
<td></td>
<td></td>
<td>emphasis to endemic and RET species&quot;</td>
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<tr>
<td>67</td>
<td>A68</td>
<td>&quot;Studies on the Eco-Mycorrhizal fungal diversity in different forest types</td>
<td>Ministry of Environment and Forests, Govt. of India</td>
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<td></td>
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<td>and their association with endemic, indigenous and exotic species in the Western</td>
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<td>ghats forests of Thiruvananthapuram district, Kerala.</td>
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<tr>
<td>68</td>
<td>A69</td>
<td>Lead Coordination institution for Agasthyamalai, Nilgiri and Gulf of Mannar</td>
<td>Ministry of Environment and Forests, Govt. of India</td>
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<td>Biosphere Reserves</td>
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<td>69</td>
<td>A70</td>
<td>KSEB Programme on Biodiversity Documentation : Indigenous Knowledge Component</td>
<td>Kerala Forest Research Institute, Peechi</td>
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<tr>
<td>70</td>
<td>A71</td>
<td>Survey, Collection, Propagation of selected, threatened palm species of S. Ghats</td>
<td>Planning &amp; Economic Affairs Department, Govt. of</td>
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<td></td>
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<td>&amp; Electronic Herbarium Database preparation of palms in Kerala</td>
<td>Kerala</td>
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<tr>
<td>71</td>
<td>A72</td>
<td>Toxic and Hallucinogenic Mushrooms of Kerala</td>
<td>Planning &amp; Economic Affairs Department, Govt. of</td>
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<tr>
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<td>Kerala</td>
</tr>
</tbody>
</table>
Facilities/Equipments

HPLC Shimadzu LC-10AS
Lyophiliser Heto Model FD. 2.5 with Vacuum pump (Pfeiffer-B243)
Gas Chromatograph Nikon 5765 with FID detector
Analytical Balance - Sartorius Basic (Readability - .001 g)
Circulating Water Bath with Temp. control- Heto model DT1
Infrared Spectrophotometer, Buck Scientific Model 500
MPCL 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 Cylcers (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)

Publications

Papers Published


Asha, V.V., Akhilla, S. Wills PJ and Subramoniam A.2004. Further studies on the anti-epileptic activity of Phyllanthus amarus Linn. J. Ethnopharmacol, 92, 67-70

Biju, C.K., Hosagoudar, V.B and Abraham, T.K.2004
Hosagoudar, V.B. 2005. Studies on foliicolous fungi XIX Indian Phytopathol 58:194-204

Lathan Kumar., K. J, Raj Vikrman, R. and Mohandas,


Mathew, P. J., Jose, J. C., Vijayaraghava Kumar, Nair G. M. and Mathew, P. M. 2005. Assessment and conservation of intraspecific variants of *Piper nigrum* (black pepper) occurring in the Western Ghats of Indian Peninsula. Acta Hort. 676: 119-126


Radhakrishnan, K. 2004. The relevance of ethnobotanical research with reference to Kerala State, India. Thulas I (2): 1-7


Shylesh, B. S., Ajikumar Nair, S. and Subramoniam, A. 2005. Induction of cell specific apoptosis and protection from Dalton’s lymphoma challenge in mice by an active fraction from *Emilia sonchifolia*. Indian Journal of
biology of four endemic Balsams from the Western Ghats.
Zoo’s Print Journal 19:1606-1610
steroid from Pallavicinia Iyellii, a liverwort. Indian Journal of
Pharmacology 37: 304-308.
Subramoniam, A. 2004 Herbs in Arthritis, Physician’s
Digest 13:37-42
Subramoniam, A. 2005 Evaluation of traditional
natural products for their anti-cancer properties.
Biomedicine, 25:27-35
Application of apotosis in the search for plant-derived
chemopreventive/ therapeutic agents. Amala Research
Bulletin, 24:1-11
Subramoniam, A., Jaichand Johnson, Molly Antony,
Sreekumar, V. Thampy M. Raveendranath, Abraham, T.K.
Shanmugam, S. Rajasekharan and Nair, G.M. 2004
Screening of elected traditional medicinal plant extracts for
antiviral and antifungal properties. Biomedicine 24:48-54
Suja, S. R., Latha, P.G., Rajasekharan, S and
Pushpangadan, P. Anti hepatotoxic activity of Spilanthes
ciliata Pharmaceutical Biology, 2004. 41 536-54
Ushakumari, J., Navas, M., Mathew Dan.,
Rajasekharan, S and Nair, G.M. 2004. Pharmacognostic
studies on Pellionia heyneana Wedd. (Urticaceae): J. of
Tropical Medicinal Plants 5(2)259-263.

Other Scientific Articles / Publicatons

Latha, P.G., Sindhu, P.G. Suja, S.R. Geetha, B.S.
Pushpangadan, P. and Rajasekharan, S.2004 Nutmeg, The
Immortal Spice. Ayurvedic Renaissance 2(3): 10-14
Protection against cyclophosphamide genotoxicity by
Macuna pruriens L. seeds and Holostemma adakodien Schultes
tubers on the mouse sperm system. Ayurvedic Renaissance
2 (2): 8-12
Latha, P.G., Suja S. R. and Rajasekharan, S. 2004
Domestication, Cultivation and Product Development from
Medicinal and Aromatic Plants (MAP) Ayurvedic Renaissance
2 (2): 7-10
Latha, P. G., Shyamal, S., Panikkar, K. R and
Rajasekharan, S. 2004 Purola corylifolia ‘Wonder Beans’
Ayurvedic Renaissance 2 (4): 3-6
Suja, S. R., Geetha, B. S., Latha, P. G., Rajasekharan, S.
and Pushpangadan, P. 2004 Protective effect of Trichopus
zeylanicus on genotoxicity induced by cyclophosphamide in
mice, Vaidyaratnam Medical Journal 4: 5-9

Book
Rajasekharan, S., Mohanan, N., Latha, P. G., Mohanal,
Nakshatramvannam. Thennalpa Eco-tourism Promotion
Council, Thiruvananthapuram Pp 104

Report
Final Consolidated Report on Indigenous / Traditional
Knowledge related to Medicinal Plants A Survey on
Thiruvananthapuram, Kollam and Pathanathamthitta Districts
of Kerala under the Implementation on ACA Project on
Promotion of Traditional Technical Knowledge to Kerala State
Planning Board.

Chapters in Books
Koshy & P. Ommah (eds.) Proceedings of National Seminar
on Biodiversity Conservation and Environment Management,
Catholic College, Pathanamthitta pp:71-75.
Dan, M. 2004. Diversity of Zingiberaceae in South India
In: G. Koshy & P. Ommah (eds.) Proceedings of National Seminar
on Biodiversity Conservation and Environment Management,
George, V, Rajasekharan, S., Latha, P.G and. Nair, G.M.
2005. Search for angiotensin converting enzyme inhibitors from
plants based on ethnomedical leads, International Seminar Prithvi
George, V, Rajasekharan, S., Dhruvan, T. and Anil
In: Quality Standards of Indian Medicinal Plants Eds.,
Gupta, A.K., Tandon, N., and Sharma, M., ICMR.New Delhi,
pp.1-8
George, V, Rajasekharan, S., Dhruvan, T and Anil
In: Quality Standards of Indian Medicinal Plants Eds.,
Gupta, A. K., Tandon, N., and Sharma, M., ICMR, New Delhi,
pp.9 19
George, V., Rajasekharan, S., Dhruvan, T. and Anil
Kumar K S. 2005. Monograph on Allium sativum (Linn.) In:
Quality Standards of Indian Medicinal Plants Eds., Gupta,
41
A. K., Tandon, N., and Sharma, M., ICMR, New Delhi, pp. 38-47


Rajasekharan, S., 2004. Indigenous Knowledge on Honey, an article written in Malayalam and included in the publication titled “Thengukaram Panam Kavaram” of All India Radio, Thiruvananthapuram.


Popular Articles


Science of Life 2(3):24 26

Seminars / Workshops / Conferences / organised / attended

TBGRI organized Mushroom Fair from 14-16 February at Trivandrum
Ajikumar Nair, A., Shylesh, B.S., Gopakumar B and Subramoniam A. Anti hyperglycemic activity of Helionitis aritifolia (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.
Gayathri, V. Asha V.V and Subramoniam, A. Identification and separation of thymus gland growth stimulatory factor from Selaginella inovens. Presented at the Southern Regional Conference of Pharmacologists (Indian Pharmacological Society), Amrita Institute of Medical Science, Kochi, Kerala, October 5-6, 2004.
Jope, P. A Attended the Workshop on Assessment of Ecological/Environmental Sensitivity of Hill Stations in Kerala on 10th October 2005 at KFRI, Thrissur.
Jope, P.A. attended and helped to organize Poster sessions of XIV National Seminar of IAAT conducted at TBGRI on 29-31th December 2004.
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, Thycuda, Thrivunanthapuram on 19.01.2006 and presented a paper titled Bamboo Research and Extension Activities at TBGRI implemented under the Western Ghats Development Programme.
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 WGDF, Planning and Economic Affairs Department, Govt. of India at Thiruvananthapuram on 17-19 January, 2006.

Pradeep, C. K., Vrinda K.B. and Sunil Kumar. S. Mushroom Diversity in the Thenmala Forest Division of Western Ghats of Kerala. National Seminar on Recent Advances in Mycology, organized by the Mycological Society of India held at Mangalore University, Mangalore. 2004.


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. 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 organised by the IFS officials from different states of India on 24th September 2004.


Sathishkumar, 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.


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


Shylosh, B.S, Ajikumar Nair S and Subramaniam. A. Induction of cell specific apoptosis by a terpene from Emilia sonchifolia (aerial part). Presented at the Southern Regional Conference of Pharmacologists (Indian Pharmacological Society), Amrita Institute of Medical Science, Kochi, Kerala, October 5-6, 2004.

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.


Subramaniam, 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


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.


Posters Presented


Kerala State Council for Science, Technology and Environment

Hon. Chief Minister, Government of Kerala President
Minister for Industries, Government of Kerala Vice-President
Minister for Finance, Government of Kerala Vice-President
Minister for Agriculture, Government of Kerala Vice-President
Minister for Health, Government of Kerala Vice-President
Minister for Education, Government of Kerala Vice-President
Minister for Forests, Government of Kerala Vice-President
Minister for Water Resources, Government of Kerala Vice-President
Dr M S Valiathan
Secretary, Department of Science and Technology, Government of India Executive Vice-President
Vice-Chancellors of Cochin University of Science & Technology and Kerala Members
Agricultural University Secretary, Finance Department, Government of Kerala Member
Secretary, Planning and Economic Affairs Department, Government of Kerala Member
Five eminent persons nationally known for their expertise in S&T, Industry and Environment (nominated by the Government) Members
Director, VSSC, Thiruvananthapuram Member
Director, RRL, Thiruvananthapuram Member
Director, SCTIMST, Thiruvananthapuram Member
Director, CWRDM, Kozhikode Member
(nominated from among The Directors of R&D Centers on rotation)
Director, RGCB, Thiruvananthapuram Member

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KSCSTE Executive Committee

Executive Vice-President
Secretary,
Department of Science and Technology,
Government of India or his nominee
Secretary,
Planning, Government of Kerala
Secretary,
Finance, Government of Kerala
Director,
CWRDM, Kozhikode (nominated from among The Directors of R&D Centers on rotation)
Director, RGCBL,
Thiruvananthapuram (nominated from Among The Directors of R&D Centers on rotation)
One representative
Members
each of Industry, Environmentand
Education, nominated by the
Government from among the
Members of the Council
Member Secretary

TBGRI Research Council

Prof H Y Mohan Ram, F.N.A., New Delhi
Dr K R Shivanna, Bangalore
Dr A R K Sastri, Kakinada
Dr M A Haque, New Delhi
Dr V Rajagopal, Kasaragod
Prof K S Manilal, Kozhikode

TBGRI Management Committee

Dr S Ganeshan, Director
K R S Krishnan, Member Secretary,
KSCSTE
Dr M Baba, Director, CESS
Smt K S Annamma, Additional Secretary,
Planning and Economic Affairs Department,
Govt. of Kerala
Dr S Rajasekharan, Scientist, TBGRI
Registrar, TBGRI

TBGRI Staff

Dr S Ganeshan
Horticulture and Garden Development
Director
Dr Jacob Thomas
Scientist C (on leave)
Mr A E Shanavas Khan
Scientist B (on leave)

Arboretum, Palmetum and Central Nursery
Dr N Mohanan
Scientist E1, Head
Dr P A Jose
Scientist A
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 Nareendran Nair
Gardener
Mr V Sathees Shan
Gardener
Mr K Vijayakumar
Gardener
Mr G Vijayakumar
Gardener
Mr L Thulasidharan
Gardener
Mr A K Azeeem
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 Sudarsanankurup
Gardener

Ornamental Plants and Plant Distribution
Mr Cheriyani P Koshy
Scientist A, Head
Mr R Rajivkraman
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
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<td>Dr. N S Pradeep</td>
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<td><strong>Plant Biotechnology</strong></td>
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<td>Deputy Director, Head</td>
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Mrs V Sujatha
Mrs Leena Kumari
Mr C R Vinukrishnan

Art and Photography
Mr K P Pradeep Kumar
Mr S Suresh Kumar
Mr C Suseendran

Administrative Staff
Mr S Ram Mohan
Mr P Raghavan
Mr K G Ajithkumar
Mrs S Radhalekshmy Ammal
Mr K M A Rahman
Mr Suresh Chandran
Mrs R Sarala Devi
Mrs C Syamala
Mr Ravi Abraham
Mrs S Meenakumary
Mr K Vijayan
Mr M Anilkumar
Mr M Sulifikar
Mrs B S Ajanthakumary
Mrs S R Bindu
Mrs N Rajalekshmi Ammal
Mrs S Subha Sankar
Mr K Mohammed Habeebulla
Mrs P S Shyladevi
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Mrs R Prasannakumary
Mr K Elias
Mr M Ramaswamy
Mr V Rajendran Nair
Mr R Gopinathan Nair
Mr A Salim
Mr D Mohanachandrakumar
Mr T Mohanakumar
Mr P Rajendran
Mr C P Somasekhara Nair
Mr V Sudheeshkumar
Mr S Chandran Chettiar
Mr C Sathyan
Mr B Vijaya Kumar
Mr G S Madhusoodhanan Asary
Mr B Jayalakshmi
Mr M Shajahan Gardener
Mr S Thulaseedharan
Mrs Kumari Girija
Mrs K Lali Kutty
Mrs Baby Girija

Junior Library Assistant
Helper
Artist/Photographer
Asst. Artist
Photographer
Registrar
Registrar
Asst. Adm. Officer
P. A. to Director
Deputy Registrar
Section Officer (Purchase)
Section Officer
Senior Accountant (Retired)
Accounts Officer (Retired)
Office Asst. Grade-III
Office Asst. Grade-III
Office Asst. Grade-IV
Office Asst. Grade-IV
Office Asst. Grade-IV
Typist Grade-I
Computer Operator
Typist/
Data Entry Operator
Typist
Stenographer Gr. I
Stenographer Gr. II
Store Assistant
Driver Gr. I
Driver Gr. I
Driver Gr. I
Driver Gr. I
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Helper Gr. I
Helper Gr. I
Helper
Gardener (On other duty)
Gardener
Gardener
Gardener
Sweeper
Sweeper
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Sweeper
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Sweeper
Sweeper
Sweeper
Sweeper
Sweeper
Sweeper
Sweepers/Cleaner
Tech. Officer
Asst. Works Supervisor
Electrician
Electrician
Plumber
Pump Operator
Painter
Label writer
Security Officer
Security Guard
(Sergeant in-charge)
Security Guard
Security Guard
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Security Guard
Security Guard
Security Guard
Estate Supervisor
Gardener
Gardener
Gardener
Chairman
Co-ordinator
Information Officer
Technical Assistant
Mr V Gangadhar Pillai
Mr P P Markose
Mr S Ajith
Mr V S Suresh Kumar
Mr P Ajith Kumar
Mr Prabhakaran Nair R
Mr M Madhusoodhanan Nair
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Mrs Baby Girija

Pathenhope Extension Centre

Bioinformatics Extension Centre

Dr S Ganeshan
Dr P N Krishnan
Dr S Sreekumar
Dr C K Biju