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Committed to Conserve Plant Biodiversity in God's Own Country



ANNUAL REPORT
2006-'07

Tropical Botanic Garden and Research Institute

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Annual Report
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Tropical Botanic Garden and Research Institute
Karimancode, P. O., Pacha - Palode, Thiruvananthapuram - 695562, Kerala, India
www.tbgrri.in



TBGRI

Annual Report
2006-07

Contents

Editors

P. G. Latha
N. Mohanan

Editorial Board

P. Padmesh
Mathew Dan

Design and Layout

K. P. Pradeep Kumar

Printed and Published by

S. Ganeshan
Director, TBGRI

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

Phone : 91 (0)472 2869226
2869246, 2869626, 2869628
Fax : 91 (0)472 2869646
e-mail tbgri@sancharnet.in
btis_tbgri@rediffmail.com
website : <http://www.tbgri.in>

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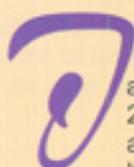
Front cover : *Ochreinauclea missionis* (Wall. ex DC) Rides.
Back cover : Living collections of herbals harmony with
Nature in the Itty Achuthan Valdyan's Garden
Cover Design & Photos : Pradeep Kumar K. P.

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From the Director's Desk



I am proud to present the Annual Report of Tropical Botanic Garden and Research Institute for 2006-2007. The Institute continued to surge forward on the right track. A spate of exciting action-oriented research programmes, well planned and implemented meticulously kept us busy during the year. The major initiatives of the Institute are highlighted below:

The Biotechnology Group successfully developed cryopreservation techniques for zygotic embryos of *Myristica malabarica* and *Coscinium fenestratum*. Significant efforts were made to establish hairy root cultures of *Plumbago rosea* and *Decalepis arayalpatra*. Transgenic callus was initiated from *Rauvolfia micrantha* cotyledenous explants. Primers specific to plant polyketide synthase gene was used for amplification of gene of *Hypericum* species.

The DNA bar coding of Bamboo species was initiated in collaboration with The Energy Resources Institute (TERI), New Delhi. A model medicinal garden was developed with Botanic Garden Conservation International (BGCI) support. *Habenaria flabelliformis* and *Seidenfia crenulata* were rediscovered from Anamudi and Munnar respectively. Twin and albino seedlings of *Humboldtia vahliana* and *Syzygium mundagon* were recorded for the first time. The Fern collection has been elevated to the position of one of the largest in the country. The Live Collection was enriched by 72 medicinal plant species, 20 bamboos, 8 palms, 100 orchids and 25 tree species.

The Conservation Biology Group studied the plant pollinator interactions, sexual system and level of gene flow in two endemic species of the Western Ghats, *Palaquium ellipticum* and *Cassine kedarnathii*.

Documentation of Traditional Knowledge related to plants used as food and medicine in Kerala has been completed. Several ethnomedicinal plants have been pharmacologically evaluated for hepatoprotective, antiinflammatory, antidiabetic, antiallergic and antiulcer activities.

The Phytochemistry Division has bioprospected selected ginger and *Ganoderma* species from the Western Ghats. An active fraction from *Sida* species has been formulated into an analgesic, anti-inflammatory and diuretic drug useful for arthritis.



The Plant Systematics and Evolutionary Science Group undertook the systematic and reproductive ecological studies on Balsams, besides several other Rare Endangered and Threatened species. Quantitative assessment and Mapping of Non Wood Forest Produce of South Kerala was completed. 523 collections of mushrooms were made during the period and 46 new species of microfungi were identified.

The Library acquired 400 books and 175 back volumes increasing the collection to 8296. Several training programmes and extension activities were conducted during the period. The Institute organized the International Workshop on "Conservation of Cycads of India" from 17-20 July 2006 and the National Symposium on "Current Trends in the Development of Herbal Drugs" from 25-27 November 2006 at Thiruvananthapuram, besides the Brainstorming Workshop on "Biodiversity Conservation through Biotechnological Interventions" from 10-11 January 2007.

The Institute operated 41 Plan funded research programmes. About 15 new externally funded research programmes were initiated, in addition to the 33 ongoing programmes funded by various national agencies like Indian Council of Medical Research (ICMR), Department of Biotechnology (DBT), Ministry of Environment and Forests (MoEF) etc. Our facilities were utilized by postgraduate students from different parts of the country for projects and dissertations. Academically, the year was highly rewarding. Three books, 12 chapters in books and 105 research papers were published. Three students were awarded Ph D degree. Scientists took part in several National and International conferences to present their findings.

The year ended on a memorable note for TBGRI. The Institute was overwhelmed by the visit of the Honourable Chief Minister of Kerala, Shri V. S. Achudanandan on 13th December 2006. He inaugurated the new Silver Jubilee Visitors Complex, Herbarium Block and released TBGRI publications entitled "Flowering Plants of Kerala - A Handbook" and a video documentary CD entitled "Saga of TBGRI".

TBGRI will continue its mandate of conservation and sustainable utilization of the plant wealth of the country, thus contributing to nation building by providing leadership, scientific expertise and infrastructure.

The various achievements made during the period were the result of the wholehearted and sincere efforts of TBGRI community. The guidance received from the KSCSTE, the Executive Vice President, Research Council and the Management Committee is gratefully acknowledged.

S. Ganeshan

Garden Management, Education, Information and Training

The Division involves in the development and maintenance of *ex-situ* Conservatories - the Arboretum, Palmetum, Fernery, Jasmines, Orchard for lesser known fruit plants, Cacti and Succulents, Ornamental plants, Gymnosperms and Conservatory for rare plants of the Garden. The unit also manages activities of the Central Nursery.

During the report period 25 accessions were introduced to the Arboretum. Rare species introduced are *Cassine glauca*, *Garcinia wightii*, *Oncobe spinosa* and *Syzygium munronii*. The regular maintenance of the Arboretum and recording of the growth performance continued. Under extension programme, saplings of star trees were propagated and widely supplied among the public. Selected economically important trees were multiplied and sold through the sales unit. Under the WGDP project on conservation of endemic trees, a restoration programme was initiated during 2006. 100 saplings each of *Buchnanian barberi*, *Buchnanian lanceolata* and *Humboldtia decurrens* were reintroduced into their original habitats. They are regularly being monitored.

Regular maintenance of the Palmetum continued. Landscaping of the Palmetum and latritic bunding to the palms was completed. About 2000 seedlings were raised for sales and supply. In 2006, an externally funded project on Conservation

of Endemic Palms of Western Ghats was initiated. Exploration trips were made throughout the state and seeds and seedlings of 18 native palms were



PHOTOGRAPH BY K. P.

"Silver Jubilee Visitors Complex" being inaugurated by the Honourable Chief Minister of Kerala, Shri V. S. Achuthanandan.



PHOTOGRAPH BY K. P.



N. MOHANAN



P. RAJESH K. P.

- a. The Lake, a subtle view.
- b. *Gnetum edule* (Willd) Bl. natural to the garden.
- c. *Calamus gamblei* Becc., endemic to South Western Ghats.

introduced to the Garden. Over 300 seedlings of endemic palms were raised for conservation purposes.

Central Nursery of the garden took

care of the regular up keep and maintenance of the nursery. 29000 clonal materials belonging to 120 accessions were tried for vegetative propagation and 12000 saplings were produced in polybags. 5450

established plants were given to sales counter and about 400 plants were given to the garden for planting at different sites. Development and maintenance of *Jasminum* germplasm continued. 30



- a. *Kunstleria keralensis* Mohanan & Nair, a rare endemic plant in flower at Arboretum
- b. Vegetative propagation of *Kunstleria keralensis*
- c. A variegated mutant of *Jasminum ritchiei* C. B. Clarke from TBGRI, registered (INGR 07043) by Plant Germplasm Registration Committee, ICAR

Jasminum stock plants were planted in the field, for taking clonal material for large-scale multiplication. Rs.1,60,000/- was earned through sale of plants.

The three-year project (2004-2007) on 'Development of propagation profiles and restoration of economically important endemic plants of Western Ghats' was completed in March 2007. The work focussed on the propagation and multiplication of the endemic species through standardized propagation methods. As part of this programme clonal propagation through stem cutting and air layering was achieved in *Antidesma montanum*, *Humboldtia vahliana*, *Hydnocarpus macrocarpa*, *Lagerstroemia microcarpa* and *Syzygium mundagom*. Air layering of *Hydnocarpus macrocarpa* and clonal propagation of *Gymnacranthera canarica* are under trial. Seed type of *Antidesma montanum* (Intermediate), *Humboldtia vahliana*, *Gymnacranthera canarica*, *Hydnocarpus macrocarpa* (Recalcitrant) and *Lagerstroemia microcarpa* (Orthodox) were categorised. Twin and albino seedlings were recorded for *Humboldtia vahliana* and *Syzygium mundagom* for the first time. Seed pest of *Humboldtia vahliana*, *Cryptorhynchus indicus* Motschulsky (Coleoptera: Curculionidae), the causal factor for poor regeneration of the species was identified. 600 seedlings of the candidate species were raised for restoration.

The ornamental plant collections, conservatories, gardens and landscape were properly maintained. Slight

restructuring and beautification was done on the front area of Office Complex, entrance and the side of the Guest House road. New planting in the shrubbery and round the year planting of annual beds were done to add variety to the Garden. The first stage of identification and documentation of the ornamental plants was completed during the year. Over 600 ornamental plants were identified and documented, giving emphasis to their landscape potential.

Maintenance and further development



a & b. *Billbergia fessmannii* Harms (Bromeliaceae) in flower

PRADHEEP KUMAR K. P.



SHEREEF S. M.

SHEREEF S. M.

RAJU ANTONY

- a. "The India Carpet Bed" made of *Alternanthera* varieties, highlighting the statue of Pandit Jawaharlal Nehru, after whom the garden wing of TBGRI is named.
- b. *Flacourtia montana* Graham, an endemic edible fruit tree of the Western Ghats.
- c. *Rubus niveus* Thunb. a wild edible fruit. (New addition).
- d. Female cone of *Ceratozamia kuesteriana* Regel, a rare cycad.

of orchard for lesser-known fruit plants continued. During the year, fruit plants such as *Syzygium lanceolatum*, *S. laetum*, *S. munronii*, *Rubus niveus*, *R. ellipticus*, and *R. fairholmianus* were added to the existing germplasm. 50 plants belonging to 35 species were planted in the orchard. About 10,000 saplings were raised for public distribution and sales.

The fern collection of TBGRI is one of the largest within the country. With the addition of 25 species during the report period, presently the fernery holds 200 species out of which 40 species are rare ones. The taxonomic studies on ferns continued. 60 specimens were identified and confirmed. The gymnosperm collection now holds 32 species out of which 15 are

cycads and the rest conifers. Many of the cycads grown in the field coned during the report period. All the cycads were labelled.

The project on the 'Collection, propagation, reintroduction and popularisation of ten endemic tree species of Western Ghats', approved under Western Ghats Development Programme continued. Extensive survey was done throughout Western Ghats areas in Kerala region. Viable populations of all the 10 species were identified at different areas of the Western Ghats. Seed propagation methods were standardised for *Artocarpus hirsutus*, *Myristica malabarica*, *Buchanania lanceolata*, *Buchanania barberi*, *Humboldtia decurrens* and *Baccaurea courtallense*. Vegetative propagation



PHOTOGRAPH BY RAJANTONY



SHEREEF S. M.



RAJANTONY

- a. Inaugural ceremony of the International Workshop on "Conservation of Cycads in India".
- b. Dr. Frazer-Jenkins, Pteridologist, The Natural History Museum, London, visiting the Fernery.
- c. *Asplenium grevillei* Wall. ex Hook. & Grev., an endangered spleenwort rediscovered after a lapse of three decades.

methods were standardized for *Buchanania lanceolata* and *Humboldtia decurrens*. A few seedlings only could be raised for *Vateria macrocarpa* and *Disoxylum malabaricum*, since we could obtain only very little seeds. All together over 2000 seedlings belonging to the ten species were raised and are being maintained at the nursery. As a part of the restoration programme, 100 seedlings each of *Buchanania barberi*, *Buchanania lanceolata* and *Humboldtia decurrens* were reintroduced in the natural habitat of these species in Palode, Ponnudi and Sankili forests of Western Ghats. Regular monitoring is being done with the assistance from the Kerala Forest Department.

"Ex-situ Conservation of Endemic

Arborescent Crop Relatives of Western Ghats." is a newly sanctioned project, funded by the Botanical Garden Conservation International, UK, (October 2005) which aims at the development of an *ex-situ* conservatory for endemic crop related tree species such as *Cinnamomum*, *Garcinia*, *Myristica* and *Syzygium* of the Western Ghats. Populations of 16 endemic arborescent crop relatives were located throughout the southern Western Ghats and these species were introduced to the garden for *ex-situ* conservation. A suitable plot in the garden site was selected for the developing of *ex-situ* conservatory. 36 accessions belonging to the 16 species were planted in the *ex-situ* conservatory. Extremely rare endemic species such as *Garcinia imberti*, *Garcinia travancorica*,

Garcinia wightii, *Syzygium travancoricum*, *Cinnamomum riparium* etc. comprise this collection.

"Survey, Collection, Propagation and Popularisation of selected Threatened Palm species of southern Western Ghats & Electronic Herbarium Database preparation of Palms in Kerala" is a new project sanctioned by the Western Ghats Development Programme. The project aims at the survey and documentation of native palms of Kerala and *ex-situ* conservation of seven rare and threatened palm species viz. *Bentinckia condapana* Berry, *Corypha umbraculifera* L., *Pinanga dicksonii* (Roxb) Blume, *Calamus brandisi* Bec., *Calamus dransfieldi* Renuka, *Calamus nagabettai* Fernandez & Dey and



a. The Honourable Chief Minister, Shri. V. S. Achudanandan, releasing the CD on TBGRI. Looking on are Smt. J. Arundathi, MLA and Dr. S. Ganeshan.

b. The Honourable Chief Minister planting a sapling at TBGRI.

Calamus vattayila Renuka. Literature survey and available data collection was done from various sources. Survey and

documentation was initiated. Population of all the targeted species were located and propagules were collected. About 50 digital photographs were collected for the digital herbarium. Propagation trials were initiated in *Bentinckia condapana*, *Corypha umbraculifera*, *Pinanga dicksonii* and *Calamus vattayila*. Seeds of other rare palms like *Calamus travancoricus*, *Calamus brandsii*, *Calamus shendurunii* etc. also were collected for germination and propagation.

One of the memorable events was the inauguration of the magnificent Silver Jubilee Visitors Complex, located amidst the tranquil surroundings of the Chittar River, by the Hon'ble Chief Minister of Kerala, Sri V. S. Achudanandan on 13th December 2006. A 15-minutes documentary film on the Garden was also released by the Hon'ble Chief Minister on the same day. A multicolour brochure about the vision and the functioning of the institution was brought out.

GRAPHICS - PRADEEP KUMAR K. P.



Plant Genetic Resources

As part of the All India Coordinated Project of Taxonomy on Orchids, a month-long trip was conducted to Andaman group of islands and over a 100 species of orchids were collected. Those that flowered later under cultivation were identified. Critical studies on a few species (*Tropidia*, *Bulbophyllum*, *Dendrobium*) continued. Preliminary studies confirmed that *Bulbophyllum macrocoleum* Seidenf. and *Dendrobium incurvum* Lindl. are new records for India. The former species was described from Thailand and Vietnam in 1979. The latter species was described from Thailand and thus far believed to be endemic. The present discovery of this

species from the Andamans thus extends their distribution range. *Bulbophyllum rufinum* Rchb. f., *Grosourdyia muscosa* (Rolfe) Garay, *Rhynchostylis gigantea* Ridl., *Thelasis pygmaea* (Griff.) Bl., *Oberonia gammiei* King & Pantl. and *O. mucronata* (D. Don) Ormerod & Seidenf. also flowered under cultivation. Critical studies on the genus *Habenaria* enabled grouping three species with two peculiar flat and rhomboid stigmas into a new genus, which is proposed to be named as *Ebarnesia* after Prof. Edward Barnes.

As part of preparation of Red Data Book of Indian Orchids supported by Dr B.

P. Pal National Environment Fellowship, based on the Catalogue of Endemic Orchids of India searches were made in and around the type localities of many rare and endangered orchids in the Western Ghats. This resulted in the collection and

Orchid novelties

New Genus

Luisiopsis Sathish & Suresh, *Rheedea* 15(1) : 46. 2005.
Luisiopsis inconspicua (Hook. f.) Sathish & Suresh, *Rheedea* 15(1) : 48. 2005.

New Species

Bulbophyllum manipurensis Sathish & Suresh, *Rheedea* 15(1) : 12. 2005
Goodyera myanmarica Ormd. & Sathish Kumar, *Taiwania* 51(3) : 156. 2006.

New Records for India

Bulbophyllum propinquum Krzl. from Manipur
Phalaenopsis fasciata Rchb. f. from Manipur
Dendrobium parcum Rchb. f. from Manipur

New Records for States

Cleisostoma discolor Lindl. for Manipur
Cleisostoma williamsonii (Rchb. f.) Garay for Manipur
Eria globulifera Seidenf. for Manipur
Vanda pumila Hook. f. for Manipur
Vanilla parishii Rchb. f. for Manipur
Vanda wightii Rchb. f. Karnataka and Kerala
Oberonia wynadensis Sivadas & R. T. Bala. for Karnataka

New to Science



Bulbophyllum manipurensis



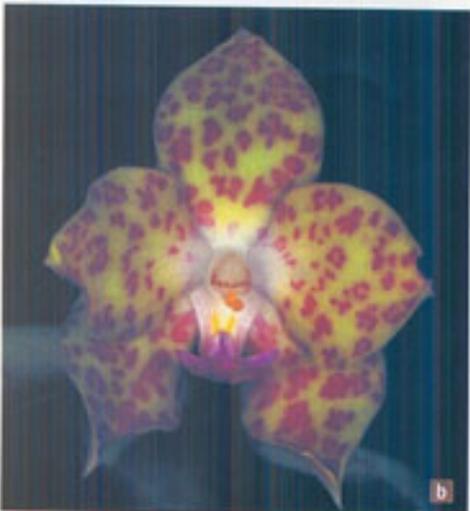
rediscovery of several species that were believed to be extinct. *Seidenfia crenulata* (Ridley) Szlach., originally described from Nilgiris was rediscovered from Munnar in Kerala. Similarly, *Habenaria flabelliformis* Summerh. ex. Fischer was collected from the Anamudi slopes after the type collections by Edward Barnes. Detailed studies based on fresh collections were completed on 70 species.

In the project entitled "Bamboo and Reed Resource Enhancement in Kerala", the Bamboo germplasm was enriched by planting 20 saplings in the Bambusetum. Five collection trips were conducted to forest areas of Bonacaud, Munnar,

a. *Ascocentrum ampullaceum* (Roxb) Schltr.

b. *Hygrochilus parishii* (Veitch & Rchb. f) Pfitz.

c. *Dendrocalamus giganteus* Wall. ex. Munro.



Pooyamkutty, Ponmudi, and Kallar - Valley and 27 field numbers of offsets and specimens were collected. All offsets were planted in the Bambusetum nursery for future study and introduction. The specimens were processed for herbarium. Data regarding the seedlings found growing inside a clump of *Ochlandra scriptoria* were gathered. The reproductive biology of

Teinostachyum wightii is being studied. Culm sheaths were collected from 10 clumps and processed for herbarium.

DNA Barcoding in *Bambusa* spp. (Bamboos) is a collaborative project between TBGRI and The Energy and Research Institute (TERI), Delhi, funded by DBT. TBGRI has a major role to locate

different species of *Bambusa*, identify them authentically and enable the collaborating team to get samples needed for DNA Barcoding. Accordingly, we have supplied 210 samples of 35 field numbers (61201-61235) from 30 *Bambusa* clumps, 28 accessioned in the bambusetum and two from the wild to Dr Sanjay Saxena, PI of the project from TERI who visited TBGRI on March 2007. The collections belonged to 14 taxa under nine species. These include species with wide range of variations. e.g. *Bambusa bambos*, *Bambusa vulgaris* etc. Samples were collected from all such variants for screening. The processing of three sets of voucher specimens for herbarium is in progress.

In the project on "Self-sustenance of Bamboo and Reed Resource Enhancement in Kerala through Intensive Farming", 14065 saplings of 12 species were produced. Two new hybrids were developed through crosses among three *Ochlandra* spp.

As part of the extension activity of Bamboo projects 6998 saplings belonging to 18 species viz. *Arundineria* sp. (443 saplings), *Bambusa bambos* (1331 saplings), *Bambusa vulgaris* (124 saplings), *Bambusa variegata* (230 saplings), *Bambusa balcooa* (36 saplings), *Bambusa multiplex* (2 saplings), *Bambusa vulgaris* cv. 'wamin' (169 saplings), *Bambusa* sp. (126 saplings), *Dendrocalamus brandisii* (1024 saplings), *Dendrocalamus giganteus* (136 saplings), *Dendrocalamus hamiltonii* (733 saplings), *Dendrocalamus membranaceus* (57 saplings), *Dendrocalamus strictus* (174 saplings), *Ochlandra wightii* (14 saplings), *Ochlandra scriptoria* (176 saplings), *Ochlandra travancorica* (162 saplings), *Oxytenanthera nigrociliata* (1837 saplings), *Thyrsostachys siamensis* (224 saplings) - were distributed to about 50 beneficiaries including the Tourism Promotion Officer, Thenmala Eco-Tourism; Iqbal College, Peringammala; The Thenmala Eco-Tourism Promotion Society; The Divisional Manager, KFDC, Thiruvananthapuram; Govt. BHS, Koodal; Dept. of Botany, University of Kerala, Karyavattom; Sri

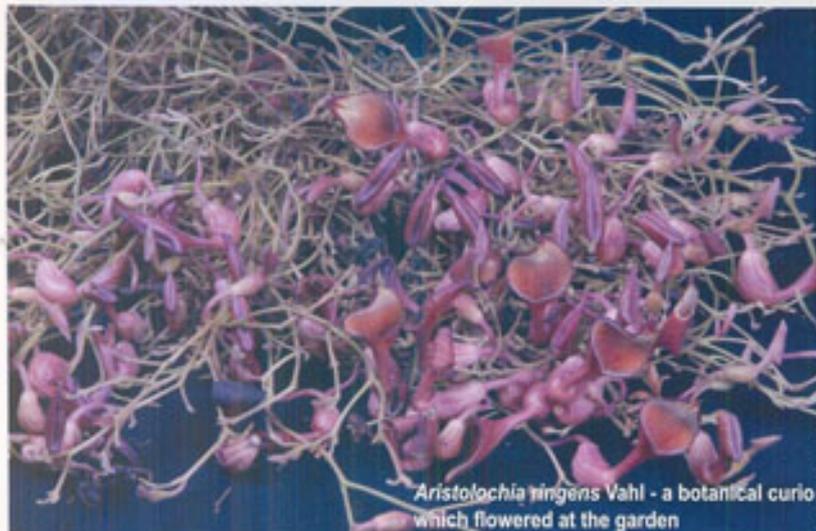


FRANKEP KUMAR K.



a. A view of Bambusetum

b. Conservatory house of Medicinal and Aromatic Plants in the Field Gene Bank



Aristolochia ringens Vahl - a botanical curio which flowered at the garden

presence of aromatic compounds and high percentage of piperine. Due to the unique lemony scent of the leaves and characteristic organoleptic properties of the fruits, *Piper nigrum* L. 'PMM' is considered as a potential genotype of the species especially in the context of genetic improvement of the spice crop with respect to quality of the spice.

The 'Seed Bank' component of the NGBMAP project was enriched with accessions of M & AP species, by adding 150 accessions of 17 species.

As part of the project Establishment of Milieu-based Sanctuary and Conservation-Education Centre of Medicinal Plants of the Western Ghats a book entitled "Medicinal Plant Resource of Kerala Towards harnessing its potential - Part I- Introduction" was published. Seven plant explorations were conducted to different parts of the Western Ghats, in Kerala and Tamil Nadu. As a result, 142 accessions belonging to 62 medicinal plant species were collected and introduced to the herbal Garden of TBGRI. A new species - *Acrotrema agastyamalayana* Santhosh, M. Dan & G. M. Nair was described. The main entrance of the herbal garden was landscaped and twining herbals were planted in a line facilitating them to climb on umbrella model iron frames, fixed for each plant, so as to form attractive shapes. The plants include *Vallisneria spiralis*, *Ipomoea mauritiana*, *Thunbergia fragrans*, *Pachygone ovata* etc. A traditional architectural feature of the walls - 'Sopanam' like structures, common in temples of Kerala - were made on the walls of the three 'Kottiyambalam' style entrances of the Itty Achuthan Vaidyan's Garden as part of enhancing its ancient look.

As part of development of the systematic garden, 110 species belonging to 36 genera (representing 35 Angiosperm families) were collected, identified, maintained and planted in the display beds. The species selected for the garden are typical members of the genus/family, which it represents. This project aims to impart to the visitors the basic principles of taxonomy, important features of the genus/family and, to create interest in them on botanical identification of plants.

In the project 'Carpology studies on South Indian *Rauvolfia* species' seed morphology studies of the following species of *Rauvolfia* - *R. micrantha*, *R. serpentina*, *R. verticillata*, *R. hookeri* and *R. tetraphylla* were undertaken and a key for identification of the *Rauvolfia* species based on seed morphology was developed. Seed protein profiling of all these species were also carried out.

As part of the project - 'Establishment of seed bank, propagation and ex-situ conservation of endemic and threatened species of the Western Ghats' - seeds of rare species of the region such as *Buchnanan barberi*, *Humboldtia decurrens*, *Piper barberi*, *Goniothalamus rhynchantha*, *Popowia beddomeana* and *Janakia arayaipathra* were collected and basic studies related to seed germination were





A view of the Itty Achuthan Vaidyan's Garden, showing its 'Kottiyambalam - style' main entrance

PHOTOGRAPH BY K. P. K.



Balanophora abbreviata Bl.,
a rare parasitic medicinal herb

carried out.

The Botanic Gardens Conservation International (BGCI) funded project 'Establishment of Model Medicinal Plant Garden at TBGRI' is aimed to promote awareness among public on conservation and sustainable utilization of medicinal plants of the region. An ideal one-hectare plot in one of the natural forest patches of TBGRI, harbouring many herbals was selected for the establishment of the garden. The herbals occurring in the plot were located and identified prior to introduction of suitable species to the plot. Proper care has been taken to develop the garden without destroying the natural setting of the plot, so that visitors can understand and appreciate the intricacies involved in the ecosystem in which the herbals sustain themselves. A garden trail of 200m length was made, connecting the Itty Achuthan Vaidyan's Garden and the MMPG. 540 plants belonging to 47 species were introduced in the garden. A model of a pond ecosystem and an educational display of components of a food-web were developed. 27 educational boards were installed in appropriate locations to project various aspects of the herbals or features of their ecosystem for the benefit of the visitors. A model developed for creating awareness on the deleterious effects of



debarking of 'medicinal trees' an example of destructive harvesting of NWFP going on in forests of the Western Ghats has attracted many visitors to MMPG. 152 herbarium specimens representing 42 field numbers were mounted, labeled and handed over to the herbarium (TBGT).

The project - 'Standardization of tissue culture techniques and mass production of ornamentals' addressed micropropagation of the following ornamentals/commercially important plants - *Phalaenopsis*, *Vanilla*, *Philodendron*, *Nepenthes khasiana* and ten ornamental varieties of *Anthurium* such as 'Senator', 'Mauritian Orange', 'Mauritian

- In vitro* multiplication of the endemic species *Amomum cannicarpum*.
- Micropropagation of *Curcuma vama*, an endemic ginger of South India.
- Microplants of a very rare ginger - *Alpinia abundiflora* growing in greenhouse conditions.

Red', 'Rosetta', 'Hawaii orange', 'Agnihotri', and 'Madourie'. Mass propagation of three cultivars of banana- 'Red banana', 'Robusta' and 'Rasakadali' were also



PRACEEP KUMAR K. P.

Aquatic / marshy herbals in the milieu-based Sanctuary of Medicinal Plants

undertaken. Altogether, about 50,000 plantlets of the above mentioned plants were produced and sold to the public.

The project 'Tissue culture multiplication for mass production of selected economically important bamboos' addressed standardization of micropropagation of two species- *Ochlandra wightii* and *Dendrocalamus giganteus*. Seeds, rhizomes and seedlings of the two species were collected from the wild and maintained in the experimental garden as source of explants. In the case of *O. wightii*, embryos showed multiple shoot development in basal medium containing

BAP, KN and TDZ within of 30 days. About 5-15 shoots were obtained at the end of second subculture. The shoots, rooted in IBA/NAA were transferred to the green house and the plantlets showed high percentage of survival rate. The studies for improving rooting and hardening are progressing. Multiple shoots were induced from nodal explants of 2-3 year old seedlings of *Dendrocalamus giganteus* using BAP/KN/TDZ. The seedlings of the species were scarce in the wild in the known localities and it limited the availability of explants and progress of the study.

As part of the project - 'Collection, micropropagation and reintroduction of some endemic Zingibers of the Western Ghats' a plant exploration trip was conducted to Pamba, Angamuzhi and Moozhiyar region and 26 plants of 13 species were collected. Micropropagation technique of three species *Alpinia abundiflora*, *Amomum cannicarpum* and *Curcuma vamana* were standardized. *In vitro* studies of *Alpinia zerumbet* is progressing. The microplants produced were hardened and established in the green house as well as in the field.



Biotechnology and Bioinformatics

Cryopreservation protocols were developed for the zygotic embryos of *Myristica malabarica* and *Coscinium fenestratum*. Shoot tips and somatic embryos of *Kaempferia galanga* were cryopreserved with 20 and 40% recovery rates respectively. The seeds of *Nothapodytes nimmoniana* were found to be intermediate type with long dormancy period, showing 21% germination after LN exposure for 24 hours. A rapid propagation protocol using seedling explants was developed for *Rubia cordifolia*. Micropropagated plants of *R. cordifolia*, *Celastrus paniculata* and *Rauvolfia serpentina* were established successfully in the greenhouse at 72-93% rate. *Ammomum fenizii* an endangered Zingiberaceae member otherwise endemic to Andaman Islands was cloned using rhizome bud cultures. The essential oil extracted from the rhizome, leaves and pseudostem parts of the plant were found to have methyl chavicol (41.09%) and anethole (49.3%) as the major constituents.

Seeds of 7 Western Ghats orchids (*Pecteilis gigantia*, *Coelogyne nervosa*, *Eulophia macrostachya*, *Acampe praemorsa*, *Vanda testacea*, *V. tessellata* and *Arundina bamboosifolia*) were deposited in the cryobank. Cryopreservation of embryos or protocorms proved successful in 6 species (*Cymbidium bicolor*, *Dendrobium ovatum*, *Coelogyne nervosa*, *Rhyncostylis retusa*, *Vanda spathulata*, *Vanda testacea*) through

encapsulationdehydration method. Pollinia of 15 orchid species (*Habenaria perrottetiana*, *H. crinifera*, *H. longicorniculata*, *Ipsea malabarica*, *Calanthe masuca*, *Arundina graminifolia*, *Smithsonia maculata*, *Aerides ringens*, *Dendrobium ovatum*, *D. macrostachyum*, *Satyrium nepalense*, *Eulophia nuda*, *Pecteilis gigantea*, *Bulbophyllum nelgherrense* and *Pholidota imbricata*) were successfully cryopreserved and germinated at 40-85% efficiency. Pollinia of *Rhyncostylis retusa*, *Luisia macrantha*, *Cymbidium aloifolium*, *C. ensifolium*, *C. bicolor*, *Habenaria perrottetiana*, *H. crinifera*, *Pecteilis gigantia* and *Arundina bamboosifolia* were deposited in the cryobank. Protocols were standardized for field level (*in situ*) pollinia cryopreservation of *Habenaria perrottetiana*, *H. longicorniculata*, *Pecteilis gigantia* *Satyrium nepalense* and *Arundina graminifolia*. Fruit set, viable seed formation and seed germination were obtained through sib-mating using cryopreserved

pollinia of 9 Western Ghats orchids (*Acampe praemorsa*, *Calanthe masuca*, *Cymbidium aloifolium*, *C. ensifolium*, *Dendrobium macrostachyum*, *Eulophia epidendrea*, *Eulophia macrostachya*, *Rhyncostylis retusa* and *Vanda testacea*). Fruit set and viable seed formation was obtained in 5 intergeneric/interspecific crosses using cryopreserved pollinia (*C. ensifolium* X *C. bicolor*, *Calanthe masuca* X *Spathoglottis plicata*, *Pecteilis gigantea* X *H. perrottetiana*, *Vanda spathulata* X *V. tessellata*, *Vanda tessellata* X *Luisia macrantha*). *In vitro* pollen germination of 13 orchids of Western Ghats was confirmed after prolonged storage (6-24 months) in LN. *In vitro* seed germination in 9 Western Ghats orchid species was confirmed after prolonged storage (6-24 months) in LN.

Twelve lesser-known cultivars of *Musa* were collected. Genomic DNA extraction methodology was standardised for their leaf samples. Flow cytometric screening of presumptive induced variants (gamma ray-

- Development of cryopreserved embryos of *Celastrus paniculatus*.
- Mericlones derived from cryopreserved embryos of *Celastrus paniculatus*.

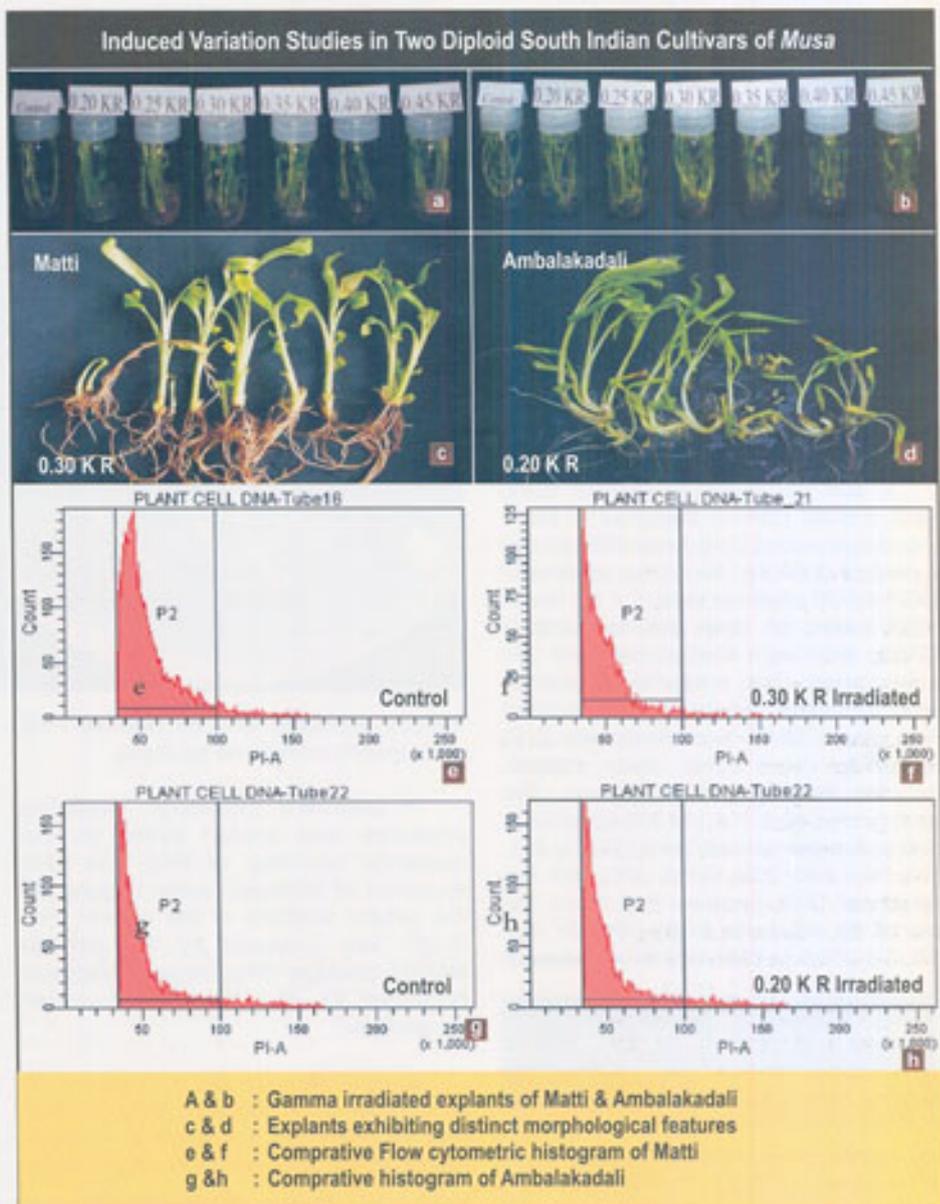


irradiated) of Matti and Ambalakadali did not indicate significant genetic variations. Micropropagation protocol was standardized for three local cultivars ('Ambalakadali', 'Zansibar' and 'Perumpadali') and micropropagated plants are being popularized among the local farmers. A diploid *Musa acuminata* was located at Bonaccord, seeds of which were germinated and seedlings reintroduced into the natural habitat, as part of conservation programme. Collaboration was established and germplasm collected from National Research Centre for Banana (NRCB), Trichy and plants raised in the Botanic Garden at Palode. A Concept Note on 'Conservation and prospecting of vanishing wild *Musa* species in southern Western Ghats through development of *ex situ* and *in vitro* strategies for sustainable resource management was prepared and submitted to NAIP (ICAR). Similarly, a project proposal for conservation of wild *Musa* of the southern Western Ghats was submitted to DBT, Govt. of India.

Rooted rattan plants (5-7cm) obtained after 18-24 months through embryo, seedling and offshoot tip cultures were hardened and established at 79-92% rate in the mist house. After 4-6 months of nursery establishment, the well rooted hardy plants were reintroduced to different forest segments of Western Ghats viz. Palode, Peppara, Kulathuppuzha and Aryankavu at the onset of south-west monsoon (May-July 2004, 2005, 2006) for studying the establishment rate. Maximum of 80-97% establishment was recorded at Palode and Podium tribal settlement in Peppara Wild Life Sanctuary after twelve months of observation. All the plants showed uniform growth and were free from morphological and growth abnormalities.

Hairy root cultures, established earlier after infecting shoot cultures of *Plumbago rosea* with A4 strain of *Agrobacterium rhizogenes*, were cultured in 250ml shake flasks as well as in 3 lit Infors Bioreactor. Growth index of the cultures developed in both the systems was significantly different with mean values 9.25 and 30.5 recorded respectively. Higher rates of biomass production in the bioreactor system however did not affect the unit concentration of plumbagin (1.1% gm dry wt).

An ointment was formulated from the hairy root extracts of *Plumbago rosea* for external application against the skin allergic problems (Eczema) in human beings. The formulation was subjected to antibacterial (*Serratia marcescens*, *Pseudomonas*



fluorescens, *Klebsiella pneumoniae*, *Escherichia coli*, *Salmonella typhi*, *Bacillus subtilis*, *Staphylococcus aureus*, *Pseudomonas aeruginosa*, *Proteus vulgaris*) and antifungal (*Candida albicans*) assays. The formulation showed very promising antimicrobial activity. The formulation was also subjected to sensitization studies in experimental guinea pigs and found not to elicit allergic reactions on skin. In experimental cancer cell lines, the formulation inhibited cell proliferation.

Established rapidly growing hairy root clones of *Decalepis arayalpathra* in shake flasks. Gene *rol A* was detected for the confirmation of transformation using PCR analysis. Phytochemical analysis confirmed the presence of the root specific compound 2-hydroxy 4-methoxy

benzaldehyde. The cost effective nature of the process to produce the compound is being evaluated. As part of the Plan Project on Establishment and phytochemical analysis of hairy root cultures of *Rauvolfia micrantha*, a rare medicinal plant, aseptic seedlings were established for hairy root induction. Normal roots were induced by culturing hypocotyl explants on medium with appropriate auxin combination as control. Transgenic callus and hairy root cultures were initiated on hypocotyls and cotyledon explants of *Rauvolfia micrantha* for the synthesis and accumulation of root-specific alkaloid, ajmalicine, a high-value anti-hypertensive agent. The work is under progress.

Degenerate primers specific to conserved domains of plant polyketide

synthase gene (PKS) was selected and used for amplification of cDNA from *Hypericum* sp. following standard protocols. Amplicons generated were agarose fractionated, eluted and cloned into T/A cloning vector and sequenced. Out of the 12 degenerate primer pairs used, 10 yielded amplicons ranging in size from 220 to 800 bp. Sequence homology search using the BLAST network service showed homology of these sequences with chalcone synthase gene from other plant sources. Multiple alignment of the putative PKS sequence of *Hypericum* sp. with CHS sequence from other plant sources was performed using the software CLUSTALX.

5' and 3'RLM-RACE analysis using gene specific primers designed to these sequences yielded 5' products of 850 bp and 3' product of 600bp. Sequence analysis of PKS1 RACE products yielded a full length cDNA having an open reading frame of 1173 bp encoding a 42 kDa protein with 390 amino acids. The nucleotide sequence similarity matrix showed that the isolated PKS shared 53-66 % similarity with CHS sequences from other plant species including members of *Hypericum*. The catalytic triad (Cys 164, His 303 & Asp 336), CHS active site residues (Met 137, Gly 211, 216, Phe 215, 265 & Pro 375) and the conserved CHS residues that forms the floor of the active site cavity (Thr 197, Gly 256, Ser 338 & Ile 254) were well conserved

RLM-RACE analysis of PKS sequences from *Hypericum* sp



Lane 1	: CHSA1 5' RACE products
Lane 2 & 5	: 100 bp DNA ladder
Lane 3	: CHSA1 3' RACE products
Lane 4	: BPS 5' RACE product
Lane 6	: BPS 3' RACE product



thereby indicating that the isolated PKS corresponds to chalcone synthase.

A standard homology modeling procedure was applied based on the sequence homology of PKS and CHS sequence of *Medicago sativa* to generate the tertiary structure of the protein. The model was produced by the SWISS-MODEL package (<http://expasy.ch/spdbv/>) provided by the Swiss-PDB-viewer programme.

Genetic diversity was estimated in 13 accessions of the otherwise self-pollinated *Mucuna pruriens* comprising varieties *pruriens* and *utilis* collected from tropical

a. Aseptic seedlings of *Rauvolfia micrantha*

b. Normal roots.

c. Transgenic callus and hairy roots on hypocotyl explants.

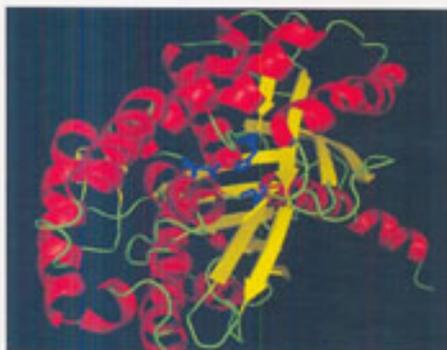
humid forest in the windward side of the Western Ghats of Kerala using 15 RAPD primers. Similarity index value of 0.68 based on Nei and Li's similarity coefficient indicated high degree of genetic variability. Analysis of various genetic diversity indices like total heterozygosity (Ht), Nei's gene diversity (h), % of polymorphic loci (P),



a. *Mucuna pruriens* callus culture

b. Shoot regeneration from callus

c. *In vitro* raised plantlets of *M. pruriens*



Tertiary structure of Polyketide synthase from *Hypericum* sp. Conserved amino acid residues are shown in blue while the core is red, yellow and green; red indicates helices, yellow indicates strands and green the random coils

expected (N_e) and observed number of alleles (A) and Shannon Index (I) strongly suggests that variety *pruriens* is genetically more diverse than variety *utilis*. Chemical analysis with respect to L-DOPA content shows uniform distribution of percentage content of active principle (2.20-0.45 d.wt). Cluster analysis showed grouping of accessions into two major clusters and tendency of accessions of variety *pruriens* to group according to their geographical locations. Bootstrap analysis confirmed the robustness of the phenogram. The putative hybrid variety MMP6 with relatively low similarity value index and low L-DOPA content (1.40%) indicated the possibility of developing promising hybrids as food or fodder crop. Isolation and characterization of tyrosine hydroxylase and establishment of its confirmatory role in regulation of L-DOPA synthesis will help develop varieties with low and high content of the active principle having agronomical and medicinal importance respectively. Therefore, RT-PCR analysis using degenerate primers specific to conserved domains of tyrosine hydroxylase was carried out which resulted in the amplification of a core fragment of 650bp. As a step towards future transgenic studies, callus mediated regeneration protocol was standardized for *M. Pruriens*.

A public domain web server facility was established for biodiversity informatics through which information resources of TBGRI can be accessed by the users. The leased line Internet connection was upgraded from 64 kbps to 512 kbps bandwidth. Maintenance and information updating was conducted for the web portal BTISNet publications and library resources,



www.tbgr.in/bioinfopub. A centre for Barcoding of Plant Species has been initiated. A software package, 'Lit Friend', was made available to the users free of cost. Reshaping and updating information on the web site www.tbgr.in/stec.htm continued which provides information about the plants conserved in the campus and flora of campus. A database was developed on raw drugs museum of TBGRI for disseminating on the web. A data entry interface was developed for digitizing herbarium data.

The Project on Women empowerment and self income generation through medicinal plant cultivation sponsored by the Department of Biotechnology, Govt. of India, implemented at Kanjikuzhi Grama Panchayat was continued. As done during the previous year, 75 women beneficiaries were selected and they were supplied well established seedlings and saplings of the

a. Harvesting of *Plumbago rosea* roots from beneficiary's cultivation field.

b. Model marketing linkage with raw drug shop.

identified medicinal plants (*Plumbago rosea*, *Holostemma annulare*, *Indigofera tinctoria*, *Aloe vera*, *Asparagus racemosus*, *Kampferia galanga*, *Caesalpinia sapan*) to initiate their home-stead cultivation. Planting work was started in the nursery and entrusted the day to day nursery activities to the selected five beneficiaries residing close to the nursery. Demonstrated harvest and post harvest technology, a model marketing system with local raw drug shop and achieved marketing linkage for the beneficiaries. The beneficiaries of the first year (2004-2005) started to generate income.

Phytochemistry and Phytopharmacology

In the project on "Development of scientifically validated nutraceuticals from selected medicinal plants of Western Ghats" the roots of five *Sida* species: *Sida acuta*, *S. alnifolia*, *S. rhomboidea*, *S. rhombifolia* and *S. cordifolia*, commonly used in traditional medicine were collected, dried, powdered and extracted with suitable solvents under hot and cold conditions. Fractionation using column chromatography and activity screening of these extracts resulted in an active fraction from one of the *Sida* species. Anti-inflammatory, diuretic and analgesic activities of the active fraction were evaluated using suitable models. Aerial parts of one of the five *Sida* sp. were also subjected to bioactivity-guided fractionation as above. Further purification of the active fraction resulted in a compound whose bioactivity is comparable to standard drugs. Short-term and long-term toxicity studies with the active fraction were carried out. The studies have shown that the drug is safe upto a dose of 6000 mg/kg body weight. Histopathological examination confirmed that there is no adverse effect on liver, kidney, heart, lungs and spleen. The immunomodulatory and shelf life studies on the active fraction are in progress now. Also efforts are being made to characterize the bioactive molecule isolated from the active fraction.

As part of "Development of anti-arthritis herbal drug from *Sida* group of plants" five commonly used *Sida* species viz. *Sida acuta*, *S. alnifolia*, *S. rhomboidea*, *S. rhombifolia* and *S. cordifolia* were pharmacologically evaluated. An anti-arthritis fraction has been developed from the ethanol extract of the roots of a commonly available *Sida* species. An active fraction named F8 has been isolated from

the ethanol extract. The effect of F8 on carrageenan paw edema suggests that the anti-inflammatory activity of *Sida rhomboidea* is at least partly due to the prevention of prostaglandin biosynthesis via cyclooxygenase blockade. Further F8 shows marked dose dependent (50-100 mg/kg.b.w) analgesic activity as evaluated by acetic acid induced writhing test. It is generally believed that the inhibition of prostaglandin biosynthesis is sufficient to explain the analgesic activity of non-steroidal anti-inflammatory drugs. F8 also showed remarkable dose dependent (15-25 mg/kg b.w.) diuretic activity. The percent increase in urine volume as compared to control was almost 100% at a dose of 25 mg/kg. b.w). In conclusion the studies conducted in our laboratory have resulted in the isolation of a strong anti-inflammatory, analgesic and diuretic fraction, which is a mixture of about seven different chemical compounds, which has all the properties of a non-steroidal anti-inflammatory drug. The anti-inflammatory and analgesic activity of F8 is comparable or even superior to that of the standard drug indomethacin. Therefore, using this active fraction we have formulated an analgesic, anti-inflammatory and diuretic drug useful for arthritis with the addition of common pharmaceutical aids.

As part of "Studies on the anti-viral properties of some known medicinal plants vis-a-vis phytomedicine development", a collaborative project involving TBGRI and Sree Chitra Tirunal Institute for Medical Sciences and Technology (Department of Microbiology), an anti-viral sesquiterpene lactone fraction which showed *in vitro* and *in vivo* anti-Coxsackie viral activity in mice has been isolated from *Rhinacanthus communis*. It is devoid of any conspicuous sub-acute toxicity in mice. Anti-Measles and

- HSV activities (*in vitro*) were also detected for the first time in *R. communis*. An alkaloid fraction, isolated from the alcohol extract of *Ocimum sanctum*, showed *in vivo* and *in vitro* anti-Coxsackie viral activity and *in vitro* anti-Measles and anti-HSV activities. Anti-Coxsackie viral activity was detected for the first time in the alcohol extract of *Cassia kleinii* leaf (a folklore anti-diabetes medicinal plant). These interesting observations have application potential in the development of phytomedicines and/or allopathic type of drugs against Coxsackie, Measles and HSV infections.

In the project on "Conservation strategies and pharmacological evaluation of *Urtica salicifolia*, an endangered ethno-medicinal plant of Western Ghats", *U. salicifolia*, with proven anti-ulcer activity was evaluated for various other pharmacological properties. The extracts of the plant root showed varying levels of *in vitro* anti-oxidant activity. The hexane extract, but not the water and alcohol extracts, showed appreciable antifungal activity against *Candida albicans*, *Aspergillus niger*, *A. fumigatus* and *Fusarium oxysporum* in *in vitro* assay. *U. salicifolia* root (water suspension) administration induced a concentration dependent increase in small bowel movement as judged from movement of charcoal in mouse small intestine.

During the study on *Selaginella involvens* with special reference to immunomodulatory and antioxidant properties, the flavonoid component isolated from it protected immunocompromised mice from fungal challenge. Thus, it stimulated immune function, which was associated with stimulation of thymus growth. Further, as judged from its effect on

age dependent changes on certain biochemical parameters in rats, it appears to have effects to reduce rate of ageing processes. This is a promising component to develop anti-ageing medicine.

In the newly initiated project on "Search for bioactive molecules from genus, *Ganoderma* (Polyporaceae) occurring in South India", *Ganoderma lucidum* has been collected from Silent Valley area and the fruit bodies have been powdered and extracted with petroleum ether, chloroform and methanol and activity studies on these extracts are in progress at The Amala Cancer Research Institute, Thrissur.

As part of "Bioprospecting of selected ginger from Western Ghats: morphological characterization and chemical prospecting" chemical and morphological characterization studies on *Curcuma haritha* have been initiated.

Studies on the "aphrodisiac properties of *Vanda tessellata* flower extract for determining its utility as a commercially viable standardized phytomedicine" is a collaborative project involving TBGRI and University of Kerala (Department of Botany). The objective of the project is the isolation of the aphrodisiac principle from *Vanda tessellata* flower and the elucidation of the mechanism of action in male mice

Phytochemical investigations on *Curcuma raktakanta*, *C. ecalcarata*, *C. haritha* and *Garcinia imbertii* were carried out. Structure elucidation of some of the isolated compounds has been carried out using UV, IR, NMR and MS techniques.

Volatile oil from the rhizomes of *Zingiber nimmonii* was isolated, characterized by analytical gas chromatography and gas chromatography-mass spectroscopy. Sixty-five constituents accounting for 97.5% of the oil were identified. *Z. nimmonii* rhizome oil is a unique caryophyllene-rich natural source with isomeric caryophyllenes, β -caryophyllene (42.2%) and α -humulene (α -caryophyllene, 27.7%), as its major constituents along with traces of isocaryophyllene. The rhizome oil contained 71.2% sesquiterpenes, 14.2% oxygenated sesquiterpenes, 8.9% monoterpenes, 1.9% oxygenated monoterpenes and 1.3% non-terpenoid constituents. The antimicrobial activity of the oil was tested against human and plant pathogenic bacteria and fungi. The oil showed significant inhibitory activity against the fungi, *Candida glabrata*, *C. albicans* and

Aspergillus niger and the bacteria *Bacillus subtilis* and *Pseudomonas aeruginosa*. No activity was observed against the fungus *Fusarium oxysporum*.

Essential oil from the fruits of *Amomum cannicarpum* (Zingiberaceae) was hydrodistilled and characterized by gas chromatography-mass spectrometry (GC-MS). The major constituents in the oil were α -pinene (14.0%), elemol (10.4%) and δ -cadinol (8.5%). Thirty-three (91.4%) out of forty-one constituents were identified by GC-MS and subsequent data analysis. The antimicrobial activity of the oil against Gram-positive and Gram-negative bacteria and the fungi *Candida albicans* and *C. glabrata* were determined by the disc diffusion assay. The oil showed good antibacterial activity against *Salmonella typhi*, *Pseudomonas aeruginosa* and *Proteus vulgaris* and very good antifungal activity against *Candida albicans* and *C. glabrata*.

Volatile oils from plants in the 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. Similar studies on essential oil bearing plants are in progress now.

Hydrodistillation of the stem bark of *Garcinia imbertii* afforded 0.62% (v/w) essential oil. Analysis 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.

Pamburus missionis (Rutaceae) is an essential oil bearing tree. severe fungal infection was observed on the leaves of *P. missionis*. This infection on its leaves was due to the fungus, *Meliola toddaliae*. Phytochemical profile and antifungal activity of essential oils isolated by hydrodistillation from the fungal infected and uninfected leaves of *P. missionis* showed marked variation. These oils were analyzed by gas chromatography-mass spectroscopy. α -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, Gram-negative

bacteria and fungi *Candida albicans* and *C. glabrata* were carried out by the disc diffusion technique. This showed the absence of inhibition zones for both these oils against *Candida albicans* and *C. glabrata*. The absence of antifungal metabolites in the infected and uninfected leaf oils supports the continued growth of *M. toddaliae* as a 'parasitic symbiont' on the leaves of *P. missionis*.

Volatile oils from the root, stem and leaves of *Schefflera stellata* were isolated by hydrodistillation and characterized by analytical gas chromatography and gas chromatography-mass spectroscopy. Sixty nine (98.3%), seventy eight (97.9%) and sixty seven (98.0%) constituents were identified from the root, stem and leaf oils, respectively. Sesquiterpene hydrocarbons were the most abundant compounds in the root (73.8%), stem (68.8%) and leaf (63.4%) oils, followed by oxygenated sesquiterpenes, monoterpene hydrocarbons and oxygenated monoterpenes. Isomeric caryophyllenes (β -caryophyllene, α -humulene), germacrene D, germacrene B and epi- α -cadinol were the major constituents in these oils. Antimicrobial activity of the leaf oil was tested against common human pathogens by the disc diffusion technique. The leaf oil showed significant antifungal activity against *Candida albicans* and *C. glabrata*, but the antibacterial activity of the leaf oil was very low. Twenty-eight compounds constituting 99.1% of the analyzed sample were identified. The oil was characterized by the predominance of monoterpenes (61.2%) with limonene (50.3%) as the major constituent. α -humulene (13.3%), β -caryophyllene (8.8%) and linalool (3.2%) were the other major components. The oil displayed significant antibacterial activity when tested against *Bacillus cereus* and moderate activity against *Serratia marcescens* and *Escherichia coli*. 20 compounds representing 88.59% of the oil were identified. The major constituent in the oil was caryophyllene oxide (49.62%). Monoterpenes were detected in low percentage (1.16%). The oil was tested for antimicrobial activity against Gram-positive and Gram-negative bacteria as well as against the fungi *Candida albicans* and *C. glabrata*.

Essential oils from leaves and bark of *Neolitsea scrobiculata* 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*. The essential oil obtained by hydrodistillation of the leaves of *Neolitsea foliosa* var. *caesia* was analyzed by GC and GC/MS. Nineteen components comprising 90.6% of the oil were identified. The major components of the oil were β -caryophyllene (35.3%), caryophyllene oxide (9.6%), elemol (8.2%) and α -elemene (6.1%). The oil showed moderate antibacterial activity against most of the tested bacteria.

The essential oils obtained by hydrodistillation of the fresh leaves and mature fruits of *Pittosporum viridulum* was analyzed by GC and GC/MS. Fifteen components comprising 85.4% of the leaf

oil and twenty-six components comprising 94.5% of the fruit oil have been identified. The major components of the leaf oil were spathulenol (28.4%), caryophyllene oxide (17.6%), and δ -cadinol (9.0%), whereas germacrene D (28.6%), δ -cadinol (13.0%) and δ -cadinene (9.4%) were the major components in the fruit oil. The oils showed moderate antibacterial activity against the Gram-positive bacteria *Staphylococcus aureus* and *Salmonella typhi*.

Trichopus zeylanicus butanol extract does not stimulate *in vitro* protein synthesis in macrophages and macrophage PKC activity, a key regulator of cell function, but it activates DLA and thymocyte PKC. In order to understand the mechanism of activation of macrophages and thymocytes by the fraction, the effect of the fraction treated mice serum on macrophages and thymocytes in culture was studied. The treated serum stimulated thymocyte proliferation in a concentration dependent manner suggesting the release of immune modulator into the blood, which stimulates thymocyte proliferation *in vitro*. Studies are

in progress to isolate and identify the immune modulator/activation factor released under the influence of the herbal drug.

An active principle/compound [a coumarino-lignoid compound] has been isolated from the water extract of *Hemidesmus indicus* (root), a known medicinal plant. This isolate stimulates water and electrolyte absorption from rat small intestine and colon. Follow up studies have shown that this chemical isolate is devoid of any conspicuous short-term toxicity in mice. Further, it showed anti-oxidant activities. It is a very promising material to improve the efficacy of ORS (oral rehydration solution) used to save lives in severe diarrhoea cases.

A compound with anti-hypoglycaemic properties and anti-diabetic properties, has been isolated from a fern (*Hemionitis arifolia*). This compound has promising potential to be developed into an anti-diabetic drug.

PRADEEP KUMAR K. P.



The herbal garden, which succumbed to severe floods and loss of plant collections in 1993, presently in the remodeled and developed state

Ethnomedicine and Ethnopharmacology

The base line documentation (field level) of Traditional Knowledge related to plants used for food and medicine of 70 Gramapanchayaths (5 each from all 14 districts of Kerala) was completed. From the 70 Gramapanchayaths covered under the present study 10999 traditional information related to medicinal properties and 625 information related to the culinary properties of our plant diversity were documented. Out of these, 1532 information were documented from the

tribal communities. 1297 informants were interviewed during the course of this study. A documentary film (30 minutes duration) of two episodes on Traditional Knowledge related to plants used for food and medicine entitled 'FROM HAZE...LIGHT!' (English and Malayalam version) was made.

The "Networking Group Research Programme on Bio-prospecting/Medicinal Plants" was initiated in collaboration with RGCB and KFRI. Creation of a "Centre for

Traditional Knowledge in Food and Medicine" was also initiated.

a. *Acrotrema arnotianum* Wight, pharmacognostically investigated in detail. Its medicated oil prevents excess hairfall and relieves headache.

b. *Thespesia populnea* (L) Sol. Ex Corr. Serr., a potent ethnic hepatoprotective plant.

PRADHEEP KUMAR K. P.





During the "Systematic documentation of traditional knowledge of plants related to food and medicine of 10 Gramapanchayath of Kasaragod District" 376 information was documented, of which 152 and 212 were on single drugs and combinations respectively. Information documented on food plants was 12.

As part of "Pharmacognostical studies on raw drugs/selected medicinal plants available in Kerala Markets" field exploration trips were conducted to four districts of Kerala and two districts of Tamilnadu to collect authentic samples of six *Sida* samples for detailed pharmacognostical investigation. The anatomical study of *Sida rhomboidea* was completed and *Sida acuta* initiated. Four market samples of *Sida* sp. were purchased from Thiruvananthapuram, Kottayam and Ernakulam Districts of Kerala and the pharmacognostical studies were initiated. Morphological characterization of the above market samples was completed. The

pharmacognostical studies of *Acrotrema arnotianum* was completed and the manuscript submitted for publication. Field exploration trips were also conducted to Neyyatinkara, Parasala, Nagercoil, Thirunelveli, Ambasamudram, Thenmala, Punalur and Chenkotta for the study on different *Sida* species as a part of the development of a nutraceutical product.

In the project on "Sustainable utilisation of lesser-known medicinal plants of Western Ghats with particular reference to liver diseases" the protective effect of methanolic extract of leaves of *Thespesia populenea* (TP) and stem bark of *Pittosporum neelgherensis* (PN) on paracetamol and CCl₄ induced liver damage has been confirmed in Wistar rats. PN showed better protection when compared to TP. Biochemical and histological findings support this observation.

As part of the study on "Anti-ulcerogenic properties of selected

- a. Kelu Vaidyan, Kurichiyar tribal healer from Tirunelli gramapanchayath, Wayanad.
- b. Radha Kuttikrishnan, Kurumar tribal healer from Nenmeni gramapanchayath, Wayanad.
- c. Mannan tribal healer from Kanchiar gramapanchayath, Idukki.
- d. Vellakumaran, Kadar tribal healer from Athirapilli gramapanchayath, Thrissur.

medicinal plants of Western Ghats, Kerala" the anti-ulcerogenic property of ethanolic extract of root of *Cyclea peltata* (CP) on ethanol induced ulceration has been confirmed in Wistar rats. The biochemical parameters and histopathological findings also support the data. Further studies are needed to confirm its antisecretory, antiulcerogenic and antioxidant properties.

The methanolic extract of *Cyrtia peltata* root showed positive tests for alkaloids. It is proposed to find out whether the alkaloid is tetrandrin, which is reported to show anti-ulcer property.

As part of the study on "Anti-allergic properties of important medicinal plants used in traditional medicine of Kerala" the anti-allergic property of methanolic extract of whole plant of *Cassia occidentalis* has been confirmed by mast cell degranulation studies and human RBC stabilising studies. Cytoprotective effect of *C. occidentalis* was confirmed by antilipid peroxidation studies and microscopic mast cell analysis.

Pisonia alba (Nyctaginaceae) leaves are used as, vegetable and also it is used in traditional medicine of Alleppey district of Kerala to treat diabetes. Pharmacological screening for antidiabetic property of methanolic extract of leaves of *Pisonia alba*, was undertaken. The plant extract showed anti-hyperglycaemic activity and also it was found to be effective in lowering blood glucose levels of alloxan induced diabetic rats. It was shown to inhibit ferric chloride-ascorbic acid induced lipid peroxidation *in vitro*.

The wound healing activities of the stem sap of *Calycotris floribunda* Lam. has been studied. The model adopted was

excision wound healing model. The stem sap was significantly better for wound healing than betadine, the positive control used in the present study.

Antiulcer activities of the root of *Decalepis arayalpathra* has been evaluated against ethanol induced gastric ulceration. The plant drug showed significant action against ethanol induced gastric lesions. The maximum protection to the gastric mucosa was observed at the dose of 500 mg/kg.



GRAPHICS - PRADEEP KUMAR K. P.

Conservation Biology

Plant-pollinator interactions, sexual systems and level of gene flow in two endemic species of Western Ghats in Silent Valley were studied. Gene flow in plants is the successful movement of genes within and among populations through pollen and seeds. This process, if effective, maintains heterogeneity of populations and the populations will have better chances to flourish in the ecosystem. Knowledge on pollination and breeding systems, seed dispersal strategies and genetic structure of the populations are essential for understanding the pattern of gene flow of a species.

Gene flow with reference to two

endemic species of the Western Ghats, *Palaquium ellipticum* (Dalz.) Bail. (Sapotaceae) a common species and *Cassine kedarnathii* Sasi. & Swarup. (Celastraceae), a rare species that occurs in Silent Valley National Park was studied. Twelve field trips extending from seven to fifteen days per month were conducted to Silent Valley to study phenology, pollination mechanism, seed dispersal and germination strategies of these two species. Phenological observations showed that as in the previous year, leaf flushing occurred from October-November, flowering from January-April and fruiting from September-June in *Palaquium*. In

Cassine, in general, leaf flushing was observed in October and flowering in January-March but marked asynchrony was observed in individual trees of *Cassine* in leaf flushing and flowering in various study sites of Silent Valley. Floral characters, time of anthesis, anther

a. *Aegiceras corniculatum* (L.) Blanco
(Myrsinaceae)

b. *Cassine kedarnathii* Sasi. & Swarup.
(Celastraceae)



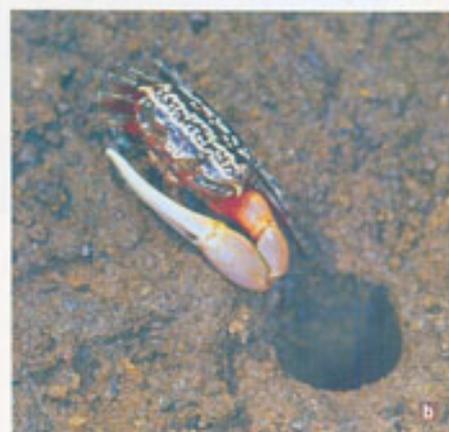


dehiscence, pollen viability, stigma receptivity and flower visitors (insects and vertebrates) were studied to know the pollination mechanism in both the species. Artificial pollination experiments were carried out for autogamy, xenogamy and geitonogamy. The results showed that *Palaquium* is predominantly xenogamous and wind pollinated while *Cassine* is an outcrossing species. Seed dispersal and germination studies showed that *Palaquium* had efficient seed dispersers and seeds had good germination capacity (33%) while there were no dispersers for *Cassine*, which had very low percentage of seed germination (2%).

Crabs play a significant role in the Mangrove ecosystem. They aerate sediments, modify topography, soil grain size and distribution, trap energy within mangrove forests and increase the amount of nutrients. They also influence mangrove forest dynamics and hence mangrove crabs are considered as keystone species. The Division undertook a study on the level of association of crabs with mangroves. Kunjimangalam in Kannur district was the study area selected. Flash survey of mangroves, their density, vertical stratification, component species and their phenology were studied; so also taxonomy, density, food and feeding behaviour of crabs associated with mangroves. Results showed that the important mangroves in the area are *Bruguiera cylindrica*, *Kandelia candel*, *Rhizophora apiculata*, *Rhizophora mucronata*, *Avicennia marina*, *Avicennia officinalis*, *Excoecaria agallocha* and *Aegiceras corniculatum*. Sesamid crabs feed on both living and dead plant materials while Ocypodid crabs depend on detritus.

a. Mangroves at Kunhimangalam, Kannur.

b. *Uca latea annulipes* - a mangrove crab.



Mangrove leaves are an important component in both.

It was decided to bring out an interactive CD with comprehensive information on all the flowering plants of Kerala. The database has characteristics like legitimate name, important synonyms, references to the best available description and illustration, distribution, nativity (indigenous, India-endemic, Western Ghats-endemic, Kerala-endemic, exotic: naturalised, exotic: planted), conservation status (locally rare, rare, endangered), phenology, uses and local names. The CD provides multiple entry points that allow a user to access the data by choosing any given characters in the database. This database is conceptualised to operate through four windows viz.: Search, Basic Search, Advance Search and About the CD. A user's guide is also provided. It records 4689 species of flowering plants, besides 58 subspecies and 289 varieties in 1416 genera under 188 families as occurring in the present political boundary of Kerala. It provides the first comprehensive work on flowering plants of Kerala and the first of its kind in electronic form making available the essential details of all the flowering plants of Kerala with a few clicks of the mouse.

The book entitled "Flowering Plants of Kerala-A Handbook" was released by Shri V S Achuthanandan, the Chief Minister of Kerala on 13th December 2006. This publication, deals with all the flowering plants occurring in the state. The book provides information regarding legitimate name, important synonym/s, habit, reference to good available description and illustration, nativity (whether indigenous / endemic / exotic), threat category, uses and Malayalam names of 4681 species, besides 58 subspecies and 287 varieties in 1415 genera under 188 families.

As part of the research programme on tree pollen of the Western Ghats polliferous materials of 35 tree species from various localities in the Western Ghats were collected. About 450 pollen slides belonging to 97 species were prepared. LM study of 78 species was carried out and SEM studies of 24 species were completed.

As part of another ongoing research programme, "Database on the Western



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Ghats Flora', data on 435 species from Tamil Nadu part of the Western Ghats were systematically gathered and analyzed. The details include: legitimate name, important synonyms, reference to good descriptions and illustrations, distribution in the World, India, the Western Ghats, nativity, endemism, exotic nature and uses.

Manuscripts of two Monographs were prepared. The first one entitled "Ethnobotany of Pathanamthitta Hill Tribes" is the outcome of a study completed on the

Ethnobotany of hill tribes of Pathanamthitta district. The document details uses, methods of administration, precautions etc. of 323 plant species used by six tribes in the district and reviews this information in the light of world literature on Ethnobotany, Indigenous System of Medicine and Pharmacology. The second one "An Atlas on the Airborne Pollen and Spores of Kerala" is the outcome of the aerobiological survey conducted by the Division from 1994 to 1999. The work deals with LM and SEM of 70 pollen and 54 fungal spores, their

Shri V. S. Achuthanandan, the Honourable Chief Minister releasing the book "Flowering Plants of Kerala - A Handbook".

description, brief description of species, distribution map, phenology, note on allergenicity etc. It has high relevance as airborne pollen and spores cause health hazards to humans.



GRAPHICS - PRADEEP KUMAR K. P.

Plant Systematics and Evolutionary Science

As part of the survey and documentation of floristic wealth of Kerala as well as systematics of specific groups of plants, 45 field trips were conducted to different forest types in the Western Ghats covering all seasons. The explorations resulted in the collection of 5820 specimens belonging to 2479 species of which 1480 species were critically studied and taxonomic identity established. These collections include 159 endemics and 60 RET species of Western Ghats. The collection assumes significance especially from the conservation point of view.

Rediscovered

Rhynchospora submarginata Kuek.
Rediscovered after 138 years of its first collection from India.

New Records for States

Impatiens trichocarpa for Maharashtra
Kunstleria keralensis for Karnataka
Xanthophyllum manickamii for Kerala

Systematic studies of the genus *Cinnamomum* Schaeffer was undertaken. The study led to the collection of 64 specimens representing 16 species, which include rare species namely, *Cinnamomum chemungianum*, *C. dubium*, *C. heyneanum*, *C. perrottetii*, *C. travancoricum*, *C. walaiaewense* etc.

Taxonomic studies of the interesting genus *Sonerila* Roxb. was carried out. The study identified 22 species from the Western Ghats with the endemic species

such as *Sonerila devicolamensis*, *S. rotundifolia*, *S. sahyadrica*, *S. speciosa* etc.

The study on climbers of Thiruvananthapuram District resulted in the collection of 521 specimens representing 125 species. Interesting climbers include *Desmos lawii*, *Erythralium populifolium*, *Flagellaria indica*, *Trichosanthes anamalayensis* etc.

900 RET species were enumerated based on literature, herbarium survey and field studies, of which the following species namely *Ceropegia omissa*, *Dalbergia horrida* var. *glabrescens*, *Eugenia argentea*, *Hedyotis hirsutissima*, *Ilex gardneriana*, *Calliandra cynometroides*, *Madhuca insignis*, *Neuracanthus neesianus*, *Pavetta nemoralis*, *Pimpinella pulneyensis*, *Smithia venkobarrowii*, *Symplocos monantha* etc. fall under "possibly extinct" category.

The systematic study on balsam resources of Western Ghats resulted in delimiting about 92 species of which 82 are remarkably endemic to Western Ghats. A field gene bank was established to grow in *ex-situ* condition and standardize propagation methods to popularize rare and ornamental balsams. The collection includes 70 wild species and 22 cultivars.

Among these, 24 species were found to be of potential ornamental value and can be grown throughout the year. Further, the collection identified several endemic and 30 endangered balsams. Interesting species among them are *Impatiens acaulis*, *I. anaimudica*, *I. auriculata*, *I. barberi*, *I. campanulata*, *I. coelotropis*, *I. dalzellii*, *I. dendricola*, *I. floribunda*, *I. jerdoniae*, *I. kulamavuensis*, *I. lawii*, *I. pandata*, *I. parvifolia*, *I. phoenicea*, *I. platyadena*, *I. stocksii*, *I. tangachee*, *I. viridiflora*, *I. wightiana* etc. Further analysis on flowering period indicated that about 62% of species flowered during July-December, 16% during April-June and 15% during January-March, while 18% flowered round the year. The study is useful especially to identify potential ornamental species for commercial propagation and popularization.

The genus *Dioscorea* is one of the largest groups among monocotyledons belonging to the family Dioscoreaceae. The members are commonly known as yams and are widely cultivated for their edible tubers throughout tropics. In India, there are 32 species distributed in tropical to temperate regions, ranging from 0-1500m MSL. There were reports of 18 species of *Dioscorea* distributed in the Western Ghats. In spite of its manifold economic importance, the group is not taxonomically well studied for the last 60 years except a few attempts by regional flora workers. This is mainly because of its dioecious nature, variable phyllotaxy, different phenology of the same species, deep seated underground tubers etc, which makes the group difficult for research and hence was neglected for quite a long time. Against this background, the present study has been undertaken to delimit and unravel the species complex that exists in the Western



Xanthophyllum manickamii



Ghats based on fresh explorations from the wild. The present investigation identified 20 species, 4 taxonomic varieties of *D. pentaphylla* and 2 taxonomic varieties each of *D. bulbifera*, *D. esculenta* and *D. oppositifolia*. The study interestingly led to collection of 8 imperfectly known taxa which may end up as new species to science, once critically evaluated both for vegetative and reproductive characters. A field gene bank had been established in the Institute as part of *ex-situ* conservation for further evaluation. This study assumes cardinal importance in understanding species diversity, distribution and status, which are essential for conservation and sustainable utilization.

As part of preparing the Status report on the RET species of Western Ghats the documentation of 900 angiosperm species under threatened category was achieved. Inputs were made from extensive field surveys, thorough screening of all available literature and visiting major herbaria of

South India. A list has been prepared with passport data of individual species. Among these 188 are trees, 174 shrubs, 422 herbs, 66 shrub climbers, 37 herbaceous climbers and 13 are woody climbers. The study clearly pointed that out of 900 RET species 727 are endemic exclusively to the Western Ghats and the remaining 173 are non-endemic but with narrow distribution. Of the 727 endemic species, 96 are exclusively endemic to Kerala. Among 900 RET species, 23 are presumed to be extinct as there is no record of occurrence or collection for the last 100 years, 93 are critically endangered, 170 are endangered, 207 are vulnerable, 355 are rare and the remaining 52 species are treated under data deficient as there was insufficient data for including in any of these categories.

Ecological/Biological Studies on RET species was carried out on 2 rare and endemic species viz., *Goniothalamus rhynchantherus* and *G. wightii* belonging to the family Annonaceae with the objectives

- a. *Impatiens trichocarpa* Hook. f.
- b. *Impatiens platyadena* Fischer.
- c. *Impatiens dalzellii* Hook. f. & Thoms.
- d. *Impatiens coelotropis* Fischer
- e. *Impatiens repens* Moon
- f. *Impatiens henslowiana* Arn.

of identifying the causes of rarity in their ecosystems. The investigation covered population structure and dynamics including insect-pest association in the life history of the species. Insects were collected and identified in consultation with the Department of Entomology, Kerala Agricultural University, Thiruvananthapuram, Department of Zoology, Sacred Heart College,



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The Honourable Chief Minister inaugurating the Herbarium Block. Looking on are Smt. J. Arundathi, MLA, Dr. A. E. Muthunayagom, EVP, KSCSTE and Dr. S. Ganeshan.





Eranakulam and Dept. of Zoology, UC College, Aluva. 6 insects were found to be interacting with different stages of life cycle of the plants. Beetle pollination i.e., 'Cantharophily' is a characteristic feature of Annonaceae flowers. The beetle, *Carpophilus rufescens*, (Coleoptera: Chrysomelidae) was the principal pollinator in *G. rhynchantherus*. The ants, *Camponotus compressus* and *Myrmenachne* sp., (Hymenoptera: Formicidae) were regularly foraging on mature flowers of *G. rhynchantherus* and may be acting as pollinators. The beetle, *Rhynchaenus* sp. (Coleoptera: Curculionidae) was main pollinator in *G. wightii*. The shield bug, *Cantao ocellatus* (Hemiptera-Scutelleridae) damaged flower stalk by sucking juice leading to premature fall resulting in reproductive loss in *G. wightii*. The spider like organisms, *Opilion* sp. (Arachnida-Opilionidae) predate on small insects found on the leaves of *G. wightii*. Stem cuttings of *Goniothalamus rhynchantherus* such as hard, medium and tender were selected for propagation. Air layering practices were also carried out. Stem cuttings were treated with IAA/IBA. But none of the cuttings responded positively. Air layering resulted in 50% rooting success. Hence this method can be considered as the promising method for propagating the species.

Populations of *Impatiens travancorica*, an endemic, RET plant of Western Ghats was located in Agasthyamala. Periodical observations on vegetative dynamics were carried out. Herbivory by a Lepidopteran was highly prevalent which in turn decreased plant population in the wild. Rearing of the larva was attempted in *ex-situ* condition, but they did not survive up to pupa stage. However, efforts are being continued to grow the larva for confirming the identity of the organism.

The reproductive ecological studies of *Impatiens cuspidata*, *I. henslowiana* and *I. verticillata* were completed. 3 more rare and endangered balsams viz., *Impatiens campanulata*, *I. platyadena* and *I. coelotropis* were also studied. Based on explorations viable populations were located and monitored to record population dynamics at monthly intervals. The candidate species started flowering in the month of July-August, which extended up to January and reached the peak during September-October. The study revealed that the morphological characters, protrandrous nature, stigma receptivity, P.O. ratio etc. are indicators of cross-pollination. The major pollinators are honey

bees, bumble bees, hawk moths and butterflies. Pollination experiments demonstrated that manual pollinations (geitonogamy and xenogamy) enhanced the fruit set in *Impatiens campanulata* and *I. platyadena* up to 52-66% than open pollination 42-54%. In all the cases fruit set was not observed in autogamous self-pollination. In case of *I. coelotropis* only 7% fruit set was observed in the natural conditions and whereas xenogamy enhanced the fruit set rate up to 22%. In *I. coelotropis* majority of the buds/flowers and tender fruits were infested by caterpillars and the damaged flowers were not visited by the pollinators. Therefore, floral damage caused by the caterpillars adversely affected the fruit production. Pollen fertility and viability tests confirmed that *I. campanulata* had 82%, *I. coelotropis* 62% and *I. platyadena* 84% pollen viability which was gradually reduced on successive days after anthesis. Percentage of seed germination in *I. campanulata* and *I. platyadena* was only 10-30%. In *I. coelotropis* only 10% seed germinability was observed in the natural condition. Vegetative propagation of all the 3 species was standardized by using IBA. The seedlings were planted as part of *ex-situ* conservation in the garden. The three candidate species are poorly distributed in the wild mainly because of habitat loss, fragmentation of populations, poor fruit set, low percentage of seed germination etc. All these causal factors either alone or in combination with others were responsible for limited distribution in the wild.

The study on "Quantitative Assessment and Mapping of NWFPs in Southern Kerala" resulted in the identification, assessment and distribution range of 110 NWFPs currently available in these districts. Traditional harvesting techniques and its impacts on the ecosystems and communities were analyzed. Based on the observations, a strategy has been proposed for sustainable harvesting and utilization of NWFPs in Southern Kerala.

As part of the "Biosphere Reserve Programme" the status reports of Nilgiri and Gulf of Mannar Biosphere Reserves were prepared in UNESCO's format for recognition. The report covers justification for designation as biosphere reserves, and their ability to fulfill the three functions of biosphere reserves such as conservation, development and logistic support. The status report dealt extensively on their biological, social and cultural significance and how the biosphere reserve provided an

opportunity to demonstrate the sustainable development on a regional scale. Based on our reports, the UNESCO recognized both the biosphere reserves and posted them on the MAB net- a network of World Biosphere Reserves. This is one of the spectacular achievements of the Co-ordination Centre. In case of Agasthyamalai Biosphere Reserve, information on Kerala portion such as spatial configuration, components, zonations, physical/landscape features, climate, geology, geomorphology, biogeographic regions, people and demographic structures, landuse history, flora, fauna etc. had already been compiled. Now data from Tamil Nadu portion is being added.

The herbarium has been well organized and managed as per the International standard. Based on the performance, the Ministry of Environment and Forests, Govt. of India had sanctioned Rs. 25 lakhs for a new building. The new Herbarium Block was inaugurated by the Hon'ble Chief Minister of Kerala, Sri. V. S. Achuthanandan on 13th December 2006. As part of herbarium management all the herbarium and reference specimens were rearranged properly for ready reference. About 18,500 herbarium specimens were

Herbarium at a glance

1 Specimens in the herbarium as on March 2007	19,640
2 Number of specimen processed	8,300
3 Mounted for filing	1,225
4 Unmounted for reference	1,075
5 Number of specimen incorporated	1,000
6 Number of Nomenclature correction carried out	550
7 Indexing of General Herbarium specimens	1,600
8 Number of sheets renovated	3,410
9 Maintenance of general Herbarium specimens	19,640
10 Number of enquiries attended	1,230

examined to assess their quality and datasheets were prepared for herbarium database.

The survey and exploration resulted in the addition of 56 taxa new to TBGRI Herbarium (TBGT). The inventory also resulted in the collection of important plant taxa such as *Abelmoschus angulosus* var. *purpureus*, *Avicennia marina*, *Bruguiera gymnorhiza*, *B. cylindrica*, *Buchananina barberi*, *Cinnamomum chemungianum*,



Cucumella silentvalleyi, *Desmodium dolabriforme*, *Didymocarpus meeboldii*, *Diospyros hirsuta*, *Excoecaria indica*, *Garcinia gummi-gutta* var. *conicarpa*, *Glycosmis macrocarpa*, *Hydrocotyle sibthorpioides*, *Myristica dactyloides*, *Orophea uniflora*, *Sageraea grandiflora*, *Symplocos kanarana*, *Syzygium bourdillonii*, *Teinostachyum wightii*, *Trapa natans* var. *quadrispinosa*, *Trichosanthes anamalaiensis* and *Ventilago bombalensis*.

In the study on "Survey, Inventory and Evaluation of Mushrooms of Western Ghats of Kerala", five major research programmes were undertaken to evaluate the macro fungal wealth. Main objectives of these programmes were to make a survey and inventory of the macro fungal wealth of Western Ghats of Kerala; to provide descriptions and illustrations of all the major edible, poisonous and hallucinogenic mushrooms; to collect and identify Ectomycorrhizal Fungi and their associated host species; to assess diversity of mushrooms and their conservation status in Wayanad district and establish a Regional Reference Centre for mushrooms. As part of these programmes, mushrooms were collected from different forest localities of

Kerala during the monsoon period. Collection sites included the wooded and undisturbed areas of TBGRI campus, forests of Kallar, Kulathupuzha, Thenmala, Periyar and Wayanad. During the period 961 collections were added to the mushroom herbarium. The collections

Achievements

Total collections made during the period	523
Collections identified to genera	523
Families represented	18
Genera represented	56
Total collections identified to species	322
No. of species obtained	122
New records for India	07
New species recognized	05
Wild edible species collected	15
Known toxic species identified	14
Hallucinogenic	01
Bioluminescent	02
Total accessions maintained in the mushroom herbarium	10,160

were systematically analyzed and identified following standard taxonomic methodology.

A molecular marker was developed for a high yielding strain of *Pleurotus florida*. A bacterial strain isolated from a sacred grove showed potential antifungal activity and

a. *Amanita hemibapha* (Berk. & Br.) Sacc.

b. *Termitomyces microcarpus* (Berk. & Br.) Heim f. *elongatus* Heim - Wild edible mushrooms from Western Ghats.

was identified as *Streptomyces atroolivaceus* showing 98% 16S RNA sequence homology to the type strain. This is the first report of antifungal activity from that particular strain. Out of the 192 actinomycetes isolates screened, 150(78%) are antifungal. Among these 10 showed more than 60% of inhibition and three of them are new strains of *Streptomyces* (16s sequencing in progress).

In the study on characterization of cellulolytic microorganisms involved in litter decomposition in the forests of Kerala eight *Aspergillus* strains isolated from litter collected from Shola forests were screened for cellulolytic activity by plating on CMC supplemented ISC agar. Among the eight isolates, three showed strong activity, four moderate and one weak. The genetic similarities of these isolates were also studied using ITS-PCR-RFLP analysis.



Micro-fungi and Lichens

Collection trips for microfungi were conducted to both Western Ghats regions of Kerala and Meghalaya State. 400 collections were made. 300 taxa were identified, of which 46 were new to science. After confirming the identity, materials were deposited in the herbarium under TBGT and



Tar Spot disease



Black Mildew Fungus



part of them in HCIO, New Delhi.

50 vanilla plantations in 7 districts of Kerala were visited for studying the rate of pathogenic infections in them. 11 plantations were severely infected. Stem rot, leaf rot, wilt were the most common diseases. Species of *Phytophthora*, *Fusarium*, *Sclerotium*, etc. were the common fungal pathogens. The plantations in Wyanad district were fully destroyed by infection. Plantations in Kottayam district were moderately infected. Only a few plantations in Kannur, Pathanamthitta and Ernakulam were infected. Alappuzha and Kasargod districts were free from infection.

Field exploration trips were conducted to various forest regions and root and soil samples were collected for studying the frequency of AM infection. Isolated spores were inoculated in pot culture by selecting Sorghum and Maize as host plants to prepare inoculum. Slides were prepared

a. Leaf spot disease of Vanilla.

b. Rust on Cinnamon.

c. *Ramalina conduplicans* Vain, a lichen

d. Mycorrhizal Spore.

from this inoculum for identification. These spores belonged to the genera *Glomus*, *Acaulospora*, *Scutellospora*, *Sclerocystis*, and *Gigaspora*.

Collection trips were conducted to different forest localities in Trivandrum, Kollam, Pathanamthitta, Kottayam, Idukki, Ernakulam, Thrissur, Palghat and Wyanad districts for Lichens. 1570 individual specimens from different forest localities, which include foliose, fruticose and crustose lichens, were collected. Among them, 633 specimens were identified.

Foliicolous Fungi

New Genus

1. *Ectendomeliola* Hosag. & Agarwal

Species New to Science

1. *Amazonia elaeocarpi* Hosag. & al.
2. *Asteridiella acanthacearum* Hosag.
3. *Asteridiella brahmagiriensis* Hosag. & al.
4. *Asteridiella capparidigena* Hosag.
5. *Asteridiella micheliae* Hosag. & al.
6. *Asteridiella oreocnidecola* Hosag.
7. *Asteridiella phaulopsidis* Hosag.
8. *Asterina adeniicola* Hosag. & Kamar.
9. *Asterina aglaiae* Hosag.
10. *Asterina canthii-dicocci* Hosag.
11. *Asterina chukrasiae* Hosag.
12. *Asterina gamsii* Hosag. & C.K.Biju
13. *Asterina girardiniae* Hosag. & C.K.Biju
14. *Asterina hyptidicola* Hosag.
15. *Asterina loranthigena* Hosag.
16. *Asterina madikeriensis* Hosag.
17. *Asterina oreocnidecola* Hosag. & al.
18. *Asterina oreocnidegena* Hosag.
19. *Asterina parsonsiiae* Hosag.
20. *Asterina rhodomartyi* Hosag. & al.
21. *Asterina sarcandrae* Hosag. & Kamar.
22. *Asterina talacauveriana* Hosag.
23. *Asterina toddallicola* Hosag. & al.
24. *Asterina tylophorae-indicae* Hosag. & al.
25. *Asterolibertia vatenae* Hosag.
26. *Asterostomella ceropogiae* Hosag. & al.
27. *Asterostomella elaeocarpi-serrati* Hosag.
28. *Asterostomella otonephelii* Hosag.
29. *Asterostomella strombosiae* Hosag.

30. *Ectendomeliola walsurae* Hosag. & Agarwal
31. *Meliola allophylogena* Hosag.
32. *Meliola anodendricola* Hosag.
33. *Meliola canthiigena* Hosag. & al.
34. *Meliola crotonis-malabarici* Hosag.
35. *Meliola cynanchi* Hosag. & al.
36. *Meliola dolichi* Hosag.
37. *Meliola emespatilii* Hosag.
38. *Meliola exacigena* Hosag. & al.
39. *Meliola kukkeensis* Hosag. & al.
40. *Meliola kufathupuzhaensis* Hosag.
41. *Meliola luvungicola* Hosag. & Rajkumar
42. *Meliola palakkadensis* Hosag. & al.
43. *Meliola parsonsilicola* Hosag.
44. *Meliola peringamalaensis* Hosag. & Kamar.
45. *Meliola pleurostylicola* Hosag. & Sabu
46. *Meliola pterigotae* Hosag.
47. *Meliola salacicola* Hosag. & al.
48. *Meliola silentvalleyensis* Hosag.
49. *Meliola smilacacearum* Hosag.
50. *Meliola strombosiae* Hosag.
51. *Meliola valleridis* Hosag.
52. *Prillieuxina aquifoliacearum* Hosag.,
Ravikumar & Archana
53. *Pseudoasperisporium millettiae* U. Braun &
Hosag.
54. *Questieriella rhamnii* Hosag. & al.
55. *Questieriella toddaliae* Hosag. & al.
56. *Sarcinella allophyli* Hosag.
57. *Sarcinella glochidii* Hosag. & al.
58. *Sarcinella oreocnidecola* Hosag.
59. *Sarcinella pouzolziae* Hosag.
60. *Shiffnerula glochidii* Hosag.

Varieties New to Science

1. *Irenopsis sidae* (Rehm.) Hughes var.
abutii Hosag. & al.
2. *Meliola alangii* var. *salvifolii* Hosag.
3. *Meliola daviesii* Hansf. var. *longiseta*
Hosag.
4. *Meliola desmodii-laxiflori* Deight. Var.
indica Hosag. & al
5. *Meliola kanniyakumariana* Hosag. var.
brahmagiriense Hosag. & al.
6. *Meliola tabernaemontanae* Speg. Var.
wrightiae Hosag. & al.

New Records to India

1. *Meliola diospyricola* Hansf.
2. *Asterina diplocarpa* Cooke
3. *Asterina leptalea* Sydow
4. *Asterina piperina* Sydow
5. *Asterina pusilla* Sydow
6. *Heteroconium solaninum*
(Sacc. & Sydow) Petrak
7. *Sarcinella raimundi* Sacc.
8. *Schiffnerula pulchra* (Sacc.) Petrak
9. *Schiffnerula ricini* Hansf.

Rare Fungi

1. *Asterina crebra* Sydow
2. *Asterina garciniae* Hansf.
3. *Armatella cinnamomi* Hansf. & Thirum.
4. *Asterina olacicola* Hansf.
5. *Asterina perpusilla* Sydow

Library

During the reporting year, the library subscribed to 76 journals and purchased 400 books. Books were classified and merged in the Collection. The journals were registered and added to the journal database. Based on requests from scientists, photocopies of articles were procured and provided to them. Journals when volume completed were bound, documented and shelved.

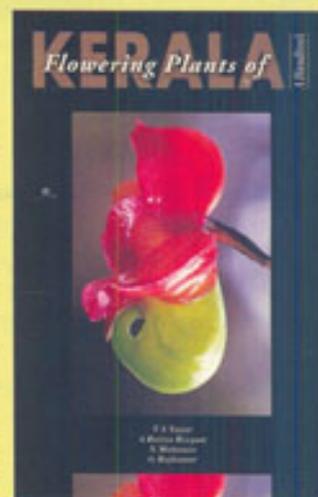
Total books	8290
Journals subscribed	76
Reports added	37
Reprints added	10
CDs added	09
Back volumes added	175

Services provided

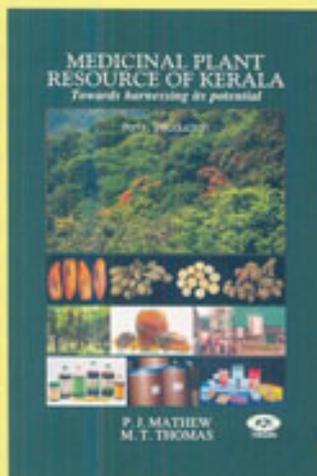
Indexing
Selective Dissemination of Information
Current Awareness
Conference Alert
Newspaper Clippings
Photocopying
Internet

Publications Books

The work treats 4681 species, 58 subspecies and 287 varieties in 1415 genera under 188 families. It provides correct name, important synonyms, habit, reference to good descriptions and illustrations, distribution in the world, the Western Ghats and Kerala, indigenous, endemic and exotic nature, conservation status, phenology, uses and Malayalam names.



'Medicinal Plant Resource of Kerala - Towards harnessing its potential Part I - Introduction' provides an overview of the state-of-the-art on collection, conservation, cultivation and utilization of medicinal plant resources of Kerala. The book intends to disseminate information useful for the development of the medicinal plant resource of the State, to all concerned, which is inevitable for ensuring their involvement in sustainable utilization of the resource.



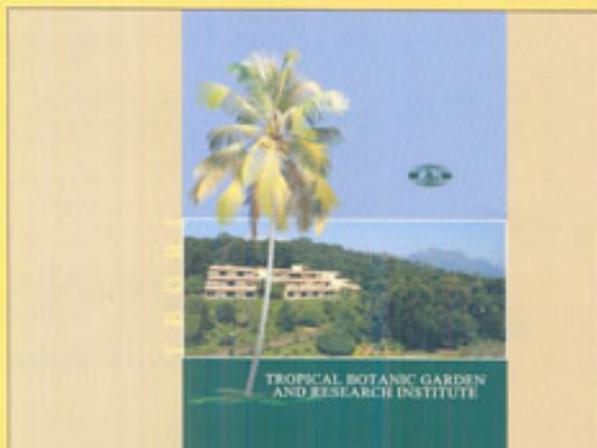
ചത്തു-ശുഷു-സസ്യങ്ങളുടെ
അവയുൽപ്പാദനം കൃഷി വിനിയോഗം

Department of Science & Technology
Government of Kerala
2003-2006

എ.പി. സിദ്ദീഖ് എഡിറ്റഡ്

കേരള സസ്യവൈദ്യശാസ്ത്ര കമ്മീഷൻ
കേരള സസ്യവൈദ്യശാസ്ത്ര കമ്മീഷൻ

The book deals with package of practices for the cultivation of 10 medicinal plants viz., *Kaempferia galanga*, *Plumbago rosea*, *Alpinia calcarata*, *Holostemma annulare*, *Kaempferia rotunda*, *Indigofera tinctoria*, *Asparagus recemosus*, *Curcuma aromatica*, *Piper longum* and *Rauvolfia serpentina*. It was prepared based on early recommendations and as part of a DST, Government of India sponsored project on medicinal plant cultivation for circulation among beneficiaries of the project (tribes).



TBGRI Brochure



TBGRI Vision

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Patents filed / Awarded

- First Examination Report of the process patent- a novel process for the production of hypericin from the shoot and callus cultures of *Hypericum hookerianum* Wight & Arn received in May 2006. Clarifications along with complete specification submitted in July 2006. (Inventors: Padmesh P, Reji J V, Seeni S and Nair G M).
- Fifteen EST sequences obtained from the forward subtracted library of *Hypericum hookerianum* submitted to NCBI database. Acc No.: EE665978 to EE665992. (Inventors: Padmesh P, Reji J V, Purushothama M G and Seeni S)
- Full length cDNA sequence having an ORF of 1173 bp obtained from *Hypericum hookerianum* submitted to NCBI database. Acc No.: EF186910 (Inventors: Padmesh P, Reji J V, Purushothama M G and Seeni S)
- "A process for preparation of novel herbal medicinal composition for cancer treatment from *Janakia arayalpatra* root and *Trichopus zeylanicus* leaves" (Patent No. 193609 of 2006. Inventors: Apjian Subramoniam; Sreedharan Rajasekharan; Palpu Pushpangadan; Varghese George; Gopalapillai Sreekandan Nair)
- "A process to prepare herbal medicine (phytomedicine) for liver diseases from a fern, *Cheilanthes farinosa*" (filed in 2006) Inventors: Asha V V, Wills P W and Subramoniam A.

Seminars / Conferences organized

- Short-term course on "Biodiversity Conservation and Characterization using Biotechnological Tools" for College Teachers, Sponsored by Department of Biotechnology, Govt. of India, from 12-30 March 2007.
- International Workshop on 'Conservation of Cycads in India', from 17 to 20 July 2006 at Thiruvananthapuram.
- 27th Annual Conference of Indian Association of Biomedical Scientists and National Symposium on Current Trends in the Development of Herbal Drugs, from November 25 to 27, 2006 at Rajiv Gandhi Center for Biotechnology, Thiruvananthapuram.
- "Brainstorming Workshop on Biodiversity Conservation through Biotechnological Interventions" from 10 to 11 January 2007 at Thiruvananthapuram.



Participation in Seminars / Symposia / Conferences / Workshops

- Ajikumaran Nair S and Subramoniam A, 2006. Antidiabetic activities of an active fraction from a folklore medicinal fern, *Hemionitis arifolia* in rats. Presented in Southern Regional Conference of Indian Pharmacological Society, Belgaum, Karnataka.
- Akhila S Nair, Pradeep N S Abraham T K and Jaya D S 2007. A study on the changes in the antioxidants and peroxidase isozyme profile of moisture stressed cowpea (*Vigna unguiculata* L.) varieties. In: Proc. of the 19th Kerala Science Congress, Kannur, pp. 796-797.
- Anilkumar C, Chitra C R, Bindu S and Lajju Mathew 2007. Seed studies on 12 southern Western Ghats species. Proc. XIX Kerala Science Congress, Kannur pp. 215-217.
- Archana G R and Hosagoudar V B 2006. Black mildew disease on Wattles (*Acacia* spp.) in Kerala State. National Conference on Recent Trends in Mycological Research, Dec. 28th & 29, J. J College of Arts and Sci. Pudukottai, TN, p. 85.
- Bejoy M, Dan M and Anish, N P 2006. Tissue culture-mediated conservation of selected gingers of the Western Ghats of peninsular India. Abstracts of the 4th International Symposium on the Family Zingiberaceae, Singapore Botanic Garden, Singapore. pp. 86-87.
- Cherian P Koshy, Jose P A, Raju Antony and Joemon Jacob 2006. Organized National Science Day Celebrations at various High Schools of Kerala.
- Dan M, Sabulal B, George V and Pushpangadan P 2006 Studies on the rhizome oils of four *Hedychium* species of South India: A chemotaxonomic approach. 4th International Symposium on the Family Zingiberaceae, Singapore Botanic Gardens, p-44.
- Divya N, Renju Krishna V and Pradeep N S 2007. Studies on the antimicrobial activities of *Oudmansia canerii* an edible mushroom. Abstracts International Conference on Mushroom Biology and Biotechnology, Solan, HP.
- Elsamma Joseph Arackal and. Pandurangan AG, 2006. Systematics of yams in Western Ghats. In: the International Seminar on Present Trends and Future Prospects of Angiosperm Taxonomy, organized by Agarkar Research Institute, Pune.
- Elsamma Joseph Arackal, Pandurangan A G and Ganesan S 2006. Diversity and distribution of the genus *Dioscorea* in Western Ghats. In: the Triennial Symposium of the International Society for Tropical Root Crops. Organized by CTCRI, Thiruvananthapuram.
- Ganesan S 2006 delivered an invited lecture entitled "Integrating fruit PGR conservation strategies for augmenting genetic diversity and generation of pre-breeding germplasm" at National Symposium on Underutilized Horticultural Crops IIHR, Bangalore, June 9-10
- Ganesan S 2006 Delivered two invited lectures entitled "Horticultural genetic resources conservation- achievements and challenges" and "How to integrate PGR conservation strategies using cryopreservation and *in vitro* conservation" at the ICAR Short course on *In vitro* Conservation and Cryopreservation. New Options to Conserve Horticultural Genetic Resources, IIHR, Bangalore, September 21-30
- Ganesan S 2006 Delivered an invited lecture entitled "Integrated conservation strategies for PGR" at the World Ayurveda Congress, Pune, November 5-12
- Ganesan S 2006 Attended "14th Triennial International Symposium on Tropical Root Crops", CTCRI (ICAR), Sreekariyam, Thiruvananthapuram., 20-26 November.
- Ganesan S 2006 Attended the National Seminar on Merging Modern Sciences for Sustainability, Health and Wellness. Thiruvananthapuram, November 30th - December 2nd.
- Ganesan S 2007 delivered a talk on "Biodiversity conservation through Botanic Gardens-targets to be achieved by 2010" at Fathima College, Kollam 12th January.
- Ganesan S 2007 Attended National Seminar on "Man & Biosphere" organised by Anthropological Society of India, Regional Center, Nagpur. and presented a paper entitled "Biodiversity Conservation - Contributions of TBGRI", 26-28 February.
- Ganesan S 2007 delivered an invited valedictory address at UGC sponsored seminar on "Plant medicine: present scenario". Department of Botany, St. Mary's College, Toothukudi (M.S. University) 24th February
- Ganesan S 2007 Attended National Seminar on MAP Government. Ayurveda College, Thiruvananthapuram March 14- 15
- Ganesan S, George V, Rajasekharan S, Latha P G and Anil John 2006. Indian Biodiversity Scenario - Its relevance in Ayurveda and support to modern medical sciences. Proceedings of the World Ayurveda Congress Pune, pp. 50-54.
- Ganesan S, Raju Antony, Mohanan N and Cherian P. Koshy 2006. 'Conservation status of Cycads in TBGRI'. Paper presented at the International Workshop on Conservation of Endemic Cycads in India, Thiruvananthapuram.
- George V and Anil John J 2006. The Role of Ethnomedical Leads in Drug Discovery. Proc. of the International Conference on Ethnopharmacology and Alternative Medicine, Invited talk. Amala Cancer Research Center, Thrissur IL-24, p. 18.
- Joice V Thomas 2006. Attended the seminar on 'Conservation and Management of National Resources for Environmental Protection of the Coastal Zone of Kerala. KFRI, Peechi, Thrissur.
- Joice V Thomas 2007. Attended the Nineteenth Kerala Science Congress held at Kannur.
- Joice V Thomas 2007 delivered a talk on 'Mangrove protection and conservation' at Govt. UP School, Kannur.
- Karthikeyan K, Ajikumaran Nair S and Subramoniam A 2006. Anticancer and



- apoptosis inducing properties of *Aplium graveolens* seeds. Presented in the National Symposium on "Current trends in the development of herbal drugs" and 27th Annual Conference of Indian Association of Biomedical Sciences, Thiruvananthapuram.
- Krishnan P N 2006. Biodiversity data management. Vacation Training Programme on Bioresources, Agricultural College, Vellayani, Thiruvananthapuram.
- Krishnan P N 2006. Application of Bioinformatics in Biodiversity Conservation. National Seminar on Modern Trends in Plant Science, Iqbal College, Peringamala.
- Krishnan P N 2006. Biodiversity Management Through Bioinformatics. Refresher Course, Academic Staff College, Kariavattom.
- Krishnan P N 2006. Bioinformatics: Role in Plant Biodiversity Documentation. National Symposium. Med. Plants: Role of Biotechnology and Bioinformatics. BIT, Ranchi.
- Krishnan P N 2007. Conservation and sustainable utilization of medicinal plant species through biotechnological means. National Seminar on Medicinal Plants, organised by Dept of Pharmacognosy, Govt. Ayurveda College, Thiruvananthapuram
- Krishnan P N 2007. Presented the Annual Project Report of Bioinformatics Sub-DIC, TBGRI in the Coordinators Meeting organized by DBT at Sikkim State Council of Science & Technology, Gangtok.
- Krishnan P N, Sreekumar S, Biju C K 2006. Biodiversity Management through Bioinformatics. Refresher course, Academic Staff College, Kerala University Thiruvananthapuram.
- Krishnan P N, Sreekumar S, Biju C K 2006. Bioinformatics: Role in Plant Biodiversity Documentation. Natl. Symposium on Medicinal Plants, Birla Institute of Technology, Mersa, Ranchi.
- Krishnan P N, Sreekumar S, Biju C K 2006. Bioinformatics: Role in Plant Biodiversity Documentation. Nat. Symp. Med. Plants: Role of Biotechnology and Bioinformatics, Organised by BIT, Ranchi, p. 12
- Latha P G 2006. Attended the National seminar on Food security through food processing. Lakshmi N Menon Institute for Empowerment of Women, Centre for Management Development, Thiruvananthapuram.
- Latha P G, Suja S R, Shyamal S, Shine V J and Rajasekharan S 2006. Ethnopharmacological investigations at TBGRI. Invited lecture presented at International Conference on Ethnopharmacology and Alternative Medicine and Annual Conference of National Society of Ethnopharmacology, Amala Cancer Research Centre, Thrissur.
- Latha P G 2006 presented an invited lecture on "Bioethics in Animal Experimentation" at the seminar on New Vistas in Science and Technology - organized by Mar Ivanios College, Thiruvananthapuram.
- Mathew S P, Abdul Jabbar M, Thomas M T and Haridas P 2007. Establishment of live collections of Andaman plants at TBGRI. Proc. XIX Kerala Science Congress, Kannur. pp. 239-240.
- Mohan N 2007. "Ex-situ conservation at Tropical Botanic Garden and Research Institute". Paper presented at Conference of the Asian Chapter of the Association for Tropical Biology and Conservation, Mahabalipuram.
- Mukunthakumar S 2006. Participated in one day symposium on "Need for Better Natural Resources Management for Kerala" conducted by Kerala State Land Use Board, at Science and Technology Museum, Thiruvananthapuram.
- Mukunthakumar S 2006. Participated in the training program and delivered a talk on Bioresources for School Children at The Rapinat Herbarium and Centre for Molecular Systematics. St. Joseph's College, Tiruchirappalli,
- Mukunthakumar S, Praveen G, Krishnan P N and Seeni S 2007. Banana and plantain - Status of conservation at TBGRI. In Abstracts, National Conference on Banana. AIPUB and NRCB, Tiruchirappalli, Tamil Nadu, pp. 31.
- Padmesh P 2007. Attended the Workshop on Biotechnological Interventions for the Conservation and Utilization of Forest Resources, Department of Biotechnology, Govt. of India at the Indian Wood Science and Technology (IWST), Bangalore.
- Pandurangan AG 2007. Biosphere Reserves in India: Legal framework and management- issues and concerns. Proc. of the Workshop on Perspectives of Biodiversity Conservation: Status of species richness in protected area. Kongunadu Arts and Science College, Coimbatore. pp.14-21.
- Pradeep C K and Vrinda K B 2006. Some noteworthy agarics from Western Ghats. In: International Symposium on Agriculturally Important Microorganisms, organized by Indian Mycological Society, Kolkatta.
- Pradeep C K, Vrinda K B and Sunil Kumar S 2007. Records of some noteworthy agarics from Western Ghats of Kerala. In: International Conference on Mushroom Biology and Biotechnology, organized by the Mushroom Society of India and NRCM, Solan, HP.
- Pradeep N S, Renju K and Shiburaj S 2007. Genetic similarity among environmental isolates of *Aspergillus* sp. Paper presented at National Symposium on Microbial Diversity and Plant Health organized by Indian Mycological Society, Kolkatta.
- Prakashkumar R and Suresh S 2006. Ultra structure features of pollen grains as an aid in the varietal characterisation of fruit crops. 28th Annual Meeting of Electron Microscope Society of India. Regional Research Laboratory, Thiruvananthapuram.
- Praveen G, Mukunthakumar S, Anandhu M D and Seeni S 2007. Flow cytometry- An ideal cytogenetic tool for rapid genome analysis in *Musa* (Banana). In Abstracts, National Seminar on Environmental Sustainability of Western Ghats of India. NMCC, Marthandam, Tamil Nadu. pp. 13-14.
- Praveen G, Mukunthakumar S, Krishnan P N and Seeni S 2007. Induced variation studies in two diploid south Indian cultivars of *Musa*. In Abstracts, National Conference on Banana. AIPUB and NRCB, Tiruchirappalli, Tamil Nadu, pp. 72.
- Radha R K 2005. Participated in the National Seminar on Trends in the Versatile Techniques of HPLC

- organized by Asian and Mideast Institute of Chemists (USA) and Amritha Institute of Medical Sciences and Research Centre, Kochi.
- Radha R K 2006. Presented a poster "In vitro propagation and chemical characterization of *Ammomum fenzlii*, an endemic insect repellent plant of Andaman Islands" at IAAT Seminar, Pune.
- Radha R K, Alex L and Mathew S P 2005. Poster entitled "In vitro propagation and chemical characterization of *Ammomum fenzlii*, an endemic insect repellent plant of Andaman Islands" presented at IAAT Seminar, Pune.
- Radha R K, William Decruse S, Krishnan P N, Seeni S and Ganeshan S 2006. Cryopreservation of embryonic axes of recalcitrant seed species *Myristica malabarica* Lam., a rare medicinal plant of the Southern Western Ghats. National Seminar on Plant Resources of Western Ghats, 7th and 8th December 2006, IISC, Bangalore.
- Rajasekharan S 2006 "Indigenous Knowledge associated with Biodiversity". National Seminar on 'Flowering Diversity' jointly organized by SNM College, Maliangara and UGC, Emakulam.
- Rajasekharan S 2006 "Benefit Sharing model developed by TBGRI" for the World Bank Delegation headed by Sri. Sidharath Prakash, Thiruvananthapuram.
- Rajasekharan S 2006. "Traditional Knowledge and Geographical Indications : Issues and Concerns" International Seminar on Global Intellectual Property Right (IPR) Regime- Challenges, Opportunities and Options. MG University, Kottayam.
- Rajasekharan S 2006. " *Paristhiti Reksha Jeevasuraksha* (Protect Environment and Save Lives)- implementation of innovative, holistic and traditional bioethical practices with peoples participation at grass root level to safe guard the ecosystem and environment in connection with an International Seminar/Workshop jointly organized by UNESCO, Bangkok, ICMR New Delhi and Department of Philosophy University of Kerala., Thiruvananthapuram.
- Rajasekharan S 2006. "Development of methodology for the survey of crude drugs" National Workshop organized by CCRAS, Ministry of Health and Family Welfare, Govt. of India at Pune.
- Rajasekharan S 2006. "Systematic Documentation of IK/TK related to the plants used for Food and Medicine". National Seminar on Medicinal Plants and Drug Development organized by Mar Athanasious College, Thiruvalla.
- Rajasekharan S 2006. "Systematic Documentation of IK/TK" National Workshop, Agricultural College, Thiruvananthapuram.
- Rajasekharan S 2006. "Traditional knowledge and Medicinal plants" Academic Staff College, Kerala University, Thiruvananthapuram.
- Rajasekharan S 2006. Attended National Workshop on "Patent issues and its regulations, rights, limitations" jointly organized by NIPP & KSCSTE, Thiruvananthapuram.
- Rajasekharan S 2006. Attended the International Workshop on *Cycads* held at Thiruvananthapuram.
- Rajasekharan S 2007. "Systematic documentation of Traditional Knowledge related to Medicinal plants and IPR related issues". 6th National Seminar on Medicinal plants organised by Department of Pharmacognosy, Govt. Ayurvedic College, Thiruvananthapuram.
- Rajasekharan S 2007. Attended the Workshop of Taxonomists organised by Kerala State Biodiversity Board, Thiruvananthapuram.
- Ramasubbu R, Kulloli S K, Sreekala AK and Pandurangan A G 2007. Reproductive Biology of *I. cuspidata* Wight & Arn. A rare and endemic Balsam of Western Ghats. In: Proc. of the 19th Kerala Science Congress, Kannur, pp.218-221.
- Rameshkumar K B and George V 2007. Phytochemistry of the Endemic Species, *Curcuma ecalcarata* Sivar & Indu. Proceedings of the 19th Kerala Science Congress Kannur p. 89.
- Renju Krishna V, 2007. Investigations on commercially exploited *Oyster* Mushrooms (*Pleurotus* sp.) in Kerala. Abstract International Conference on Mushroom Biology and Biotechnology, Solan, HP.
- Renju Krishna V, Pradeep N S and Shiburaj S 2007. Studies on the distribution and phylogenetic analysis of antifungal actinomycetes in selected sacred groves of Kerala. In: Proc. of the 19th Kerala Science Congress, Kannur, pp. 730-732.
- Riju M C, Vijayakumar K and Hosagoudar V B 2006. Mycorrhizal association of some medicinal plants of Western Ghats. National Conference on Recent Trends in Mycological Research. J. J College of Arts and Sci. Pudukottai, TN, p. 49.
- Seeni S 2006. Presented a paper on 'Sustainability of Environmental Education Schemes in Tamilnadu Schools in India' at the BGCII 6th International Congress on Education in Botanic Gardens in the University of Oxford Botanic Garden, UK.
- Seeni S 2007. Presented a lecture on 'Income generation and livelihood enhancement in rural areas through biotechnology based floriculture development' at the Centre for Biotechnology, Anna University, Chennai.
- Seeni S 2007. Presented a series of invited lectures on 'Conservation, bioproduction of plant-specific molecules and biodiversity based patents in Holy Cross College, Trichi, Jamal Mohammed College, Trichi, M.S. University, Thirunelveli, Thiagaraja College, Madurai and Madurai Kamaraj University, Madurai.
- Shareef S M, Sam P Mathew and Cheriyan P Koshy 2006. "Wild and cultivated edible Myrtaceous fruit plants of Thiruvananthapuram district in Kerala state." Poster presented at IAAT Conference, Pune.
- Sherina T V and Sudha C G 2005. Establishment and growth analysis of hairy root cultures of *Decalepis arayalpathra*, a critically endangered ethnomedicinal plant - Proceedings 17 Kerala Science Congress, Thrissur, pp116-117.
- Shyamal S, Latha P G, Suja S R, Rajasekharan S and Ganga Devi T 2007. Hepatoprotective effects of *Pittosporum neelgherrense* on D - Galactosamine(D-GalN) induced liver



- injuries in rats. Nineteenth Kerala Science Congress, Kannur. pp 337-338.
- Sreekumar S 2006 Biodiversity Informatics and Barcoding of Life Forms. Seminar organized by Kristhu Jyothy College, Changanassery.
- Sreekumar S, 2006 Bioinformatics an Overview with emphasis on Biodiversity Informatics. Organized by Dept. Biosciences, S N College of Technology, Kollam.
- Sreekumar S, Safer P M, Biju C K, Raveendran M, Parvathy Sankar and Krishnan P N 2006. Bioinformatics an overview with emphasis on Biodiversity Informatics. Proc. Nat. Seminar on Human Resource Development in Bioinformatics: Challenges and Prospects. Dept. Biosciences, S.N.College of Technology, Kollam, pp.10-32.
- Subramoniam A 2006. 'Promising plants in the development of phytomedicines for fungal diseases'. International Conference on Ethnopharmacology and Alternative Medicine. Amala Cancer Research Centre, Thrissur.
- Subramoniam A 2006. "Pharmacological Evaluation of Herbal Drugs for their Efficacy and Safety". Lecture for Refresher Course in Life Sciences organized by UGC-Academic Staff College, Thiruvananthapuram.
- Subramoniam A 2006. Lecture to M Sc Students, Amala Cancer Research Centre, Thrissur.
- Sudha C G 2005. *In vitro* approach for the production of secondary metabolites: Bioconcepts -2005, Souvenir, National Seminar on Biotechnological Interventions in Environmental Management, organised by S.N College, Quilon, pp 103-107
- Sudha C G 2005. Medicinal Plant Cultivation for Women Empowerment and Self Income Generation- National Workshop on Women Friendly Technology organized by Women's Wing of Swadeshi Science Movement (SHAKTI)
- Sudha C G 2006. Delivered a talk on "Technology in Agriculture" during Wayana varam conducted by the Information and Education Department, Govt.of Kerala.
- Sudha C G 2006. Delivered a talk on Medicinal Plant Cultivation for Self Income Generation for Kudumbasree Units, at Rehabilitation Plantations Ltd., Kulathupuzha.
- Sudha C G 2007. Served as resource person for short term course on "Biodiversity conservation and characterisation using biotechnological tools " for college teachers, Sponsored by the Department of Biotechnology, Govt. of India.
- Sudha C G, Mathew George and G M Nair 2005. Rapid and high frequency *in vitro* multiplication of *Alpinia calcarata* Rosc., a commercially important medicinal plant.; Proceedings, 17 Kerala Science Congress, Thrissur, p 276.
- Suja S R, Latha P G, Pushpangadan P and Rajasekharan S 2006. Hepatoprotective effect of *Helminthostachys zeylanica* (Linn) Hook. f. on CCl₄ induced liver damage in Wistar rats. Paper presented at the 5 th National Seminar on Medicinal Plants, Department of Pharmacognosy, Ayurveda College, Thiruvananthapuram.
- Suja S R, Latha P G, Pushpangadan P and Rajasekharan S 2007. Hepatoprotective activity of *Rhinacanthus nasuta* (Linn). Kurz on ethanol induced liver damage in Wistar rats. Nineteenth Kerala Science Congress, Kannur. pp 333- 335.
- Thomas M T, Dan M and Mathew P J 2006. Quantitative variation of bioactive compounds in *Centella asiatica* occurring in Southern India. Abstract. National Symposium on Current Trends in the Development of Herbal Drugs. Thiruvananthapuram, Kerala.
- Thomas M T, Haridas P, Abdul Jabbar M and Ganeshan S 2007. Developemnt of the field gene bank of medicinal and aromatic plants at TBGRI. Proc. XIX Kerala Science Congress. Kannur. pp. 213-214.
- Vrinda K B, Pradeep C K and Sunil Kumar S, 2007. Wild edible mushrooms in indigenous forests, a source of food and income. In: International Conference on Mushroom Biology and Biotechnology, organized by the Mushroom Society of India and NRCM, Solan, HP.

Popular articles

Rajasekharan S and Latha P G 2006. The Indian Laburnum: Destroyer of diseases Ayurveda and Health Tourism. 1 (3) 20-23.

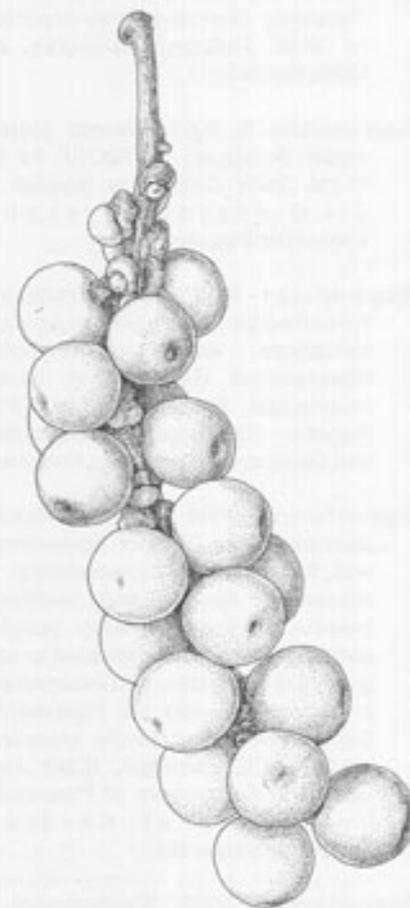
Rajasekharan S and Latha P G 2006. *Amoora rohituka* :drug for spleen and liver diseases. Ayurveda and Health Tourism. 1 (2) 28-30

Rajasekharan S and Latha P G 2006. Amrit (*Tinospora cordifolia*), the elixir of life . Ayurveda and Health Tourism. 1 (1) 24-27.

Rajasekharan S and Latha P G 2006. Asoka: the woman's best friend. Sangamam Magazine on Ayurveda. 2 (4) 34-37

Vrinda K B and Pradeep N S 2006. 'Koon vibhavangal', Vanitha, 11:78-84.

William Decruse S 2005. Ini Pachavellakkeniyum, Kerala Karshakan, FIB, Kerala.



Institutional collaborations and Industrial linkages

The Bioinformatics Centre joined hands with Apex Centre at Delhi to develop the web portal system for BTISNet Publications and Library resources. The Centre also had preliminary discussion to tie-up with IIT, New Delhi for the development of web portal for BTISNet, as per the directions of the Task Force of DBT Bioinformatics Division.

Established collaboration with National Centre for Banana Research, Trichy for *Musa* germplasm collection and *ex situ* conservation.

Preliminary discussions were held with industry participants from Coimbatore and Chennai for commercialising *Trichopus* cultivation and the hairy root-based ointment from *Plumbago rosea*.

A SBIRI (Small Business Initiative) project on commercialisation of bamboo flowering and seed setting was submitted to the DBT for collaboration with Abl Biotech, Chennai.

Involved in preparation of Management Plan for Agasthyamalai and Nilgiri Biosphere Reserves and also site specific plan for Neyyar, Peppar and Shendurney Wildlife Sanctuaries.

Assisted the State Forest Department in identifying species rich areas in terms of NWFPs, Wild relatives of crop plants, traditional cultivars and demarcated for *in-situ* conservation giving suitable protection by using local people as EDCs in both Agasthyamalai and Nilgiri Biosphere Reserves.

Assisted the State Forest Department to identify the ecologically sensitive areas for conservation as well as for creating awareness to the local people. Accordingly, 6 *Myristica* swamps were identified and all the species grown in this special habitat were labeled for awareness and environmental education programme organized by the Forest Department.

Interacted with Herbaria of Botanical Survey of India namely Central

National Herbarium (CNH) Kolkatta, Madras Herbarium (MH), Coimbatore; Blatter Herbarium, Bombay; Madras Christian College; Presidency College Madras, KFRI Thrissur, Calicut University Herbarium (CALI), NBPGR, Thrissur for the purpose of matching and confirming the identity of the specimens.

Insect specimens collected as part of population dynamics of RET species were identified in association with Department of Entomology, Kerala Agricultural University, Thiruvananthapuram. Department of Zoology, Sacred Heart College, Ernakulam and Department of Zoology, UC College, Aluva.

Awards / Honours / Memberships / New Ph Ds

Ganeshan S was nominated as Member of the Advisory Board of the Journal of Medicinal and Aromatic Plant Sciences, by CIMAP, Lucknow.

Ganeshan S was nominated as Member of the Editorial Board of the Journal of Palynology by the Palynological Society of India.

Ganeshan S was nominated as Member of the Management Committee of NATPAC.

Ganeshan S nominated as Member, Organizing Committee 19th KSC, Kannur.

Ganeshan S was nominated to the Faculty of Applied Sciences, University of Kerala.

Ganeshan S was nominated as Member of the Executive Committee, Malabar Botanical Garden, Kozhikode.

Ganeshan S was nominated as Member, Steering Committee KSLUB- Natural Resources Conservation Awareness National Seminar.

Ganeshan S was nominated as Member, Task Force, Screening Committee for Access & Benefit Sharing, National Biodiversity Authority, Chennai.

Ganeshan S was nominated as Member of

Consultative Group for Forestry Research and Management, KFRI, Peechi, Thrissur.

Ganeshan S was nominated as Member of the KFRI, Management Committee.

Ganeshan S was nominated as Member, National Panel of Consultants, Environmental Resources Research Centre, Thiruvananthapuram.

Ganeshan S was nominated as Member, Research Advisory Committee, Kerala Forest Department.

Sreekala A K has been selected as Fellow of Indian Association for Angiosperm Taxonomy.

Renjukrishna V won Young Scientist Award and Gold Medal for the oral presentation during the International Conference on Mushroom Biology and Biotechnology organized by NRCM and Mushroom Society of India.

Pradeep N S won best poster award for the paper "A study on the changes in the antioxidants and peroxidase isozyme profile of moisture stressed cowpea (*Vigna unguiculata* L.) varieties" 19th Kerala Science Congress, Kannur.

Pandurangan A G, Research Guidesip, Kannur Univeristy.

Sreekala A K, Research Guidesip, Kannur Univeristy.

Vrinda K B, Research Guidesip, Kannur Univeristy.

Hosagoudar V B Research Guidesip, Kannur Univeristy.

Hosagoudar V B appointed Honorary Research Advisor to the Sengamala Thayaar Educational Trust Women's College, Mannargudi, Tamil Nadu.

Hosagoudar V B, Editorial Committee Member of Journal of Indian Phytopathological Society.

Hosagoudar V B, Editorial Committee Member of Journal of Scientific Transactions and Environmental Technovations.

Pandurangan A G served as Member of the Steering Committee of Biosphere Reserves for Kerala State.

Krishnan P N was nominated as Chairman, Board of Studies in Bioinformatics and Member, Faculty of Science of Calicut University.

Latha P G (2006) Ph D Examinar at Gandhigram Rural Institute, Dindigul.

Sreekumar S, Biju C K and Raveendran M served as the Adjudicators in the district level High School Students Science Congress, Attingal, sponsored by DST, Govt. of India.

Seeni S has been nominated as an Honorary Director, KELPAM, Government of Kerala.

Suresh S along with Prakashkumar R won best oral presentation prize for the paper entitled 'Ultra structure features of pollen grains as an aid in the varietal characterisation of fruit crops' in 28th Annual Meeting of Electron Microscope Society of India.

Rajasekharan S nominated as Expert Committee Member of National Biodiversity Authority (Access and Benefit sharing).

Rajasekharan S nominated as Expert Committee Member of National Biodiversity Authority (Access and Benefit sharing).

Rajasekharan S nominated as Chairman Advisory Committee of the Central Research Institute (Ayurveda) Cheruthuruthi, Kerala CCRAS, Ministry of Health and Family Welfare Govt. of India.

Rajasekharan S nominated as Member to State Medicinal Plant Board.

Rajasekharan S nominated as Member, Advisory Board of Kerala Innovation Foundation of Kerala State IT Mission.

Rajasekharan S nominated as Member, Board of Studies (Phytomedical Technology) MG University, Kottayam.

Rajasekharan S appointed as a Co-ordinator of Networking Group on bio-prospecting/ medicinal plants/connected programmes by KSCSTE.

Raj Vikraman R was awarded Ph D of the University of Kerala.

Subhisha Sathyan was awarded Ph D of the

University of Kerala.

Gayathri V was awarded Ph D of the University of Kerala.

Shylesh B S, Ajikumaran Nair S and Subramoniam A were awarded Jaipur Prize by Indian Pharmacological Society for the best paper published in Indian Journal of Pharmacology in the year 2005. The same paper has been recognized as one of the 25 significant findings in the area of cancer preventive herbals in 2005 by NIH, USA.

Subramoniam A awarded Dr V V Swaminathan Research Endowment Award 2005 of Indian Association of Biomedical Scientists.

Subramoniam A and colleagues won Dr B Mukerjee Prize of Indian Pharmacological Society for their publications in Indian Journal of Pharmacology during 2005-2007.

Subramoniam A awarded Fellowship of Indian Association of Biomedical Scientists (FABMS).

Subramoniam A elected Vice President of Indian Association of Biomedical Scientists 2006.

Subramoniam A was selected as Member of Advisory Board, Annai Velankanni College, Tholayavattam, Kanya Kumari District.

Subramoniam A started Kerala Chapter of Indian Association of Biomedical Scientists as its Convenor & President.

Subramoniam A served as a judge in the selection of Young Scientist in Life Science and co-chaired the technical section on Life Science in the 19th Kerala Science Congress, Kannur.



Extension Activities

The Institute mandate of Conservation Education was strengthened, with the inauguration of the Silver Jubilee Visitors Complex, by the Hon'ble Chief Minister of Kerala, Sri V. S. Achudanandan on 13th December 2006. A 15-minute documentary film on the Garden and a multicolour brochure about the vision and the functioning of the institution were published. About 20,000 students and public visited the Garden during 2006-2007. Rs 77,000/- was earned as the gate collection from visitors.

The Institute organised a DBT-sponsored 21-day training programme for college teachers involved in undergraduate teaching in Life Sciences and Biotechnology, the major objective of which is to expose the participants to a broad range of *in vitro* culture, phytochemical and molecular biological techniques useful in the conservation and characterization of plant germplasm particularly of medicinal and aromatic plants. The hands-on training (70%) in seed biology, micropropagation, bioproduction of plant-specific molecules, genetic transformation, genetic diversity analysis, QTL mapping and biological database organisation using Bioinformatic tools was supplemented with lectures and interactive discussion (30%). A total of 12 teachers from all over India participated in the training.

30 B Tech, M Sc and M Phil students did their dissertations at various Divisions of the Institute.

In an effort to enthuse the local tribal community to participate in medicinal plant cultivation for sustainable use, two training programmes were organised for selected 27 tribals from Peringammala, Vithura and Kuttichal Gramapanchayaths. Saplings of (tissue culture) *Alpinia calcarata* (1395), *Kaempferia galangal* (3350), *Kaempferia rotunda* (1425), *Curcuma aromatica* (305), *Plumbago rosea* (969), *Holostemma annulare* (445), *Rauvolfia serpentina* (131), *Indigofera tinctoria* (117) and *Piper longum* (185) were supplied to the beneficiaries. In addition, seeds of *Indigofera tinctoria* (100 each) and rhizome cuttings (15

each) of *Curcuma aromatica* were supplied. One training manual on medicinal plant cultivation in local language was also printed and supplied to them.

Under a project funded by the WGDP, *Holostemma annulare* and *Alpinia calcarata* were multiplied through tissue culture and hardened plants supplied to women beneficiaries of Peringammala Panchayat. Survey details including cultivation, preparation of herbal remedies and sale of plants cultivated by Kudumbashree unit indicated the success of the project.

The DBT project on Benefit sharing with women beneficiaries of Kanjikuzhi Panchayat was launched. Each beneficiary received a stipend of Rs. 500 as an incentive under the programme. Medicinal plants (*Aloe vera*, *Plumbago rosea*, *Asparagus racemosus*, *Holostemma annulare* and *Kaempferia galanga*) multiplied through conventional and non-conventional methods were distributed to the beneficiaries under the supervision of Panchayat Standing Committee members and the guidelines for planting and rearing given to the beneficiaries. Infrastructure establishment (Mist chamber, shade house and barbed wire fence) was completed. The irrigation facility in the nursery land was completed. The nursery planting and maintenance was entrusted with to the selected beneficiaries residing close to the nursery and a special training and instruction was given to them. Progress of the cultivation by the beneficiaries in their own land was surveyed. At the end of second year each beneficiary was ready with the plants to sell them and some of them realised an income of Rs. 100-160 per month through sale.

As part of the extension activity with Bamboos, 6998 saplings belonging to 18 species viz. *Arundinaria* sp. (443 saplings), *Bambusa bambos* (1331 saplings), *Bambusa vulgaris* (124 saplings), "*Bambusa variegata*" (230 saplings), *Bambusa balcooa* (36 saplings), *Bambusa multiplex* (2 saplings), *Bambusa vulgaris* cv. 'wamin' (169 saplings), *Bambusa* sp. (126 saplings), *Dendrocalamus brandisii* (1024 saplings), *Dendrocalamus giganteus* (136 saplings), *Dendrocalamus hamiltonii*

(733 saplings) *Dendrocalamus membranaceus* (57 saplings), *Dendrocalamus strictus* (174 saplings), *Ochlandra wightii* (14 saplings), *Ochlandra scriptoria* (176 saplings), *Ochlandra travancorica* (162 saplings), *Oxytenanthera nigrociliata* (1837 saplings), *Thyrsostachys siamensis* (224 saplings)- were distributed to 50 beneficiaries including the Tourism Promotion Officer, Thenmala Eco-Tourism; Iqbal College, Peringammala; The Thenmala Eco-Tourism Promotion Society; The Divisional Manager, KFDC, Thiruvananthapuram; Govt. BHS, Koodal; Dept. of Botany, University of Kerala, Karyavattom; Sri Sathya Sai Orphanage Trust, Thonnakkal, Thiruvananthapuram; Bio-Diversity Park Programme, New Delhi; Social Forestry, Punalur Range; The Asst. Wild Life Warden, Neyyar Sanctuary; Director, NBRI, Lucknow; St. Thomas H.S.S. Thiruvananthapuram etc.

Organized a special interactive session for the students from the various schools of Thiruvananthapuram District at TBGRI on 28th September 2006 in connection with *Youva Sangamam* (Meet of Youngsters) organized by KSSP.

Extended support to the school children for the preparation of Biodiversity Register at Vilavoorkal Gramapanchayath, Thiruvananthapuram 19th October 2006.

Imparted two days training / Demonstration class on 'Nursery plant establishment and setting up of satellite Nursery 'Vinobaniketen', Vellanad, Thiruvananthapuram.

T B G R I participated in the following Exhibitions

"Silver Jubilee Celebration" Expo 2006, Mithranikethan, Thiruvananthapuram.

"Thrissur Pooram Festival", Thrissur.

"Onam Trade Fair and Exhibition" at Sooryakanthi Ground Kanakakunnu, Thiruvananthapuram.

Swayashraya Bharathi 2006 All India Exhibition, organised by Swadeshi Science Movement, Ernakulam.

"Science Exhibition" at Neeramankara N S College, Thiruvananthapuram.

Exhibition organised by C.T.C.R.I Trivandrum in connection with 14th Triennial Symposium of the International Society for Tropical Root Crops.

"Golden Jubilee Celebration of Kerala State Formation" organised by Department of Animal Husbandry at Institute of Animal Health and Veterinary Biology, Palode.

"Golden Jubilee Celebration 2006-2007" organized by Thonnakkal Samskarika Samithy, Thiruvananthapuram.

Science Exhibition in connection with 19th Kerala Science Congress, Kannur.

Palode Cattle Fair, where the Institute received 'Best Pavilion Award'.

"Agri-Horticulture Fair" at Konchira Mudippura Temple, Thiruvananthapuram.

"Nedumangad Expo 2007", organised by Nagarasabha, Nedumangadu.





People and TBGRI

- Students of Government Higher Secondary School, Neyyattinkara, Thiruvananthapuram, Kerala
- B Sc and M Sc Botany students of Dhanalakshmi Srinivasan College of Arts and Science for Women, Perambular, Tamil Nadu
- M Sc students of Fathima Matha National College, Kollam, Kerala
- Staff of Home Department, Government Secretariat, Thiruvananthapuram, Kerala
- Members of Tamil Nadu Registered Siddha Medical Practitioners Association, Coimbatore, Tamil Nadu
- B Sc Biotechnology students of Kuringi College of Arts and Science, Tiruchirapalli, Tamil Nadu
- B Sc Biotechnology students of Sree Narayana College of Technology, Vadakkevila, Kollam, Kerala
- Students of Adayamon U P S, Kilimanoor, Thiruvananthapuram, Kerala
- Science Club students of N R P M Higher Secondary School, Kayamkulam, Alapuzha, Kerala
- B Sc Botany and Biotechnology students of Bishop Moore College, Mavelikara, Alapuzha, Kerala
- B Sc Botany students of St. Thomas College, Ranni, Pathanamthitta, Kerala
- B Sc Agricultural students of College of Horticulture, Vellanikkara, Thrissur, Kerala
- Staff of Lord Krishna Residential School, Chathannur, Kollam, Kerala
- Students of Government U P S Poovachal, Thiruvananthapuram, Kerala
- E C E students of Government College of Engineering, Bargur, Krishnagiri, Tamil Nadu
- B Sc Agriculture students of College of Agriculture, Padannakkad, Kasaragod, Kerala
- Ayurveda students from Italy, sponsored by Medicus Ayurvedic Centre, Kovalam, Thiruvananthapuram, Kerala
- Students of Janardhanapuram Higher Secondary School, Ottakesharamangalam, Thiruvananthapuram, Kerala
- B Sc Botany students of Assumption College, Changanacherry, Kottayam, Kerala
- Ayurvedic physicians of Central Research Institute (Ay), Cheruthurthy, Thrissur, Kerala
- Students of St. Xavier's Higher Secondary School, Peyad, Thiruvananthapuram, Kerala
- Students from S N Parallel College, Njakkad, Thiruvananthapuram, Kerala
- B Sc Plant Biology and Plant Biotechnology students of P S G College of Arts and Science, Coimbatore, Tamil Nadu
- M Sc Botany students of University School of Sciences, Gujarat University, Ahmedabad, Gujarat
- M Sc Botany students of PG Department, Karnataka University, Dharwad, Karnataka
- B Sc Bioinformatics students of SASTRA Deemed University, Thanjavur, Tamil Nadu
- B Sc Botany students of Saraswathi Narayanan College, Perungudi, Madurai, Tamil Nadu
- M Sc Biotechnology students of Holy Cross College, Nagarcoil, Tamil Nadu
- Forest Ranger trainees from Kerala Forest School, Arippa, Chozhiyacode, Thiruvananthapuram, Kerala
- M Sc Plant Biology and Plant Biotechnology students of St Joseph's College, Tiruchirapalli, Tamil Nadu
- B Sc Biotechnology students of N M S S Vellaichami Nadar College, Madurai, Tamil Nadu
- B Sc Medical Lab Technology students of Medical College, Thiruvananthapuram, Kerala
- Students of Youvasangamam Camp of Kerala Sasthra Sahithya Parishad, Thiruvananthapuram, Kerala
- M Sc Botany students of Christain College, Kattakkada, Thiruvananthapuram, Kerala
- M Sc Environmental studies students of Manonmaniam Sundaranar University, Tirunelveli, Tamil Nadu
- Members of Vegetable and Fruit Promotion Council, Kerala, Pandalam, Pathanamthitta, Kerala
- Children of Wisdom Valley Kindergarten, Thirumala, Thiruvananthapuram, Kerala
- B Sc Industrial Microbiology students of National College, Manacaud, Thiruvananthapuram, Kerala
- Medical Practitioners of Kerala Parambarya Siddha Mamma Chikilsa Sanghom, Kudappanakunnu, Thiruvananthapuram, Kerala
- Students of A P R M Central School, Chithara, Kollam, Kerala
- M Sc Pharmacy students of Government Homeo College, Thiruvananthapuram, Kerala
- Students of Government Girls Vocational Higher Secondary School, Pettah, Thiruvananthapuram, Kerala
- Children from Mar Gregorios English Medium Nursery, Nemon, Thiruvananthapuram, Kerala
- Medical students of Dharma Ayurveda Medical College and Hospital, Sriperumbudur, Kancheepuram, Tamil Nadu
- Students of Government V H S for Boys, Attingal, Thiruvananthapuram, Kerala
- Children from Bethel Child Development Centre, Parassala, Thiruvananthapuram, Kerala
- B Sc Botany students of St. Gregorios College, Kottarakara, Kollam, Kerala
- Students of Government Higher Secondary School, Kummil, Thiruvananthapuram, Kerala
- College Teachers who participated in Orientation Course of Academic Staff College, University of Kerala,

- Thiruvananthapuram, Kerala
- Government Girls Higher Secondary School, Malayinkeezhu, Thiruvananthapuram, Kerala
- M Sc Botany students Ramniranjan Jhunjhunwala College, Ghatkopar, Mumbai, Maharashtra
- B Sc Biotechnology students of K R R Government Degree College, Kodad, Nalgonda, Andhra Pradesh
- B A Communicative English students of Iqbal College, Peringamala, Thiruvananthapuram, Kerala
- M Sc Applied Fisheries students of St. Albert's College, Ernakulam, Kerala
- Students of Shanmukha Vilasom Higher Secondary School, Clappana, Kollam, Kerala
- B Sc Biotechnology students of Sri Maata Degree College, Hospet, Bellary, Karnataka
- M Sc Botany Students of P P N College, Kanpur, UP
- B Sc Botany students of Mar Ivanios College, Thiruvananthapuram, Kerala
- B Sc Botany students of St. Mary's College, Sulthan Bathery, Wayanad, Kerala
- Students of Government Higher Secondary School, Puthoor, Kollam, Kerala
- BAMS students of Gomantak Ayurveda Mahavidyalaya, Shiroda, Goa
- Students of Government Town UPS, Kilmanoor, Thiruvananthapuram, Kerala
- Students of Vimala Hridaya Higher Secondary School for Girls, Pattathanam, Kollam, Kerala
- Children from Mar Gregorios English Medium Nursery, Nemom, Thiruvananthapuram
- Students of St. Thomas U P School, Vakayar, Konny, Pathanamthitta, Kerala
- B Sc Botany students of St. Philomena College, Darbe, Puttur, Karnataka
- Students of S N S College, Attingal, Thiruvananthapuram, Kerala
- Scientists of Institute of Animal Health and Veterinary Biologicals, Palode, Thiruvananthapuram, Kerala
- Students of Edakattuvaal U P S, Piravom, Ernakulam, Kerala
- Students of Maths Tech, Attingal, Thiruvananthapuram, Kerala
- Students of Manarul Huda Higher Secondary School, Nedumangad, Thiruvananthapuram, Kerala
- Students of Government Vocational Higher Secondary School, Koodal, Pathanamthitta, Kerala
- Students of Government Higher Secondary School, Kamaleswaram, Thiruvananthapuram, Kerala
- Students of Government Model Higher Secondary School, Venganoor, Thiruvananthapuram, Kerala
- Students of NSV Vocational Higher Secondary School, Punaloor, Kollam, Kerala
- Members of Sevika Sangham, St. Thomas Marthoma Church, Pattoor, Thiruvananthapuram, Kerala
- Students of PTM Higher Secondary and Vocational Higher Secondary School, Kottukal, Thiruvananthapuram, Kerala
- Students of PSVM Higher Secondary School, Konni, Pathanamthitta, Kerala
- Students of Akshara Tuition Centre, Bharathannoor, Thiruvananthapuram, Kerala
- Students of Government High School, Karippoor, Nedumangad, Thiruvananthapuram, Kerala
- Students of LMS U P S, Cantonment, Thiruvananthapuram, Kerala
- BSc Botany and Biotechnology students of AJ College of Science and Technology, Thonnakkal, Thiruvananthapuram, Kerala
- Students of Mitraniketan Peoples College, Vellanad, Thiruvananthapuram, Kerala
- TTC students of MCT Teachers Training Institute, Melmuri, Malappuram, Kerala
- B Sc Botany students of MSC Institute of Science, Kadakkal,
- Thiruvananthapuram, Kerala
- Scientists of Southern Regional Diagnostic Laboratory, Bangalore, Karnataka
- Students of Murukkumon UPS, Nilamel, Kollam, Kerala
- Students of K M U P School, Pallassery, Pathanamthitta, Kerala
- Students of Nehru Memorial Higher Secondary School, Adichanallor, Kollam, Kerala
- Students of S S Higher Secondary School, Urangattiti, Malappuram, Kerala
- Members of Janatha Grandhasala, Kulanada, Pathanamthitta, Kerala
- Students of Rajiv Gandhi National School, Malayinkil, Thiruvananthapuram, Kerala
- BAMS students of SB Shiddaling Shivacharya Swamigi Ayurveda Medical College, Mundaragi, Gadag, Karnataka
- Students of Government Siddha Medical College, Palayamkottai, Tirunelveli, Tamil Nadu



Facilities / Equipments

- Analytical Balance - Sartorius Basic
 Animal House Facility
 Automatic Polarimeter -Rudolf Research Analytical Autopol IV
 Automatic Refractometer - Rudolf Research Analytical J-257
 Blister Packing Machine
 BOD Incubators
 Cadmill Pulveriser
 Centrifuge
 Circulating Water Bath with Temp. Control - Heto Model DT1
 Conductivity Meter
 Controlled Environment Incubators
 Controlled Rate Freezer
 Cross Beater Mill- RETSCH Model SK-1
 Cultural Collections (Micro & Macro fungi, Actinomycetes etc)
 Deep Freezer
 De-humidifiers
 Desiccators
 Digital Camera
 Distillation Unit
 Electrophoresis (Vertical & Submarine)
 Flame Photometer
 Fully Automatic Biochemical Analyser
 Garment Cubicle
 Gas Chromatograph Nucon 5765 with FID detector
 Gas Chromatographic System
 Gel Documentation System
 Gel Documentation Unit
 GPS
 High-speed Refrigerated Centrifuge
 Homogenizer
 HPLC- Shimadzu LC-10 AS
 Ice Flaking Machine
 Incubated Shaker
 Infrared Spectrophotometer, Buck Scientific - Model 500
 Inverted Microscope
 Kalwega-All Purpose Machine
 LCD Projectors
 Leica Stereomicroscope
 Liquid Nitrogen Plant
 Liquid Scintillation Counter
 Lyophiliser- Hetosic Model FD. 2.5 with Vacuum Pump (Pfeiffer-BZ43)
 Microcentrifuge
 Microscopes with Photodocumentation Facility
 Microwave Oven
 Midterm Storage Room (15°C/15%RH).
 Moisture Analyzer
 MPLC- Buchi with UV Vis Filter
 Photometer Detector and Fraction Collector
 Multicapillary Automated DNA Sequencer
 Mushroom Cultivation Unit
 Mushroom Spawn Production Unit
 Nikon Camera
 Nikon Optical Microscope with Microphotographic Attachment.
 PCR Machine
 Radio- Isotopes (for bio-chemical pharmacology and cell biology)
 Refrigerated Microcentrifuge
 Research Centrifuge
 Rota Vapour Assembly
 Rotavapor - Buchi Model R-114
 Seed Blower
 Seed Germinators
 Seed Grader
 Server
 Shaker NBS
 Shakers
 Stereo Microscope
 Submarine Gel Electrophoresis
 Super Cold Refrigerators (-200C),
 Tableting Machine- Single Punch
 Thermal Cyclers (PCR Machine)
 Transilluminator
 Tropbactrin Production Unit
 Turbovap- Zymark Turbo Vap II
 UV Chamber.
 UV- Visible Spectrophotometer
 Vacuum Pump
 Water-jacketed CO₂ Incubator
 Web Server



List of externally funded projects during 2006-07

Sl. No.	Code	Name of Project	Name of Funding Agency
1	A13	"All India Coordinated Research Project on Orchids"	Ministry of Environment & Forests, Govt. of India
2	A19	"Establishment of Sub-Distributed Information centre at TBGRI under Bio informatics Programme"	Dept. of Biotechnology, Govt. of India
3	A23	"Conservation of Selected Rare and Economic Rattan Palms of the Western Ghats through <i>in vitro</i> Multiplication and Re introduction"	Dept. of Biotechnology, Govt. of India
4	A26	"Hepatoprotective studies on selected Medicinal Plants of the Western Ghats, Kerala"	KSCSTE, Govt. of Kerala
5	A27	"Investigation on the Macrofungal Diversity in the Thenmala Forest Division of Western Ghats of Kerala"	Planning & Economic Affairs Department, Govt. of Kerala
6	A28	National Gene Bank for Medicinal and Aromatic Plants" (III phase)	Dept. of Biotechnology, Govt. of India
7	A29	"Collection, Micropropagation and Reintroduction of Some Endemic Zingibers of Western Ghats, Kerala"	Planning & Economic Affairs Department, Govt. of Kerala
8	A30	"Bamboo and Reed Resource Enhancement in Kerala"	Planning & Economic Affairs Department Govt. of Kerala
9	A31	"Establishment of a Milieu-Based Sanctuary & Conservation Education Centre of Medicinal Plants of the Western Ghats"	Planning & Economic Affairs Department, Govt. of Kerala
10	A32	"Industrial Development and Economic Upliftment of Weaker Sections through Biofertilizer Manufacturing"	Planning & Economic Affairs Department, Govt. of Kerala
11	A33	" <i>Ex situ</i> Conservation and Sustainable Utilisation of Rare, Endemic and High-Value Medicinal Plants of Southern Western Ghats through <i>In vitro</i> Multiplication and Evaluation of Quality Retention-A Lab to Land Programme"	Planning & Economic Affairs Department, Govt. of Kerala
12	A39	"Induction and Phytochemical Investigations of Normal and Hairy Root Cultures of <i>Decalepis arayalpathra</i> , a Critically Endangered Medicinal Plant"	KSCSTE, Govt. of Kerala
13	A42	Establishment of Seed Bank, Propagation and <i>ex situ</i> Conservation of Endemic and Threatened Species of W. Ghats	Ministry of Environment & Forests, Govt. of India
14	A43	"Studies on Anti-Viral Properties of Some Known Medicinal Plants vis-à-vis Phytomedicine Development"	Dept. of Biotechnology, Govt. of India
15	A44	"Micropropagation and Cultivation of Most Sought After Medicinal Herbs used in Ayurveda and Allied Systems with People's Participation"	Dept. of Biotechnology, Govt. of India
16	A45	"Establishment of Seed and Pollen Cryobank for <i>ex situ</i> Conservation and Sustainable Utilization of Orchids of Western Ghats"	Dept. of Biotechnology, Govt. of India
17	A49	Isolation and Characterization of Genes Involved in the Regulatory Steps Leading to the Biosynthesis of Hericin using Transcript Profiling Technology and Metabolic Engineering of Andrographolides Accumulation in <i>Andrographis paniculata</i> Nees by Modulation of the Isoprenoid Precursor Pool with Expression of Plastidial Deoxyxylulose Phosphate Synthase and Cytosolic HMG CoA Reductase	Dept. of Biotechnology, Govt. of India
18	A50	Metabolic Engineering of Andrographolides Accumulation in <i>Andrographis paniculata</i> Nees by Modulation of the Isoprenoid Precursor with Expression of Plastidial Deoxyxylulose Phosphate Synthase and Cytosolic MMG CoA Reductase	Dept. of Biotechnology, Govt. of India
19	A51	Nutraceuticals from Indigenous Edible Mushrooms	Dept. of Biotechnology, Govt. of India



Sl. No.	Code	Name of Project	Name of funding agency
20	A53	Cultivation of High Value Medicinal and Aromatic Plants Through Conventional and Non-Conventional Methods for Empowerment of Rural Women in The Selected Localities of Kerala A Novel Participatory Programme for Income Generation	Dept. of Biotechnology, Govt. of India
21	A55	Collection, Propagation, Reintroduction and Popularization of Ten Endemic Trees Species of Western Ghats.	Planning & Economic Affairs Department, Govt. of Kerala
22	A56	Tissue Culture Multiplication for Mass Production of Selected Economically Important Bamboos	Planning & Economic Affairs Department, Govt. of Kerala
23	A59	Development of Scientifically Validated Nutraceuticals from Sselected Medicinal Plants of Western Ghats	Department of Biotechnology, Govt. of India
24	A60	Red Data Book on Indian Orchids	Ministry of Environment & Forests, Govt. of India
25	A61	Hepatoprotective Studies on Three Selected Medicinal Plants of Kerala,	Department of Biotechnology, Govt. of India
26	A62	Studies on Reproductive Biology of Selected Rare, Endemic and Horticulturally Promising Balsams from W. Ghats	Dept. of Science and Technology, Govt. of India
27	A6	Infectivity and Effectiveness of Arbuscular Mycorrhizal Fungi on Some Medicinal Plants of W. Ghats,	Forest Dept., Govt. of Kerala
28	A65	Plant Crab Association in the Mangrove Ecosystem of Kerala,	Ministry of Environment & Forests, Govt. of India
29	A66	*Establishment of MMPG at TBGRI, Palode.	BGCI
30	A67	*Ex-situ Conservation of Arborescent Crop Relatives of Western Ghats, Giving Emphasis to Endemic and RET Species"	NBRI, Lucknow
31	A68	*Studies on the Eco-Mycorrhizal Fungal Diversity in Different Forest Types and Their Association with Endemic, Indigenous and Exotic Species in the Western Ghats Forests of Thiruvananthapuram District, Kerala	Ministry of Environment & Forests, Govt. of India
32	A69	Lead Coordination Institution for Agasthyamalai, Nilgiri and Gulf of Mannar Biosphere Reserves	Ministry of Environment & Forests, Govt. of India
33	A70	KSEB Programme on Biodiversity Documentation : Indigenous Knowledge Component	KFRI
34	A71	Survey, Collection, Propagation of Selected, Threatened Palm Species of S. Ghats & Electronic Herbarium Database Preparation of Palms in Kerala	Planning & Economic Affairs Department, Govt. of Kerala
35	A72	Toxic and Hallucinogenic Mushrooms of Kerala	Planning & Economic Affairs Department, Govt. of Kerala
36	A73	Antitumor and Wound Healing Properties of Three Selected Medicinal Plants of the W. Ghats, Kerala	Planning & Economic Affairs Department, Govt. of Kerala
37	A74	Toxicological Evaluation of Herbal Products	Amity Institute for Herbal & Biotech Products Development
38	A75	Search for Bioactive Molecules From Genus Ganoderma (Polyporaceae) Occurring in South India,	Dept. of Science and Technology, Govt. of India
39	A76	Conservation of Endemic Cycads in India Workshop	INDO-US Science & Technology Forum
40	A77	Collection, Identification and Concumentation of Follicolous Fungi, Endomycorrhizal Fungi and Lichens in Silent Valley National Park	Ministry of Environment & Forests, Govt. of India
41	A78	National Pprogramme on Recovery of Red-Listed Species (<i>Coscinium fenestratum</i> , <i>Phaphiopedium druyii</i> , <i>Dialium travancoricum</i> and <i>Poeciloneuron pauciflorum</i>) Through Application of Biotechnology Tools	Department of Biotechnology, Govt. of India

Sl. No.	Code	Name of Project	Name of funding agency
42	A79	Biodiversity Conservation and Characterization Using Biotechnology Tools'	Department of Biotechnology, Govt. of India
43	A80	Diversity and Distribution of Asterinaceous Fungi in India	Ministry of Environment & Forests, Govt. of India
44	A81	Inventory and Conservation Status of Mushrooms of Wayanadu Area of Kerala	Ministry of Environment & Forests, Govt. of India
45	A82	Bioprospecting of Selected Gingers From W. Ghats : Morphological Characterization and Chemical Prospecting	Department of Biotechnology, Govt. of India
46	A83	Brain Storming session on Biodiversity Conservation Through Biotechnological Interventions	Department of Biotechnology, Govt. of India
47	A84	Standardization of Agrotechnological Packages of Practices and Establishment of Demonstration Plots for Commercial Cultivation of <i>Plectranthus vettiveroides</i>	National Medicinal Plant Board, Govt. of India
48	A85	Studies on the Aphrodisiac Properties of <i>Vanda tessellata</i> Flower Extract for Determining its Utility as Commercially Viable Standardized Phytomedicine	Dept. of Science and Technology, Govt. of India

Kerala State Council for Science, Technology and Environment (KSCSTE)

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
Vice-Chairman, Kerala State Planning Board	Vice-President
Chief Secretary, to Government of Kerala	Vice-President
Dr A E Muthunagayam	Executive Vice-President (up to 20/02/2007)
Dr E P Yesodharan	Executive Vice-President (from 22/02/2007)
Secretary, Department of Science and Technology, Government of India	Member
Vice-Chancellors of Cochin University of Science & Technology and Kerala Agricultural University	Members
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 (nominated from among The Directors of R&D Centers on rotation)	Member
Director, RGCB, Thiruvananthapuram (nominated from among The Directors of R&D Centers on rotation)	Member
Dr K. R. S. Krishnan	Member Secretary (up to 29/06/2006)

KSCSTE Executive Committee

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

TBGRI Research Council

Prof H Y Mohan Ram, FNA., New Delhi	Chairman
Dr K R Shivanna, Bangalore	Member
Dr A R K Sastry, Kakinada	Member
Dr M A Haque, New Delhi	Member
Dr V A Parthasarathy, Kozhikode	Member
Dr R D Iyer, Karunagapally	Member

TBGRI Management Committee

Dr S Ganeshan, Director, TBGRI	Chairman,
Member Secretary, KSCSTE	Member
Dr M Baba, Director, CESS	Member
Mr K Radhakumar, Dy. Secretary, Govt. of Kerala	Member
Dr S Rajasekharan, Scientist F, TBGRI	Member
Registrar, TBGRI	Member (Convener)



TBGRI Staff

Dr S Ganeshan Director

Biotechnology and Bioinformatics

Dr S Seeni Scientist G and Deputy Director, Head
 Dr P N Krishnan Scientist E2, (Coordinator, Bioinformatics Centre)
 Dr K Sathesh Kumar Scientist C
 Dr S Mukuntha Kumar Scientist C
 Mr P Padmesh Scientist B
 Dr C G Sudha Scientist B
 Dr William Decruse Scientist B
 Dr S Sreekumar Scientist B
 Mrs R K Radha SSA
 Dr K K Sabu JSA (Deputation to KSCSTE)
 Dr C K Biju JSA
 Mr M Raveendran JSA
 Mrs S Shailajakumari Tech. Officer
 Mr K Gopakumar Tech. Officer
 Mrs V S Sindhu Lab. Attendant
 Mrs S Syamala Kumari Lab. Attendant
 Mr G S Madhusoodhanan Asary Helper

Conservation Biology

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

Ethnomedicine and Ethnopharmacology

Dr S Rajasekharan Scientist F, Head
 Dr P G Latha Scientist E2
 Mr K Radhakrishnan Scientist A
 Mr A Subash Baby Pharmacist
 Dr S Binu SSA
 Dr T G Vinod Kumar JSA (On leave)
 Dr B S Geetha JSA (Deputation to KSCSTE)
 Mrs S R Suja JSA
 Mr M Navas Tech. Officer
 Mr S Radhakrishna Pillai Technical Assistant
 Mr G Anilkumar Animal House Assistant

Garden Management, Education, Information and Training

Dr N Mohanan Scientist E1, Head
 Dr Jacob Thomas Scientist C (on leave)
 Mr A E Shanavas Khan Scientist B (on leave)
 Dr R Rajvikraman Scientist B
 Dr P A Jose Scientist B
 Mr Cheriyan P Koshy Scientist A
 Mr P C Binoy SSA (On leave)
 Mr Dhruvan Tandyekal JSA
 Mrs Seema G Gopal JSA (On leave)
 Mr Raju Antony Tech. Officer
 Mr T Sabu Tech. Officer

Mr Joemon Jacob Tech. Officer
 Mr S M Shereef Tech. Officer
 Mr G Thulasidas Tech. Officer
 Mr K S Kalesh Tech. Officer (On leave)
 Mr K J Lathan Kumar Tech. Officer
 Mr A Hussain Tech. Officer
 Mr K Selvaraj Labour Supervisor
 Mr J Michael Garden Maistry
 Mr B Jayakumar Gardener
 Mr K Narendran Nair Gardener
 Mr P Manikandan Nair Gardener
 Mr C Sudarsanan Gardener
 Mr K Vijayakumar Gardener
 Mr B Harihal Kumar Gardener
 Mr S Baburaj Gardener
 Mr M Varkey Gardener
 Mr G Vijayakumaran Gardener
 Mr J Rajan Gardener
 Mr V Satheesan Gardener
 Mr D Udayakumar Gardener
 Mr R Suresh Kumar Gardener
 Mr P Babu Gardener
 Mr L Thulaseedharan Gardener
 Mr N Pradeep Gardener
 Mr A K Azeem Gardener
 Mr V Ranjan Gardener (Under suspension)

Phytochemistry and Phytopharmacology

Dr V George Scientist F, Head
 Dr A Subramoniam Scientist E2
 Dr B Sabulal Scientist B
 Mr K B RameshKumar JSA
 Mr J Anil John Tech. Officer
 Mr Gopannraj Tech. Officer
 Mr S Ajikumaran Nair Tech. Officer
 Mrs S R Rajani Kurup Tech. Officer
 Mr G Santhosh Kumar Technical Assistant
 Mrs P Sasikala Lab Attendant
 Mrs A Leela Helper

Plant Genetic Resources

Dr P J Mathew Scientist C, Head
 Dr C Sathish Kumar Scientist C
 Dr K C Koshy Scientist C
 Dr P K Suresh Kumar Scientist B
 Dr Bejoy Mathew Scientist B
 Dr Mathew Dan Scientist B
 Dr C Anil Kumar Scientist B
 Dr Sam P Mathew JSA
 Mr C Muralaeeharan Unnithan Tech. Officer
 Dr E S Santhosh Kumar Tech. Officer (On Leave)
 Dr M Abdul Jabbar Tech. Officer
 Dr M Saleem Tech. Officer
 Mr B Gopakumar Tech. Officer
 Mrs B J Radhika Tech. Officer
 Mrs C R Chithra Tech. Officer
 Mrs S Bindu Tech. Officer
 Mr P Mony Garden maistry
 Mr K C Thomas Gardener
 Mr G Manoharan Gardener

Mr N Venugopalan Nair
Mr N Salahudeen
Mr P Shaji
Mr K Asok kumar
Mr S Ajayakumar
Mr G Sudarsana Kurup
Mr C Murali
Mr B Jayalal kumar
Mr M Shajahan
Mr Asokachandran Nair
Mr S Thulaseedharan
Mrs Kanakasundaram

Gardener
Lab. Attendant
Mrs S Meenakumary
Mr K Vijayan
Mr M Anilkumar
Mr M Sulfiakar
Mrs B S Ajanthakumary
Mr K Mohammed Habeebulla
Mr T S Sunil kumar
Mr S S Dayal
Mr V Prem Kumar
Mrs C Gracy
Mrs R Prasannakumary
Mrs N Rajalekshmi Ammal
Mrs R Subha Sankar
Mrs P S Shyladevi
Mr K P Elias
Mr B R Dinesh
Mr M Ramaswamy
Mr V Rajendran Nair
Mr R Gopinathan Nair
Mr A Salim
Mr D Mohanachandrakumar
Mr T Mohanakumar
Mr P Rajendran
Mr V Sudheeshkumar
Mr C Sathyan
Mr B Vijaya Kumar
Mrs R Valsaladevi
Mr M Shajahan
Mr S R Kamalesh Kumar
Mr P Vijayakumar

Office Asst. Grade III
Office Asst. Grade III
Office Asst. Grade IV
Office Asst. Grade IV
Office Asst. Grade IV (on deputation)
Office Asst. Grade IV
Office Asst. Grade IV
Guide
Guide
Stenographer Gr I
Stenographer Gr II
Typist Grade I
Computer Operator
Typist
Store Assistant
Record Keeper
Driver Gr I
Driver
Driver
Driver
Helper Gr I
Helper Gr I
Helper
Helper
Gardener (On other duty)
Security Guard (On other duty)

Plant Systematics and Evolutionary Science

Dr A G Pandurangan
Dr K B Vrinda
Mr G Rajkumar
Dr M Rajendra Prasad
Dr A K Sreekala
Dr S Shiburaj
Dr N S Pradeep
Mr T Shaju
Dr C K Pradeep
Dr A Nazarudeen
Mrs V S Usha
Mrs M P Geethakumari
Mrs K P Deepthi Kumari
Mr R Thulaseedharan
Mr P Prabhakaran
Mrs Kumari Girija

Scientist E2, Head
Scientist B
SSA
JSA
JSA
JSA (On study leave)
JSA
JSA
JSA
JSA
Herbarium Assistant
Tech. Officer
Tech. Officer
Gardener
Gardener
Sweeper

Micro-Fungi Laboratory

Dr V B Hosa Goudar
Mr H Biju
Mrs A Sabeena
Mr K Anil Kumar
Mr V Gireesh kumar

Scientist C
Tech. Officer
Tech. Officer
Gardener
Lab Assistant

Library and Information Services

Mrs A Syamala Kumari
Mrs V Sujatha
Mrs Leena Kumari
Mr C R Vinukrishnan

Librarian
Junior Library Assistant
Helper
Helper

Art and Photography

Mr K P Pradeep Kumar
Mr S Suresh Kumar
Mr C Suseendran

Artist - Photographer
Asst. Artist
Photographer

Administrative Staff

Mr P Raghavan
Mr K M A Rahman
Mr K G Ajith Kumar
Mrs S Radhalekshmy Ammal
Mrs R Sarala Devi
Mr Suresh Chandran

Registrar
Deputy Registrar (On deputation to CWRDM)
AADO/ IC PCC
P A to Director
Section Officer
Section Officer

Engineering Section

Mr P P Markose
Mr S Ajith
Mr V S Suresh Kumar
Mr P Ajith Kumar
Mrs M R Geetha
Mr G Ajayakumar
Mr M Madhusoodhanan Nair
Mr R Prabhakaran Nair
Mr A Thankappan
Mr P S Hanikumar
Mrs K Lali Kutty
Mrs Baby Girija
Mr V Gangadhara Pillai

Tech. Officer
Tech. Officer
Tech. Asst.
Tech. Asst.
Tech. Asst.
PABX Operator
Pump Operator
Plumber
Painter
Label writer
Sweeper
Sweeper
Sweeper/Cleaner

Security

Mr V Jayedhar
Mr P R Chandrasekharan Nair
Mr S Chandran
Mr P Jain
Mr K Mohanan
Mr P Ramachandran Nair
Mr G Somasekharan Nair
Mr C Stanley
Mr K Krishnankutty Nair
Mr R Rajan
Mr K Ramachandran Nair
Mr V Sreedharan Nair
Mr A Subairkunju

Security Officer
Security Guard (Sergeant)
Security Guard
Security Guard



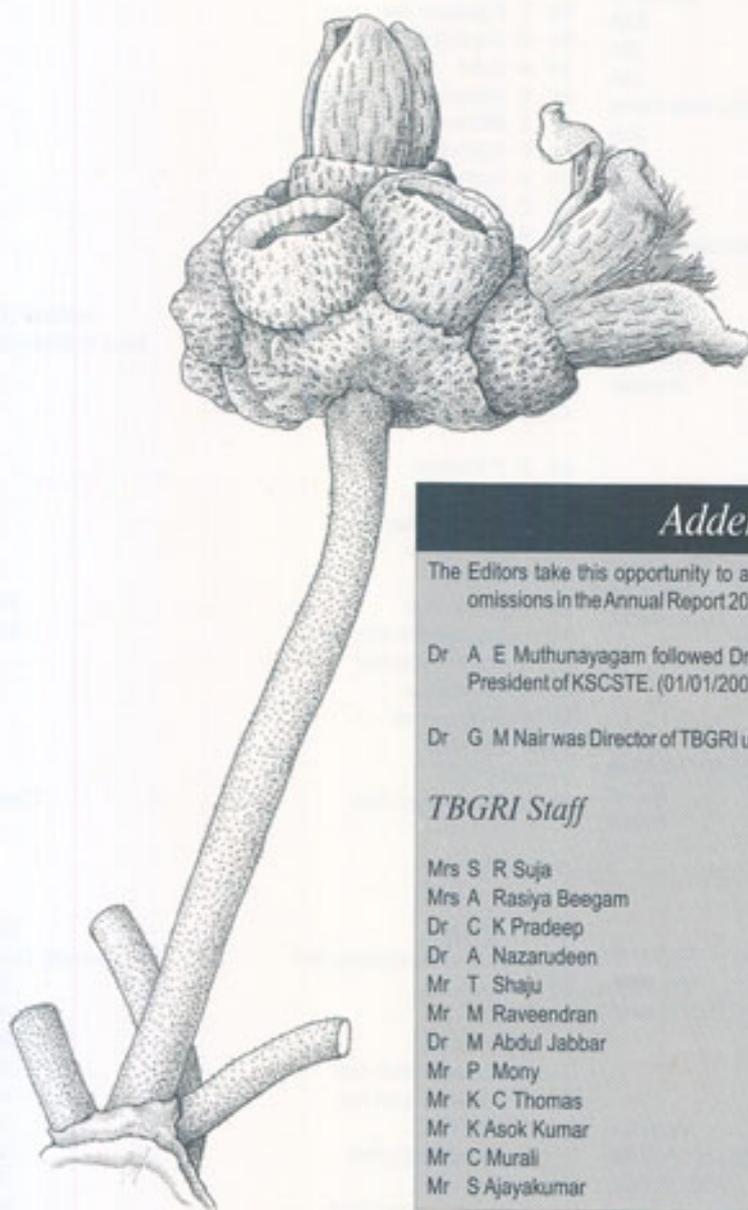
Mr C Sukumaran Nair
Mr T Sukumaran Nair
Mr B Surendran Nair
Mr K Surendran Nair
Mr S Venugopalan Nair
Mr B Venukrishnan Nair
Mr P Vijayakumar
Mr G Viswambharan
Mr K Balakrishnan Nair

Security Guard
Security Guard

Puthenthope Extension Centre

Dr C Sunil Chandran
Mr B Chandran
Mr M Vijayan
Mr R Anilkumar

Estate Supervisor
Gardener
Gardener
Gardener



Addendum

The Editors take this opportunity to apologise for the following inadvertent omissions in the Annual Report 2004-2006.

Dr A E Muthunayagam followed Dr M S Valiathan as the Executive Vice President of KSCSTE. (01/01/2005 onwards)

Dr G M Nair was Director of TBGRI up to 18/05/2005

TBGRI Staff

Mrs S R Suja	JSA
Mrs A Rasiya Beegam	JSA
Dr C K Pradeep	JSA
Dr A Nazarudeen	JSA
Mr T Shaju	JSA
Mr M Raveendran	JSA
Dr M Abdul Jabbar	Tech. Officer
Mr P Mory	Garden Maistry
Mr K C Thomas	Gardener
Mr K Asok Kumar	Gardener
Mr C Murali	Gardener
Mr S Ajayakumar	Gardener



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