Annual Report
2007-2008

TROPICAL BOTANIC GARDEN AND RESEARCH INSTITUTE

ANNUAL REPORT

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Tropical Botanic Garden and Research Institute
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Dendrocalamus longispathus (Kurz) Kurz
K.C. Kaim

From The Director's Desk

Tropical Botanic Garden and Research Institute (TBGRI) was founded by a great scientist and visionary, Prof. A. Abraham who laid a strong foundation for its growth. The Institute will attain its 30th year of existence in 2009. It moved forward encountering up and down periods in its onward march. No doubt, TBGRI is moving forward towards its ultimate glory. I feel privileged to serve the institute occupying the present position.

Conservation of tropical plant genetic resources and development of improved scientific methods for their sustainable use to the maximum extent for human welfare are the major objectives of TBGRI.

Botanic Gardens and Institutes like TBGRI have crucial roles to play in environmental education, eco-education and utilization of plant resources for humans in a sustainable manner. The glimpses of varied plant lives in a botanic garden along with intricacies of nature stimulate any human mind. Live collections of plants in natural settings as seen in TBGRI, helps one to sense how the plant life is in a unique way interwoven with the eco-system.

TBGRI has two arms: one is a conservatory garden and the other is a full-fledged research institute involved in advanced research in diverse areas of plant sciences. TBGRI maintains a 300 acre conservatory garden for the wild tropical plant genetic resources of the country as well as representatives from other tropical regions with a well integrated multi-disciplinary research and development system. It is the biggest conservatory garden in Asia with over 50,000 accessions belonging to about 3500 species. The collections of garden include 842 species of medicinal plants, 700 species of trees and an orchidarium with 600 wild species.

For plant improvement, utilization, etc. TBGRI is involved in multidisciplinary research (botanical, chemical, medicinal, etc.). Research in plant taxonomy, conservation of plant diversity, plant biotechnology including gene technology, bioprospecting (pharmacological and phytochemical), discovery and development of phytotherapeutic agents (plants-derived medicines) and documentation of indigenous knowledge on the medicinal use of plants are actively being pursued here. Further, the amazing interaction and association of plants with animals, microbes and non-living environment are also studied.

The period 2007-2008, is a remarkable one in many ways in the realization of the objectives of TBGRI.

One of the major uses of plants for human beings is their use as resources of medicines. The periods 2006-2007 and 2007-2008 witnessed the emergence of many significant leads in this direction. TBGRI has earned international and national recognition in herbal drug research. A triterpene isolated from *Emelia sonchifolia* showed promising anti-cancer activity. This work was selected as one of the significant contributions in the area of herbal anti-cancer agents by NIH, USA. A cholesterol lowering triterpenoid was discovered from *Averrhoa bilimbi* fruit. An aphrodisiac principle which stimulates Nitric Oxide Synthase (NOS) was discovered from *Vanda tessellata* flower. Therapeutically promising anti-viral fractions were separated from *Rhinacanthus communis* and *Ocimum sanctum* leaves. A coumarin isolated from *Selagenella involvens* reversed involution of thymus in adult mice and protected immuno-compromised mice from fungal infection. An anti-diabetic steroid was discovered from *Hemionitis arifolia*, a wild fern. A novel rehydration agent, a coumarin, was isolated from *Hemidesmus indicus* root. This enhances the absorption of water and electrolyte in acute diarrhea (patent filed).

Phytochemical and essential oil research on several indigenous medicinal plants have made significant in-roads.

This year the garden has grown to considerable extent in quantity and quality. A visitors' management centre was established in November 2007. A new variety of Jasmine was developed through selective breeding. A new genus (*Sivadasania*) and a new species (*Selaginella agastyamalayana*) were described.

The Bamboosetum was maintained as one of the best living collections of Bamboos in India. A field gene bank of herbals was developed as part of the project 'National Gene Bank of Medicinal and Aromatic Plants'. Mass multiplication of *Anthurium, Nepenthes* and Banana varieties was done and the plants were sold at nominal cost to public. Cryo-preservation protocol was developed for embryos and seeds of certain plants for the first time. Biotechnological intervention for bio-production of certain plant compounds was carried out successfully. A project on Bar-coding of plant species was launched with the support of Kerala State Council for Science Technology and Environment (KSCSTE).

Web-enabled data base was produced for 700 species of plants. Development of data base in several areas of Plant Science was initiated.

Systematic documentation of traditional knowledge related to plants used for food and medicine of 10 Gramma Panchayats of Kerala has been completed in the year. Ethnopharmacological screening of more than 20 ethnomedicinal plants was carried out. To evolve effective conservation strategies, plant pollinator interactions, level of gene flows etc. were studied with respect to a few endemic tree species. Important leads were obtained on plant-crab association in the mangrove ecosystem of Kerala.

The Ministry of Environment and Forests, Govt. of India in recognition of TBGRI's contribution in *ex-situ* plant conservation has elevated TBGRI as a lead garden for the Peninsular India. A master plan was prepared to develop RET (Rare, Endangered and Threatened) Species Park.

In the survey of micro-fungal flora of the Western Ghats, seven species new to science were discovered. The survey and exploration of lichens from the Western Ghats resulted in the collection of about 423 species.

TBGRI is handling 50 ongoing externally funded projects this year. Further, 42 in house projects are being operated. Sixty five original research papers have been published in referred national and international journals. A patent was also filed.

These achievements were made possible by the determined and concerted efforts of TBGRI scientists, other supporting staff and research/project fellows.

The interest and wisdom of our Hon'ble Chief Minister Shri. V. S. Achuthanandan in shaping Science & Technology in Kerala have been inspiring and made considerable influence in various achievements of R&D institutions under the Kerala State Council for Science, Technology and Environment (KSCSTE) and elsewhere. TBGRI has been fortunate to be a beneficiary of his farsightedness and wisdom. The constant support from KSCSTE and advice from the Research Council of TBGRI are gratefully acknowledged.

30-6-'09

Dr A. Subramoniam
Director
30th June 2009

PROFESSOR A. N. NAMBOODIRI REMEMBERED

Prof. A. N. Namboodiri, an eminent teacher, scientist, science writer and administrator passed away on 25th June 2007 after a brief illness. He was 77. He is survived by his wife and two children.

A. N. Namboodiri was born on 30th July 1930 at Azhoor Chandramana, at Pathanamthitta district of Kerala as son of Shri Narayanan Namboodiri and Smt. Devaki Antharjanam. He had his early education in Pathanamthitta and high school education at Kulakkada near Kottarakkara. Namboodiri took his B. Sc. and M. Sc. degrees in Botany from the University College Thiruvanathapuram. After M. Sc. he joined as a teacher in the same college in 1952. In 1961, he went to Michigan University, USA, to do research. The cell division in *Neurospora* (a genus of moulds used for genetic research) was the topic. He worked under eminent scientists including Nobel laureates and received the Horas H. Raccam award for the best research work done at Michigan University.

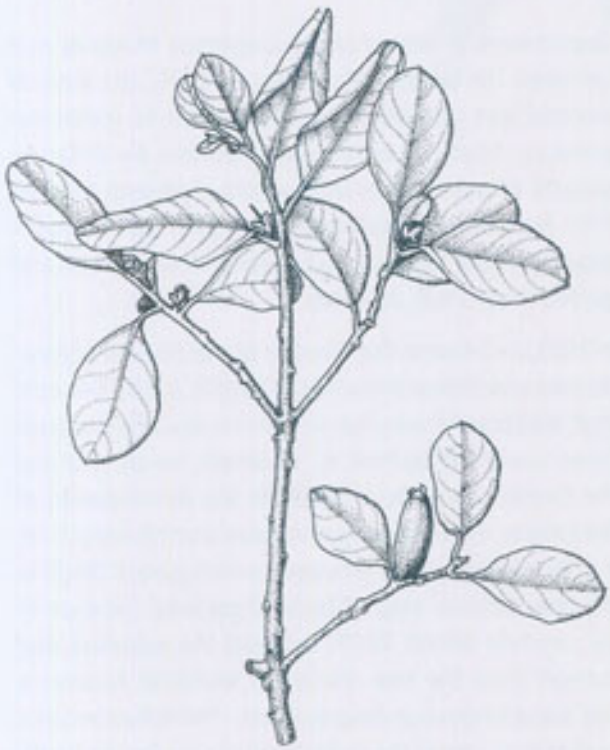
After working as a teacher in Michigan for three years, Prof. Namboodiri returned to India and joined the Department of Botany of the University of Kerala as a Lecturer. He became Professor in 1975. His field of interest was the sterility of plants and its molecular genetics. Many of his students worked on different aspects of pollen-pistil interaction of several species. Prof. Namboodiri published more than 200 research papers in both national and international journals and guided many Ph.D. students.

In 1983, he became the Director of the Tropical Botanic Garden and Research Institute (TBGRI). As the Director, Prof. Namboodiri was instrumental in realizing the great vision conceived by Prof. A. Abraham, his teacher and the founder Director of TBGRI in the development of the garden, especially conservatories and infrastructure. It is his administrative efficiency which placed TBGRI in the international map of botanic gardens. Because of his constant efforts TBGRI received the expertise and support from the Kew Garden in technical assistance and human resource development. TBGRI has become by that time one of the largest botanic gardens in South East Asia. The collection of many different species of

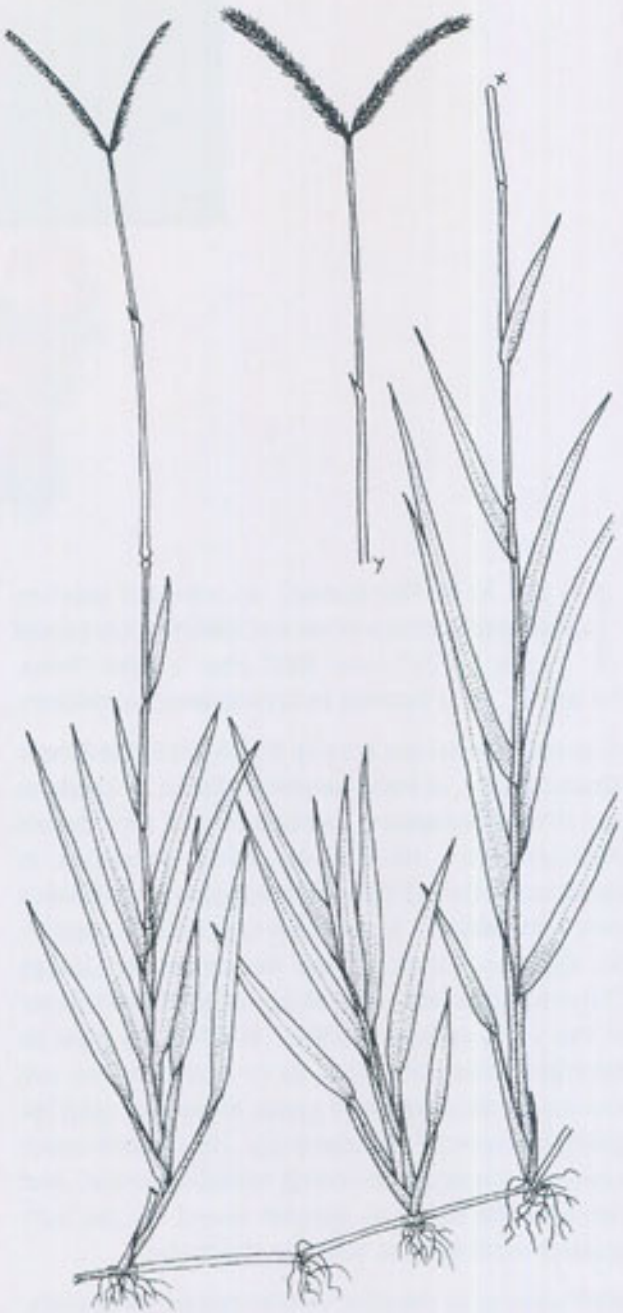
plants in this garden was a great attraction to scientists from India and abroad. Prof. Namboodiri retired from service in 1990. After retirement also he was very active in writing popular articles in science. He was especially fond of Darwin and theory of evolution and tried to popularize it through articles and books. Through his writings the common people came to know more about science and new developments in the field, especially the development of transgenic plants, cloning of animals, terminator genes etc.

He was the editor of the Journal of the Kerala Academy of Biology, which was the first science journal in Malayalam. He has written nearly 150 popular science articles in Malayalam and English. His book, *"Kottiyute Kaalum Kurangante Vaalum"* (Leg of an egret and tail of Monkey- a book on evolution) was adjudged as the best children's book for the award of the prize instituted by the Kerala State Science and Technology Department in 1995. Some of his other works are: *"Kallum Pullum Kaduvayum"* (Stone, Grass and Tiger), *"Professor Abraham"*, *"Barbara Maclintok"*, *"Darwin, Freud, Mendel"*, *"Jeevan - Udbhavavum Vikaasavum"* and *Dollium Pollium Biologium* (Dolly Polly and Biology) and *Jeevalokam*. Prof. Namboodiri's last book 'Science Fiction' was published in 2007 a study on six science fictions which included Jurassic Park. Prof. Namboodiri's contribution to popularization of science through AIR and other media was remarkable, for which he received several awards.

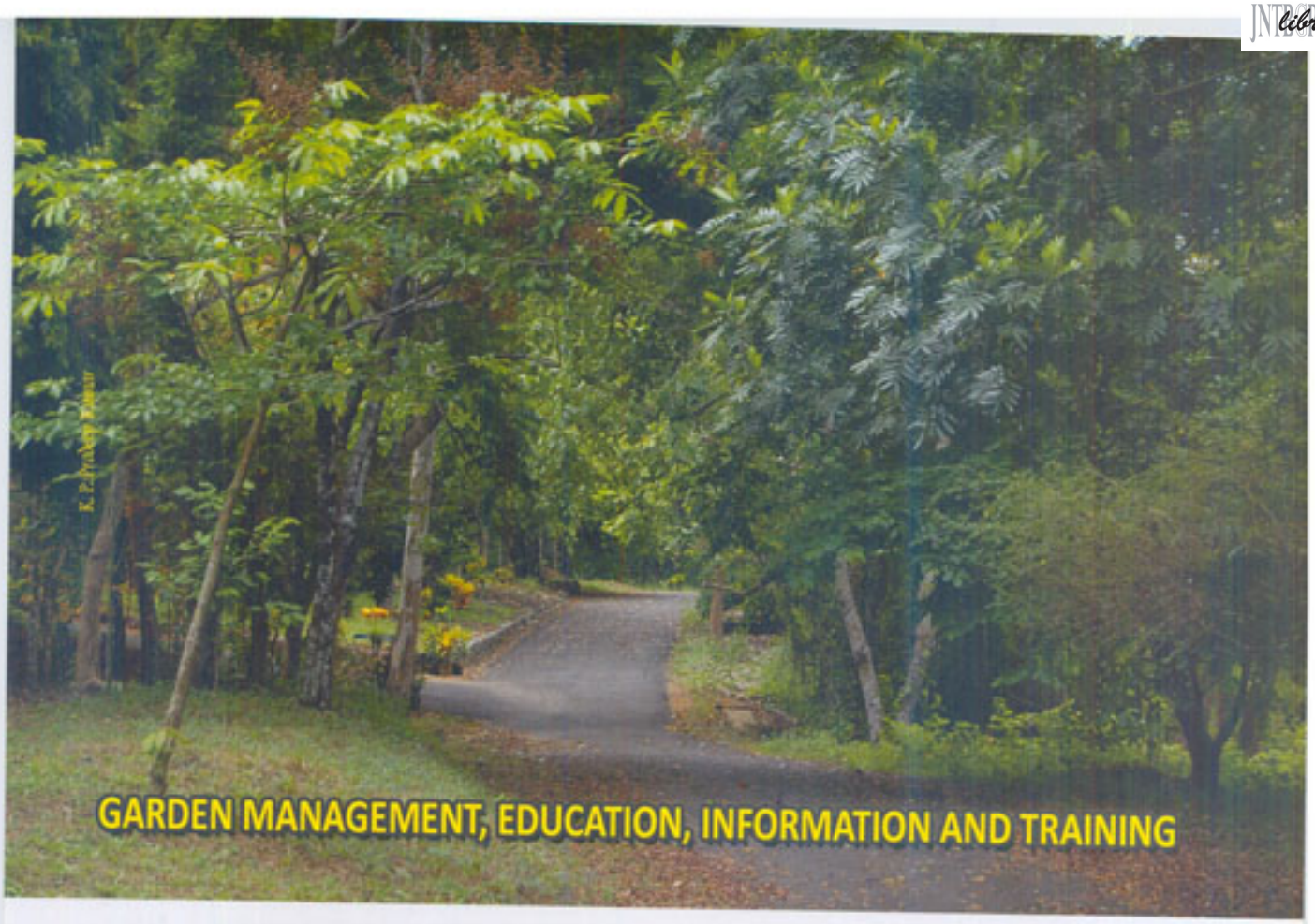
His vision, lovable nature and encouragement given to all the staff made TBGRI to proceed in the right direction. Prof. Namboodiri is commemorated by the plants *Dimeria namboodiriana* Ravi & Mohanan (1997), a grass and *Symplocos macrophylla* subsp. *namboodiriana* Sivad. & Mohanan (1997).



Symplocos macrophylla subsp. *namboodiriana* Sivad. & Mohanan



Dimeria namboodiriana Ravi & Mohanan



GARDEN MANAGEMENT, EDUCATION, INFORMATION AND TRAINING

Arboretum, Palmetum, Fernery, Orchard for lesser-known fruit plants, Cacti and Succulents, Gymnosperms and a collection for rare plants are the main *ex situ* Conservatories under this Division. Activities of the Central Nursery also come under the purview of the Division.

This year 20 accessions were introduced to the Arboretum. Species newly introduced are *Majidea zanqueberica* Kirk ex Oliv., *Sapindus emarginatus* Vahl, *Cassia glauca* Lam. and *Acacia nilotica* (L.) Willd. ex Delile. With the financial assistance from Western Ghat Development Programme, a project 'Collection, propagation, re-introduction and popularization of ten endemic tree species of the Western Ghats' was undertaken. As part of this, the following endemic species (*Buchanania lanceolata* Wight, *B. barberi* Gamble, *Gluta travancorica* Bedd., *Baccaurea courtallensis* Wight, *Myristica malabarica* Lamk., etc.) were collected, propagated and re-introduced. Three programmes associated with this project were conducted with the idea of 'Conservation through people's participation' in three panchayats - Peringamala in Thiruvananthapuram district and Veliyam and Melila in Kollam district. More than 10,000 saplings of eight endemic tree species and lesser known fruit plants were distributed among the people of different social strata. About 300 to 350 people from each panchayat participated in these programmes. Seminars were also conducted associated with such programmes highlighting the importance of biodiversity conservation.

Twenty palm species were newly introduced to the Palmetum during the year. This was under an exchange programme with the Indian Botanical Garden, Calcutta. Twenty five new accessions were planted in the Palmetum. The project on 'Survey, collection, propagation and popularization of selected, threatened Palm species of southern Western Ghats & electronic Herbarium Database preparation of Palms in Kerala' under the Western Ghat Development Programme continued. As part of this project, collection trips were conducted throughout Kerala for the survey of palms. Palakkad, Kasargod, Kannur, Thiruvananthapuram and Kollam districts were covered extensively. Occurrence of *Calamus karnatakensis* Renuka & Lakshmana in Silent Valley National Park, *Calamus shendurunii* Renuka & Sasi

in Ponmudi hills and discovery of a new habitat of *Phoenix pusilla* Gaertn. in the Western Ghats formed new information. Besides, we could collect a species of *Calamus* new to science from Silent Valley National Park.

Fifteen accessions of Rose cultivars and 18 accessions of annuals were procured as part of the beautification of the garden. *Allamanda* sp., *Lonicera japonica* Thunb. ex Murray, *Osmoxylon lineare* (Merr.) Philipson and 6 *Portulaca* cultivars were added to the ornamental plant germplasm. Fifteen species of wild ornamental plants from the Western Ghats were introduced, which include species such as *Callicarpa tomentosa* Lam., *Gomphostema eriocarpon* Benth., *Phyllanthus gageanus* (Gamble) M. Mohanan and *Globba ophioglossa* Wight.

Twenty species of Pteridophytes were added to the fernery. The new additions include *Azolla pinnata* R. Br., *Cyathea albosetacea* (Bedd.) Copel., *Pteris multifida* Poir. and *Leptochilus* sp. Forty specimens were planted in pots and in the field. Fifteen latrite beds for growing Cycads were developed in the Cycad Garden.

Twelve species of wild edible and relatives of edible fruit plants (*Aporusa bourdillonii* Stapf, *Salacia malabarica* Gamble, *Palaquium ellipticum* (Dalzell) Baill., *Ziziphus xylopyrus* Willd., *Bridelia scandens* Gehrm., *Syzygium thwaitesii* Duthie, *S. mundagam* (Bourd.)Chithra, *S. munronii* (Wight) Chandrab., *Dimocarpus longan* Lour., *Antistrophe glabra* Pandurangan & V. J. Nair, *Eugenia terpnophylla* Thwaites and *Garcinia imberti* Bourd.) were introduced as new additions to the existing germplasm collection. Thirty two accessions of 22 species of fruit plants were planted in the orchard.

K.P. Prabeesh Kumar

Landscape in front of the Office Complex

Central Nursery took care of the propagation, multiplication, establishment and distribution of planting materials required for different units of the Garden and for sales. Seedlings (2850) and graft plants (80) were distributed to the local people through the extension programmes. Seedlings (1720) and grafts (35) of fruit plants were sold through the Sales Unit. During the period of report, sale of plants worth Rs. 2, 29,923/- was done. This covered, Rs. 1, 04,142/- through the sale of conventionally propagated saplings and Rs. 1, 25,781/- through the Tissue Culture plants.

S.M. Sherief

Aporusa acuminata Thwaites, a lesser known fruit from Western Ghats

A Visitors' Management Unit (VMU) was established in November 2007 for managing visitors, conducting socially committed programmes and engaging Public Relation activities. The Visitors Centre was equipped with audiovisual facilities. The Unit effectively disseminates information on scientific achievements of TBGRI as well as the message of biodiversity conservation. Over 21,000 visitors, mainly students and teachers visited the Garden during 2007-2008. Drinking water was provided throughout the campus by installing 7 water-purifying units. Ten Garden benches were purchased for arranging seating facilities for visitors at different points of the garden. Efforts were initiated to install educational and display labels throughout the Garden. Twenty eight self-explanatory educational boards have already been fixed at appropriate places.

A new genus (*Sivadasania* Mohanan & Pimenov (Apiaceae) and a new species (*Selaginella agastyamalayana* Raju Antony, Shanavaskhan and Sreekandan Nair (Selaginellaceae: Pteridophyta) have been discovered by the scientists of the Division during the report period.

PLANT GENETIC RESOURCES

Orchid Biology

As part of the AICOPTAX Project on 'Orchid Taxonomy' funded by MoEF, over a hundred species of orchids collected from different parts of India were illustrated and detailed descriptions prepared for publication. Under the Dr B P Pal National Environment Fellowship (RED DATA BOOK OF INDIAN ORCHIDS) was awarded to Dr. C. Sathish Kumar by MoEF for a two year period (2005-2007) all the 400 odd endemic species of Indian orchids were catalogued, collected, described and illustrated. Of this, 150 species fall under various degrees of threat. Final report for submission was prepared. Ongoing study on the orchids of Myanmar based on materials from European herbaria and central National herbarium, Kolkata enabled to publish jointly with Australian orchidologist Paul Ormerod, second part of the series. This included one new species of *Dendrobium* called *D. khihumense* from Myanmar. Also published was another novelty from Silent Valley, called *Gastrodia silentvalleyana* Sathish, Sibi & Suresh, a saprophytic species.

The project on 'Barcoding on *Dendrobium*' funded by DBT was initiated in collaboration with Delhi University and about 15 target species were collected and sent to Delhi for molecular work. A joint exploraion was conducted in Wayanad for the collection of orchid materials. Materials studied were *Dendrobium jerdonianum* Wight, *D. nutantiflorum* Hawkes & Heller, *D. macrostachyum* Lindl., *D. aphyllum* (Roxb.)C. E. C. Fisch., *D. aqueum* Lindl., *D. chrysanthum* Wall. ex Lindl., *D. wightii* Hawkes & Heller, etc.

Bamboo Biology

As part of the project 'Bamboo and Reed resource enhancement in Kerala' funded by The Planning and Economic Affairs Department through WGDP, seven field trips were conducted to the forest areas of Ponmudi, Bonaccord, Tirunelli and Vazhachal for the collection of bamboo germplasm. Under the DBT funded project 'DNA Barcoding of *Bambusa* spp.', five explorations were conducted to Bonaccord, Athirappally, Periyar, Wayanad and Kattikkulam. During these trips offsets and specimens of different species were collected. All offsets were planted in the bambusetum nursery. During the period under report, 8 saplings were planted in the bambusetum. Culm sheaths from 12 species were gathered and preserved

for detailed studies. The specimens were processed for herbarium and 123 sheets were mounted. About 35 species were photodocumented.

K.C. Koshy

Storm damage in bambusetum on 23.6.07

A severe storm caused considerable damage to the Bambusetum on 23 June 2007, damaging 15 established clumps. Maintenance works were carried out and 8 uprooted clumps were restored. During the period 6700 saplings of 17 species were produced through experimental trials and 9375 saplings belonging to 19 species were supplied to farmers and different organizations. In addition, technical expertise regarding selection of sites and species, spacing and planting were also provided to various outside agencies like various state Forest Departments, various Forest Development Corporations and many private enterpreuners. The important beneficiaries who were supplied with seedlings were Crescent TTI, Peringammala (725 Nos), Kulathupuzha Grama Panchayath (120 Nos), District Agricultural Farm, Kotuku (94 Nos), VSS Rajathottam, Aryankavu Range (5000 Nos), Periyar Tiger Reserve, Idukky (200 Nos.), KFDC - EDC, Meenar (600Nos), KSFDC, Chithranjali, Thiruvananthapuram (445 Nos), etc. The species preferred by farmers were *Bambusa bambos* (L.)Voss, *Oxytenanthera nigrociliata* (Büse) Munro, *Thyrsostachys siamensis* Gamble, *Dendrocalamus hamiltonii* Nees & Arn. ex Munro, *Ochlandra scriptoria* (Dennst.)C. E. C. Fisch., *Dendrocalamus strictus* (Roxb.)Nees, *Bambusa vulgaris* Schrad. ex J. C. Wendl., *Dendrocalamus membranaceus* Munro, *Ochlandra travancorica* (Bedd.) Benth. ex Gamble, *Dendrocalamus brandisii*(Munro)Kurz and *Dendrocalamus giganteus* Wall. ex Munro. Bamboo leaf samples of 37 species were supplied to P I Jattisha, Dept.of Botany, Calicut University for her Ph. D. studies.

Data on the reproductive biology of two bamboo species were gathered during this period. The male/female stages of *Teinostachyum wightii* Bedd. and number of seedlings growing inside and outside of a few clumps of *Ochlandra scriptoria*(Dennst.)C. E. C. Fisch. were studied.

Medicinal, Aromatic and Spice Plants

As part of the project 'National Gene Bank for Medicinal and Aromatic Plants' funded by DBT, five plant exploration trips were conducted to different parts of Andhra Pradesh, Tamil Nadu and Kerala and collected 123 accessions of Medicinal, Aromatic and Spice Plants. Field-plots for planting accessions of herbaceous and shrubby species were prepared and field planting in the Field Gene Bank was initiated. Propagules of the accessions which needed special care were maintained in the conservatory-house. Maintenance of 'Andaman - Plot', the largest *ex-situ* conservatory of Andaman plants outside the Island, which harbours 116 species from Andaman Islands, was carried out (See also p. 39). Morphological characterization of *Crateva religiosa* Forster. f. (2 accessions), *Hemidesmus indicus* (L.) R. Br. ex Schult. (8 accessions) and *Pseudarthria viscida* (L.)Wight & Arn. (5 accessions) with respect to 5, 6 and 37 characters, respectively, were carried out.

Mathew Dan

Gardenia gummifera L. f. in the medicinal Garden

Under the project 'Development of Model Medicinal Plant Garden (MMPG) at TBGRI' funded by BGCI, 430 medicinal plants representing 40 species are maintained. Among them, about 20 species started flowering in the garden, which include *Piper longum* L., *Naravelia zeylanica* (L.)DC., *Alpinia calcarata* Roscoe, *Ampelocissus indica* (L.)Planch., *Trichopus zeylanicus* Gaertn. subsp. *travancoricus* Burkill ex Narayanan, *Kaempferia galanga* L., and *Thottea siliquosa* (Lam.)Ding Hou. The tree species planted in the MMPG - *Myristica malabarica* L., *Mesua ferrea* L., *Arenga wightii* Griff., *Nothopodytes nimmoniana* (J. Graham)Mabb., *Pterospermum rubiginosum* Heyne etc. were also established in the garden. The model pond ecosystem

created in the MMPG was maintained appropriately by growing water loving species such as *Angiopteris evecta* (G. Forst.) Hoffm., *Artanema sesamoides*(Vahl) Benth. and *Lagenandra* spp. A display on the 'food web' comprising seven images, representing different levels of 'consumers' was installed in the MMPG along with educational label explaining the importance of food-chain in an ecosystem. Two hundred and thiry seven herbarium specimens representing 52 species were deposited at TBGT.

Development of a 'Hut' and its landscape for a homeyard medicinal plant garden is progressing. Twenty two selected medicinal plant species ideal for the homeyard herbal garden were procured and are maintained in the Nursery.

As part of the project 'Bioprospecting of selected Gingers from the Western Ghats: Morphological characterization and Chemical prospecting' funded by DBT, eight plant exploration trips were carried out and 13 accessions of 9 species belonging to the genera *Curcuma, Zingiber, Hedychium* and *Amomum* were collected for chemical characterization. Essential oils and oleoresins of *Curcuma haritha* Mangaly & Sabu and *Zingiber nimmonii* Dalzell were isolated and detailed chemical characterization was done in collaboration with Phytochemistry and Phyto pharmacology Division. The study showed that camphor (36.0%), 1,8-cineole (13.9%) and isoborneol (10.6%) were the major constituents in the essential oil of *C. haritha*. In *Z. nimmonii*, the major constituents of the essential oil are b-caryophyllene (42.2%) and a- humulene (27.7%). The rhizomes of *Zingiber zerumbet* (L.) Roscoe ex Sm. collected from 6 different places in Kerala and one from Malysia were subjected to isolation of essential oils. High percentage (80%) of the bioactive compound (zerumbone) was observed in all the Kerala samples, whereas, in Malaysian sample, the percentage of zerumbone was low (68%).

As part of the work of the Network project on 'RET medicinal plant conservation and utilization in South and Northeast India', plant exploration trips were conducted to Konni and Punalur. Herbaria MH and IFGTB Coimbatore were consulted for collection of data on distribution and phenology of species selected under this programme.

Intraspecific variability studies on *Centella asiatica* (L.)Urb. and *Mucuna pruriens* (L.)DC. were carried out as part of the project 'Assessment of intraspecific variability of selected medicinal plants of the Western Ghats'. Sixty accessions of *Centella asiatica* were maintained in the Field Gene Bank. Morphological characterization with respect to 35 characters of 10 accessions of the species maintained in uniform environmental conditions was carried out. Meiotic studies on 15 accessions of the species were also done. Fifteen accessions of *Mucuna pruriens* were maintained in the Field Gene Bank and morphological characterization with respect to 11 characters of 7 accessions was carried out.

As part of the project 'Establishment of a National Collection and Conservation-Education Centre of Medicinal, Aromatic & Spice Plants', nine plant explorations were conducted in different parts of the Western Ghats and introduced 25 accessions of 18 species. The areas adjacent to the demonstration bed, which harbours special group of medicinal plants and the area near to the 'hut' in the Itty Achuthan Vaidyan's Garden were landscaped. Plants belonging to eight

Madhav Das

Seed germination in *Humboldtia decurrens* Bedd. ex Oliver

K.P. Pradeep Kumar

'Nagavayambu' *Neomarica gracilis (Herb-ex Hook.)* T. Sprug, a medicinal herb

species of *Sanseveria* and three species of *Aloe* were planted as herbaceous border in the succulent garden.

Seed Bank

Collection of 785 accessions of seeds, which includes 251 accessions of 205 species collected during the reporting period, is maintained. The seed bank also holds 2265 reference collections.

As part of the project 'National Gene Bank for Medicinal and Aromatic Plants' funded by DBT, plant exploration trips were conducted to Rajamundry and Visakhapattanam areas of the Eastern Ghats and 14 accessions of the listed medicinal species were collected.

In the project 'Studies on Seed biology and nursery practices of *Coscinium fenestratum* Colebr. and *ex situ* conservation of the species through establishment of field-gene-bank and seed bank'- funded by the Kerala Forest Department, 5 plant exploration trips were conducted to different Forest Divisions of Kerala and accessions of *Coscinium fenestratum* as part of *ex situ* conservation of the species were collected.

Seed germination studies of *Rauvolfia serpentina* (L.) Benth. ex Kurz were initiated under the project 'Germplasm Collection, Characterization and Conservation of Select Medicinal Plants of Kerala State' funded by National Medicinal Plants Board. Seeds of the species were collected from Kulathupuzha Reserve Forests. On desiccation, seed germination increased from 30 to 50%. As part of the in house project 'Carpology studies on South Indian *Rauvolfia* species', macro and micro morphological studies on five *Rauvolfia* species were carried out.

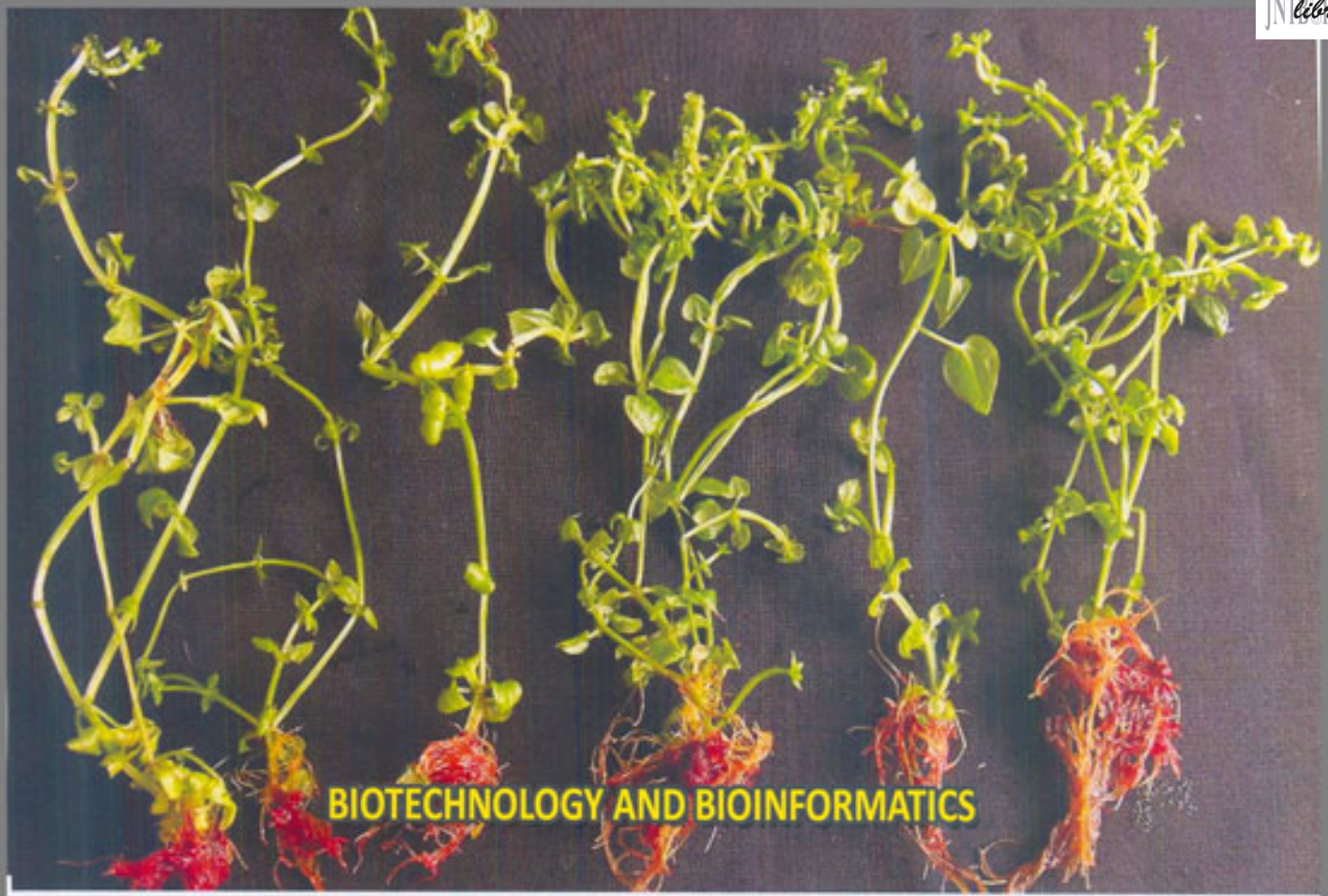
Seed germination and storage studies on *Tinospora cordifolia* (Willd.)Miers, *Phoenix pusilla* Gaertn., *Ormosia travancorica* Bedd. and *Calophyllum apetalum???* were carried out. Carpological studies on *Antidesma menasu* (Tul.)Mull.Arg., *Alangium salviifolium* (L. f.) Wangerin, *Antidesma ghaesembilla* Gaertn. and *Jatropha multifida* L. were also done.

Tissue Culture Programme

As part of the project 'Tissue Culture Multiplication for Mass-Production of Selected Economically Important Bamboos' funded by WGDP, *in vitro* nodal explants of *Ochlandra wightii* (Munro) C. E. C. Fisch. were selected for developing a multiplication system. Nodal segments from *in vitro* shoots showed bud brake followed by growth of the axillary buds. About 55% of the nodal explants responded to single or multiple shoot development. It is interesting to note that about 60% of the cultures showed simultaneous root development in the same induction medium. These roots supported the plantlets to survive in greenhouse conditions. Thus, it offered a multitier multiplication system to increase the propagation base of *O. wightii* (Munro) C. E. C. Fisch. In addition, 6 endemic species (Zingiberaceae) were multiplied and maintained in the Unit.

The project on 'Mass Production of Ornamentals using Tissue Culture Techniques', aims at tissue culture multiplication and supply of important floriculturals and other ornamentals to the growers at a reasonable price. Micropropagation of 9 *Anthurium* hybrids and *Nepenthes khasiana* were carried out as part of the project. Foliar calli induced initially were subcultured for shoot development. At present, the unit harbours about 5000 cultures comprising 18 taxa. Rooted shoots of different ornamentals were deflasked and 22,000 micro-plants were transferred to community pots for hardening. Out of this about 10000 plants are now ready for sale.

Under the project 'Tissue Culture Mediated Multiplication of Popular Bananas and Other Commercially Important Taxa', - three popular varieties of banana cultivated in Kerala namely 'Nendran', 'Rasakadhali' and 'Robusta', and an Israeli variety ('Grand Naine') were micropropagated during the period. Shoot tip explants isolated from healthy suckers were multiplied and the shoots so obtained were subcultured for rooting. About 4000 plantlets were transferred to greenhouse conditions during the tenure and they showed 98% survival. Hardened plants re-potted in polybags were sold to the growers.



BIOTECHNOLOGY AND BIOINFORMATICS

The R&D activities of the Division are broadly classified under Conservation biotechnology, Bioproduction of plant-specific compounds, Bioprospecting and gene technology, Biodiversity Informatics and Training and Extension services.

Conservation biotechnology

As part of the project on National Gene Bank for Medicinal and Aromatic Plants (NGBM& AP, supported by DBT, Govt.of India), 17 accessions belonging to 14 species were maintained as shoot cultures in *in vitro* meristem bank. They are *Mahonia leschnaultii*(Wall. ex Wight & Arn.)Takeda, *Heracleum candolleanum* Gamble, *Rauvolfia serpentina* (L.) Benth. ex Kurz, *Rauvolfia beddomei* Hook. f., *Acorus calamus* L., *Adhatoda beddomei* C. B. Clarke, *Rubia cordifolia* L., *Curcuma longa* L., *Curcuma aromatica* Salisb., *Celastrus paniculatus* Willd., *Trichopus zeylanicus* Gaertn. subsp *travancoricus* Burkill ex Narayanan, *Nothapodytes nimmoniana* (J. Graham) Mabb., *Decalepis arayalpathra* (J. Joseph & Chandras.) Venter and *Rubia cordifolia* L. Shoot tip cryopreservation of *Kaempferia galanga* L. recorded 30% success. Three accessions of *Holostemma annulare* were added to the *in vitro* repository. Micropropagated plants of *Celastrus paniculatus* and *Rubia cordifolia* recorded establishment rate at 84% and 86.6% respectively in the field.

Nine accessions belonging to 5 species already standardized during previous years were maintained in the cryo bank. Development of cryopreservation protocol for embryos of *Myristica malabarica* (90 min. dehydration with 65% survival) and *Coscinium fenestratum* (60 min desiccation with 60% survival) was completed. In *Calophyllum apetalum* Willd., pilot scale experiments suggest that isolated embryos are tolerant to 120 min. desiccation with 53% survival. Standardization of embryo cryopreservation of *Myristica dactyloides* and *Nothapodytes nimmoniana* is in progress. Cryopreservation protocol for seeds of *Eulophia cullenii* (Wight) Blume and *Holostemma annulare* (one accession each) was standardized and pollinia of *Eulophia culleni* were deposited in the cryobank.

Under a Department of Biotechnology, Govt.of India funded project, pollinia cryopreservation of several rare and endemic orchid species was standardized. Cryostored pollinia were used for intergeneric/

interspecific crossing experiments in orchids. Some of the initial results are encouraging. Successful fruit set and viable seed formation were obtained in a cross (*Eulophia culleni* × *E. nuda)* using cryopreserved pollinia. Seedlings were developed in crosses using cryopreserved pollinia (*C. ensifolium* X *C. bicolor*). Intergeneric seedlings obtained out of the cross of *Vanda tessellata* X *Luisia macrantha* were intermediate in morphological characters.

Seedlings of a cross between *Vanda tessellata* and *Luisia macrantha*

Under the National programme on 'Recovery of red-listed species through application of biotechnological tools (DBT Network project)' plant exploration was conducted in Agasthyamala. Fruits of *Paphiopedilum druryi* (Bedd.)Stein and seedlings of *Poeciloneron pauciflorum* Bedd. were collected for micropropagation-mediated conservation. Populations of *Poeciloneuron pauciflorum* were located in three different sites in the Western Ghats. The whole population of *Paphiopedilum druryi* in the original locality in the wind-ward side of the Agasthyamala were depleted. Embryo culture of both *P. druryi* and *Coscinium fenestratum* was successfully established. In *C. fenestratum*, multiple shoot formation was achieved from seedling node cultures. Besides, conventional propagation attempts resulted in 50% rooting of macro cuttings and 40% rooting of air-layered shoots. Seed culture of *Eulophia cullenii*, a threatened orchid was standardized and protocols developed.

The ploidy status of six south Indian cultivars of *Musa* was analyzed and ascertained using flow cytometry. This study confirmed diploid genome constitution in all the cultivars. This suggests that flow cytometry is an adequate tool for rapid determination of ploidy among the cultivars of *Musa*. Molecular characterization of certain disputed cultivars of *Musa* by ISSR markers to determine genetic variability was attempted. (Altogether 62 products were generated, of which 50 were found to be polymorphic. Thus, pedigree of a few cultivars can directly be linked to certain wild species).

Bioproduction of plant-specific compounds

Campothecin (CPT) was isolated and quantified from the field grown as well as *in vitro* derived plants of *Ophiorrhiza eriantha* Wight (0.02%). Scaled-up production of multiple shoot cultures of *Ophiorrhiza mungos* L. was successfully achieved in kettle flasks containing appropriate nutrient medium. Each individual shoot transferred to the medium sprouted and produced 5-6 shoots in a period of 30 days. Altogether 65 sub clusters, each of 5-6 rooted shoots, were obtained against a maximum of 5 sub clusters in 250 ml conical flasks/culture bottles.

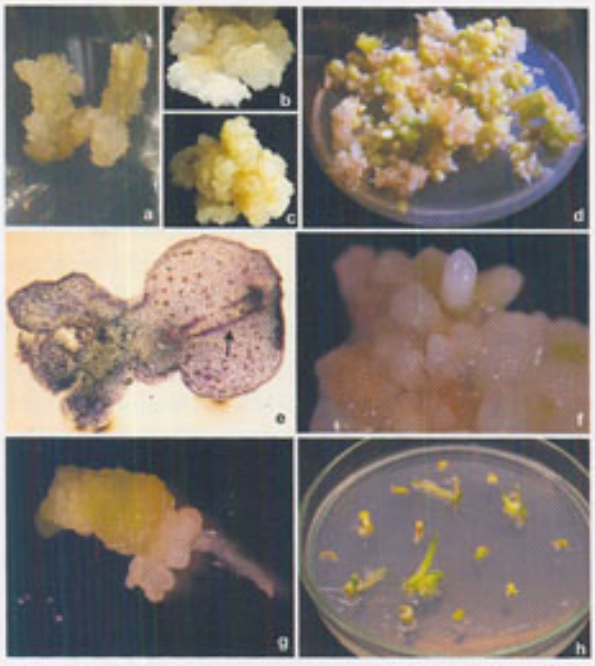
Type of plants (*O. eriantha*)	% of Camptothecin
Field grown plants	0.026
In vitro plants	0.031
Tissue cultured plants after field transfer	0.01

Large-scale production of *Ophiorrhiza mungos* in Reaction Kettle flasks

Hairy roots of *Plumbago rosea* grown in Bioreactor

Hairy roots cultures of *Plumbago rosea* L. developed in shake flasks were transferred and successfully established in 2 lit MS basal liquid medium (pH 5.8) in a 3 lit bioreactor (Infors- switzerland) for scaled-up cultivation. Aeration was provided by an air compressor. The chopped roots attached on to the metallic mesh started growing within 3-4 days and the biomass production was remarkably increased. The growth index (GI) was calculated as 21 in 38 days of incubation.

A non-steroidal ointment was prepared with the extracts of hairy root cultures and found effective for Eczema. Skin sensitization study in guinea pigs did not show any allergic action to the cream. Anticancer property of the



Somatic embryogenesis from leaf base explants in *Kaempferia galanga*. (a) Leaf base explants after 3 wk in MS medium supplemented with 9.84 µM Dicamba showing callus induction; (b) White friable callus (Type I) produced on leaf base segments in MS medium supplemented with 4.92 µM Dicamba; (c) Semi-friable cream callus induced on leaf base segments in MS medium supplemented with 3.91 µM 2,4,5-T; (d) Formation of embryoids from the callus in MS medium supplemented with 0.54 µM NAA along with 2.22 µM BA after 3 weeks; (e) Longitudinal section of embryoid showing independent and closed vasculature (arrow mark); (f) Microscopic view of club-shaped shiny, white embryoid; (g) Microscopic view of bipolar somatic embryo showing secondary embryogenesis; (h) Germination of embryoids in growth regulator-free MS medium.

product was tested in human skin cancer cell line at Regional Cancer Research Centre, Thiruvananthapuram and was found to be anti cancerous. Clinical trials are in progress.

Experimental conditions of aseptic seed germination and selection of juvenile explants for hairy root induction in *Rauvolfia micrantha* Hook. f. were standardized. Transgenic calli were induced from hypocotyl explants. Transgenic callus was cultivated in half strength MS medium devoid of hormones and growth rate was assessed. Normal root culture was raised from shoot culture derived stem explants in half-strength MS medium with a combination of auxins (IBA and NAA). Preliminary phytochemical analysis was done for the normal root-culture and transgenic callus. Transgenic callus produced relatively higher concentrations of ajmalicine.

The essential oil components of the rhizomes, leaves and roots of the micropropagated and mother plants of *Alpinia calcarata* Rosc. were analyzed using GCMS and identified 74 essential oil compounds and 6 terpenoids.

In vitro propagation protocol for *Amomum fenzlii (Kurz)* K. Schum., an insect repellent plant of the Andaman Islands was developed. Essential oil isolated from rhizome, leaves and pseudostem of *Amomum fenzlii* was analyzed using GC/MS and the major constituents (methyl chavicol - 41.09%, and anethole - 49.3%) were identified. This material may be a potential source of an insect repellent product rich in methyl chavicol and anethole. Productization using *in vitro* multiplied and field established plants is being tried. An improved procedure for the shoot regeneration from *in vitro* root segments of *Holostemma ada-kodien* Schult. was standardized.

Bioprospecting and gene technology

Differential screening of hypericin rich and low yielding shoot cultures was done using SSH (Suppression Subtraction Hybridization) analysis to identify differentially expressed gene(s) during auxin supplementation. About 38% of the sequences showed homology to sequences involved in protein synthesis / modification including trihelix DNA binding protein, transcription initiation factor TFIID subunit A, ethylene receptor homologous gene, etc. Further analysis is required to establish whether these sequences are related to ARF/AuxREs like proteins involved in auxin regulated gene expression in plants.

Attempts were also made to isolate full-length PKS cDNA using RT-PCR analysis. From literature, degenerate primer pairs specific to the conserved domains of plant PKS were designed and used for cDNA amplification. Three of them (CHSA, BPS & Ikuro P1&P2) yielded amplicons of size range 850, 450 and 540 bp respectively. The products were sequence characterized and sequence similarity search using the BLAST network service showed homology of one of these sequences with chalcone synthase gene from other plant sources. 5' and 3'RLM-RACE analysis using gene specific primers designed to these sequences yielded three full length cDNA having open reading frame ranging from 1173 bp to 1179 bp encoding protein of »43 kDa size. Multiple alignments of these sequences and analysis of amino acid residues at the conserved domain of CHS showed amino acid replacements at conserved regions thereby indicating that two of the isolated PKSs are novel forms.

Functional characterization to establish their role in hypericin biosynthesis is in progress. PKS mediated synthesis of hypericin in *Hypericum hookerianum* Wight & Arn. and completion of functional characterization of PKS genes will establish their role in hypericin biosynthesis.

Molecular characterization of *Mucuna pruriens* (L.)DC., a natural source of L-DOPA, was taken up to isolate and characterize gene(s) involved in catecholamine biosynthetic pathway with emphasis on Tyrosine hydroxylase (TyrOH). RT-PCR analysis using degenerate primers specific to the conserved domain to TyrOH yielded amplicons of size range 450-700 bp. Gene specific primers designed to the 5' end of the 700 bp amplicon using RLM-RACE analysis yielded a 850 bp amplicon. 3' RACE is in progress.

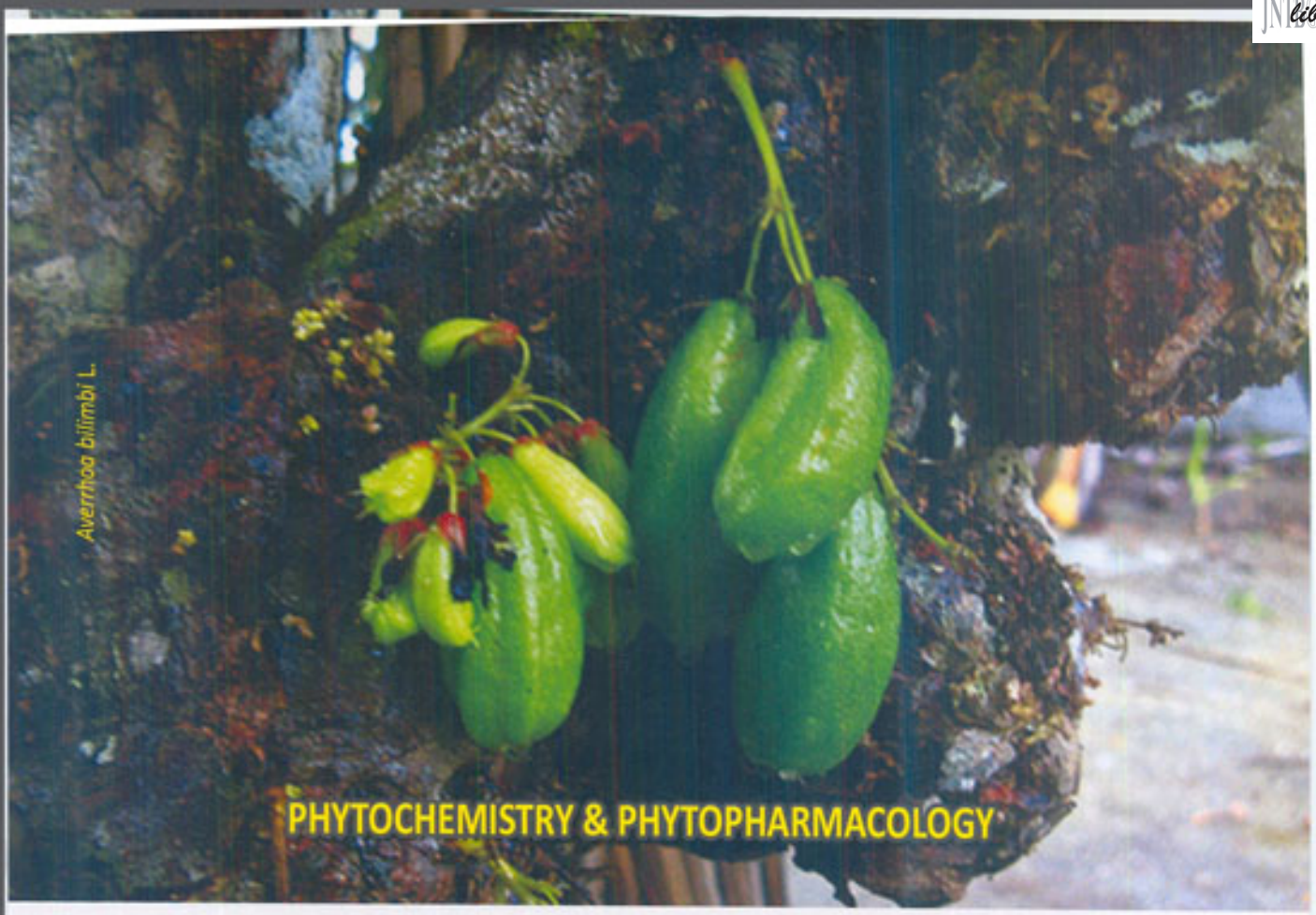
Bioinformatics Centre, Puthenthope

This Centre established and maintained with the support of DBT, Government of India works towards the data management of our plants and its availability in the public domain. Primary data such as taxonomic details, local name, habit, distribution, phenological details, conservation status, details of useful parts, economic importance, photographs, etc. of 700 plant species conserved at TBGRI campus were collected and organized into a web enabled database. Primary data of 1300 plant species were incorporated into the Plant Info database and documentation of photographs is in progress. Field exploration trips to sacred groves of Thiruvananthapuram district were conducted and various data collected were incorporated into the database www.tbgri.in/sacredgroveonline. A database package for organizing the data of endemic plants of India was developed. Development of a web enabled database for TBGRI herbarium and database organization on foliaceous fungi of sacred groves of Kerala were initiated. Information resources of TBGRI are made available on the web through three URLs such as www.tbgri.in, www.bioinfotbgri.org, www.tbgri.in/stec.htm. A project on Barcoding of plant species with the financial support of KSCSTE was launched. Information on the web portal BTISNet publication and library resources (a collaborative programme of TBGRI and DBT, Govt. of India) was updated.

The project "Standardization of Agrotechnological Package of Practices and Establishment of Demonstration Plots for Commercial Cultivation of *Plectranthus vettiveroides*" with financial assistance from National Medicinal Plant Board, Govt. of India, was undertaken. Cuttings of *Plectranthus vettiveroides* (K.C. Jacob) N.P. Singh & B.D. Sharma collected from different cultivated localities such as Chidambaram, Tamil Nadu and Palakkad, Kerala, institutions such as Pharmacy College, Thiruvananthapuram, Department of Botany, Kerala University, Thiruvananthapuram and College of Agriculture, Padanakkad, Kasaragod were established at Puthenthope campus. Experiments were carried out in the following lines for standardizing the agrotechnological package and practices. 1. Preliminary screening for promising cultivars from the established germplasm, 2. Standardization of suitable soil type for growth and developments, 3. Analysis of light requirements, 4. Standardization of soil bed preparation, 5. Individual and community effect of planting, 6. Standardization of propagation method, 7. Standardization of proper spacing for planting, 8. Land preparation and establishment of demonstration plots, 9. Fertilizer and irrigation requirements, 10. Harvesting of roots and extraction of essential oil, 11. Identification of disease and pests/insects and 12. Standardization of pesticide.

The centre has also established cultivation demonstration plots of orchids. Currently about 10,000 orchid cuttings were planted in the demonstration plots. In addition, different varieties of anthuriums and other ornamentals are also maintained. Heliconias (22 varieties), Torch Ginger, Ornamental Musa (2 varieties), *Hibiscus* (30 varieties), Table rose, Begonias, Jasmines, *Ervatamia*-miniature, Euphorbias, Cactus, *Thunbergia erecta* (Benth.) T. Anderson, *Russelia equisetiformis* Schltdl. & Cham., *Impatiens repens* Moon, *Eupatorium triplinerve* Vahl, *Euphorbia multifida* N.E. Br., *Cestrum nocturnum* L., *Caesalpinia sappan* L., *Capsicum annuum* L., *Ocimum* sp., *Sida* sp., *Bacopa monneiri* (L.) Wettst., *Centella asiatica* (L.) Urb., *Costus speciosus* (J. König)Sm., *Coleus aromaticus* Benth., *Pandanus amaryllifolius* Roxb., *Murraya koenigii* (L.) Spreng., *Citharexylum subserratum* Sw., *Quassia amara* L., *Passiflora edulis* Sims., *Vitex negundo* L., *Rhinacanthus communis* Nees, *Ruta graveolens* L., *Plumbago rosea* L., *P. indica* L., *P. chinensis*, *Aloe vera* (L.) Burm. f., *Geophila reniformis* (Kunth) Cham.& Schltdl. *Chassalia curviflora* Thwaites, *Ochna integerrima* (Lour.) Merr., *Mentha piperita* L. and *Mucuna pruriens* (L.) DC. were introduced during this period.

Compost making using the organic waste is practiced at Puthenthope campus. The boundary wall construction at the front of the building and renovation of the building were also completed.



PHYTOCHEMISTRY & PHYTOPHARMACOLOGY

Seven projects funded by Department of Science and Technology (DST), Department of Biotechnology (DBT) and Indian Council of Medical Research (ICMR), have been implemented during this period. The Division has also been implementing four in-house projects, besides pursuing Ph. D., M. Pharm. and other training programmes.

I. Externally funded programmes

As part of a DBT project on nutraceuticals, roots of five *Sida* species viz., *Sida acuta* Burm. f., *S. alnifolia* L., *S. rhomboidea* (Roxb.) Fleming, *S. rhombifolia* L. and *S. cordifolia* L. were studied. This led to the discovery of an active fraction with anti-inflammatory, diuretic and analgesic activities from one of the *Sida* species. This active fraction has the potential to be used as a nutraceutical for pre-natal care, validating the traditional claims on *Sida*.

In a DST project, the fruiting bodies of *Ganoderma lucidum* were collected from Thrissur, Kerala and subjected to phytochemical and bioactivity studies. Further studies are in progress.

In a DBT project, the chemical prospecting of essential oils and oleoresins of two hitherto uninvestigated gingers *Curcuma haritha* Mangaly & Sabu and *Zingiber nimmonii* (J. Graham) Dalzell was studied. *Z. nimmonii* rhizomes were collected from Ponmudi, essential oil was isolated by hydrodistillation and characterized by GC- FID, GC-MS, Co-GC, RRI, data base and literature search. Sixty-five constituents comprising 97.5% of the oil were identified. *Z. nimmonii* is reported to have antitumour activities in traditional knowledge. This lesser known ginger from the Kerala region of the Western Ghats was found to be a unique source of isomeric caryophyllenes, viz., β-caryophyllene and α-humulene. The chemical profile of the rhizome oil of *C. haritha* was also studied. Fifty constituents comprising 99.9% of the oil were identified. The oleoresins/extracts and essential oils of *C. haritha*, with major constituents as camphor, curdione, germacrone, furanogermanone etc., are natural sources with potential bioactivities.

In a DBT-funded-collaborative project, involving TBGRI and the Department of Microbiology, Sree Chitra Tirunal Institute for Medical Sciences and Technology (SCTIMST), the anti-viral properties of some known medicinal plants were investigated. An anti-viral fraction has been isolated from the water extract of

Untreated control duckling dying with typical hind limb paralysis; active fraction from *Ocimum sanctum* L. treated pubs are protected.

Rhinacanthus communis Nees. It exhibited significant *in vitro* anti-Hepatitis B activity in cell line. Interestingly, it exhibited remarkable *in vivo* anti-Coxsackie viral activity in suckling mice. The active fraction at a dose of 200 mg/kg (per oral; daily) protected all the virus challenged pups whereas all the untreated virus challenged control mice died of the infection. Besides, it exhibited some level of *in vivo* activity in ducklings challenged with Duck Hepatitis Virus. At a dose of 200 mg/kg it protected 50% of the virus challenged ducklings. The fraction was found to be devoid of any conspicuous sub-acute toxicity in mice.

Further, the alcohol extract of *Ocimum sanctum* L. leaf showed anti-Coxsackie virus, anti-Measles and anti-Herpes Simplex virus (type 1) activities. An anti-viral butanol fraction has been isolated from the alcohol extract of *O. sanctum* by sequential extraction. It exhibited remarkable in *vivo* anti-Coxsackie viral activity in suckling mice challenged with the virus. The active fraction at a dose of 250 mg/kg (per oral; daily) protected all the viral challenged pups whereas all the untreated virus challenged control mice died of the infection. It also showed some level of *in vivo* efficacy against duckling challenged with Duck Hepatitis Virus. The fraction was found to be devoid of any conspicuous sub-acute toxicity in mice. Significantly, this study showed that the active fraction and the alkaloid isolate from *O. sanctum* leaf are attractive materials for anti-viral drug development against Coxsackie, Hepatitis B and other viruses.

In another DST-funded collaborative project involving TBGRI and the Department of Botany, University of Kerala field survey and collection of *Utleria salicifolia* Bedd. ex Hook. f., conservation strategies and *in vitro* propagation studies were carried out at University of Kerala. The anti-oxidant, antifungal, antibacterial, cytotoxicity and anticancer activities of *U. salicifolia* extracts were evaluated at TBGRI.

Studies on the wild fern *Selaginella involvens* (Sw.) spring, underan ICMR-supported SRF programme, have shown that its water extract exhibits thymus growth stimulatory activity in adult mice (reversal of involution of thymus) and remarkable anti-lipid peroxidation activity. In this study, following activity guided isolation, the active principle/component (AC) was isolated from the water extract of *S. involvens*. The effect of AC on immune function was studied using fungal (*Aspergillus fumigatus*) challenge in cortisone treated mice. The *in vitro* anti-fungal activity of AC was assayed using disc diffusion assay. *In vitro* and *in vivo* effect of AC on DNA synthesis in thymus was studied using ^{3}H-thymidine incorporation. AC (which showed positive reaction to coumarin and flavonoid) was isolated in a chromatographically pure form. AC possessed both thymus growth stimulatory and anti-oxidant properties. AC protected cortisone treated mice from *A. fumigatus* challenge. It did not exhibit *in vitro* antifungal activity. Increased ^{3}H-thymidine incorporation was observed in the thymus reticulo-epithelium obtained from AC treated mice. However, *in vitro* AC treatment to thymus for 5 hr did not result in an increase in ^{3}H-thymidine incorporation. Thus, AC (named as Selagin) from *S. involvens* could reverse involution of thymus to a large extent, exhibit remarkable anti-oxidant activity, and protect immune compromised mice from fungal infection. Therefore, it is very promising for the development of a drug to ameliorate old age related health problems and prolong life span.

In an ongoing DST-funded programme, studies were carried out to determine the mechanism of the aphrodisiac action of the alcohol extract of *Vanda tessellata* (Roxb.) Hook. ex G. Don. flower and to isolate the active principle involved. An active chloroform

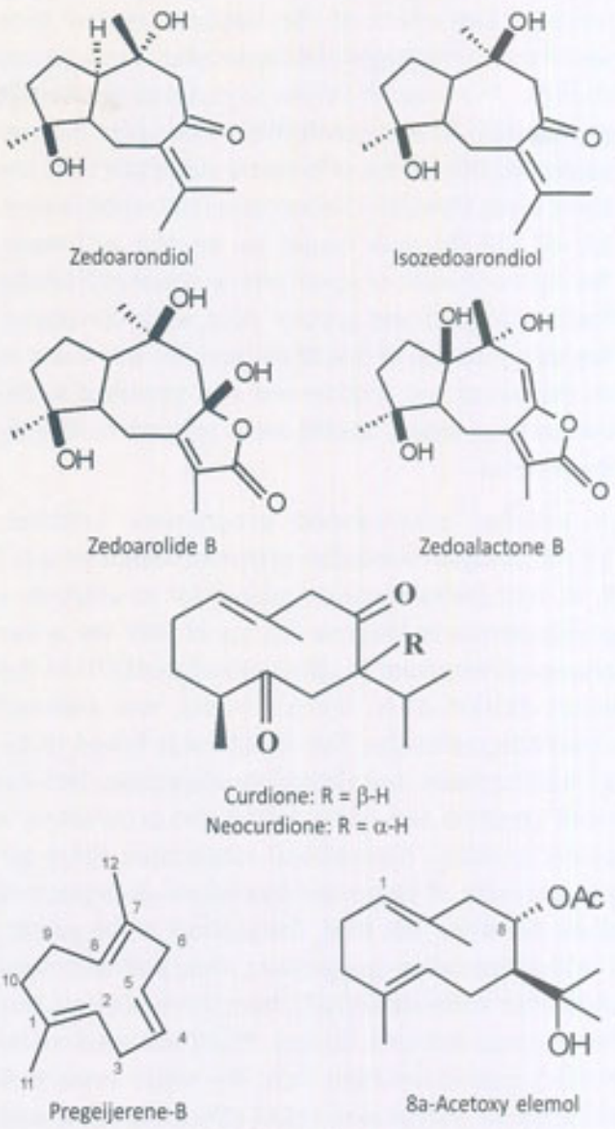
fraction has been isolated from the alcohol extract with the guidance of the aphrodisiac activity. The study has shown that serum NO level in mice is transiently increased by the extract/ herbal drug. There was a positive correlation between the increase in blood NO levels induced by the drug and the mounting behavior of the mice. The active principle has been isolated by preparative TLC and column chromatography. Preliminary observations have shown that the active principle activates corpus cavernosum NO-synthase. In conclusion, *V. tessellata* flower contains an active principle which activates penile tissue NO-synthase and brings about aphrodisiac action in mice. This drug is extremely promising to develop as a commercially viable medicine.

II. Plan-funded programmes

In a plan-funded scheme, 'Phytochemical investigation of tropical medicinal plants with a view to develop new drugs, pharmaceutical products, chemicals, industrial raw materials etc.' extensive studies were carried out on selected medicinal plants. These studies led to the isolation of potential secondary metabolites from *Curcuma haritha* (germacrane and guaiane-type sesquiterponoids), *Pittosporum viridulum* (coumarins: scoparone, scopoletin), *Neolitsea* spp. (aroma chemicals: safrole, a-terpineol, methyl eugenol etc.) and *Thottea ponmudiana* (pregeijerene-B, 8-a-acetoxyelemol).

In a second plan funded programme entitled, 'Studies on tropical aromatic plants with a view to discover new sources of essential oils for perfumery, cosmetics, flavour and drug industry', the search for new essential oils sources/potential oil constituents from plants in Kerala part of the Western Ghats was continued. The chemical profiles of aromatic plants such as *Globba schomburgkii* Hook. f., *G. ophioglossa* Wight, *Eugenia rottleriana*, *Syzygium gardneri* Thwaites, *S. caryophyllatum* (L.) Alston, *Curcuma haritha*, *Pittosporum neelgherrense*, *Thottea ponmudiana* Sivar., *T. siliquosa* (Lam.) Ding Hou, *T. sivarajani*, *Zingiber zerumbet* (L.) Roscoe ex Sm., etc were studied by gas chromatographic and spectroscopic techniques. Their bioactivities viz., antimicrobial, anti-inflammatory, antioxidant activities and their potential for applications in flavour and fragrance industries were also evaluated in this programme.

Trichopus zeylanicus Gaertn. subsp *travancoricus* (Bedd.) Burkill ex Narayanan is a traditional medicinal



Secondary metabolites isolated from *Curcuma haritha* and *Thottea ponmudiana*

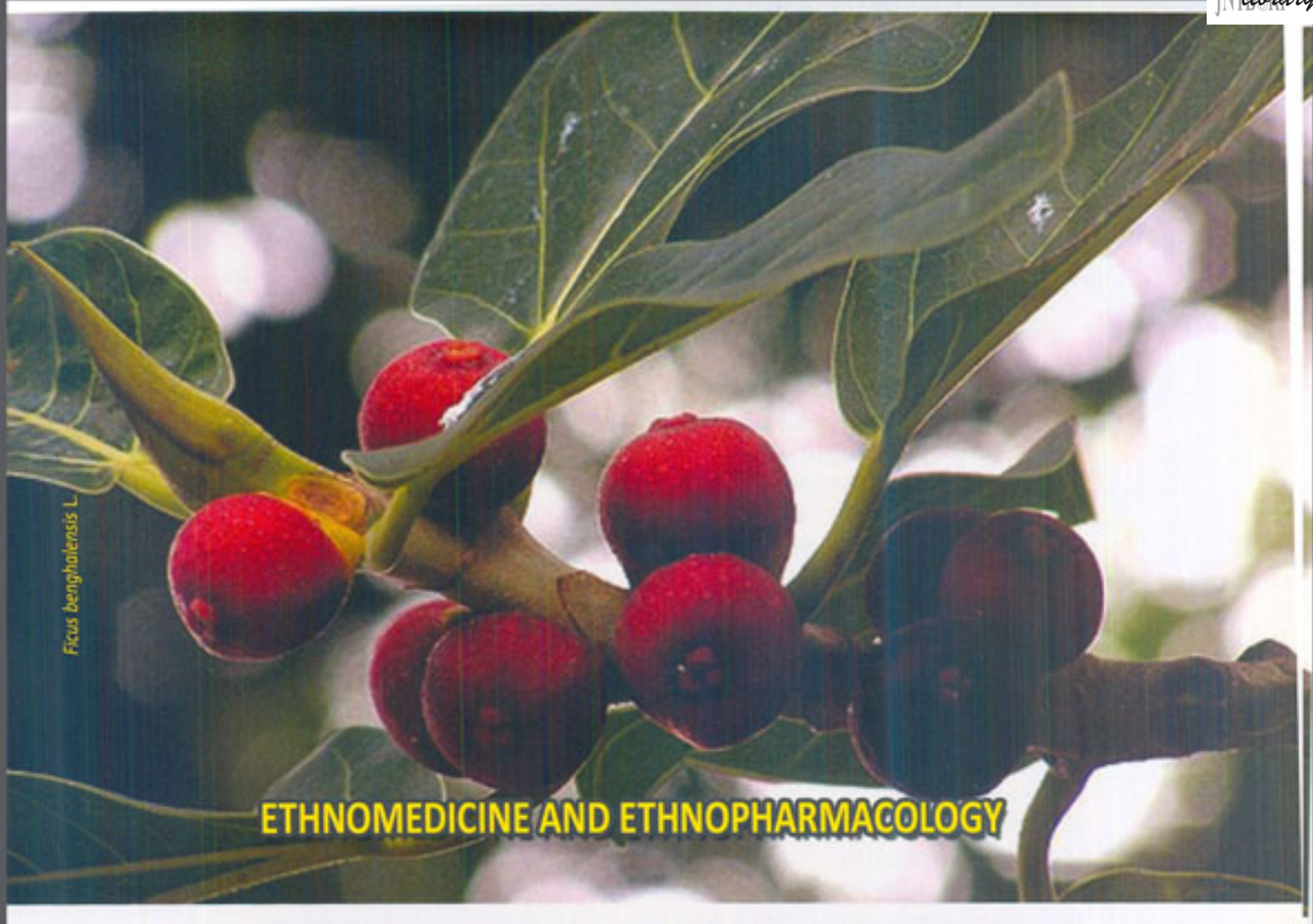
herb with several pharmacological properties such as immune modulation, anti-fatigue, anti-ulcer and hepato-protection. It is a promising anti-stress/ adaptogenic herbal drug. The objective of the present study included mechanism of modulation of immune functions and elucidation of the full spectrum of pharmacological activities of the plant extracts/active fractions. We have shown previously that the activation of peritoneal macrophages by the active butanol fraction obtained from alcohol extract occurs under *in vivo* and not *in vitro*. The 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 in to the blood which stimulates thymocyte proliferation *in vitro*. Serum (10 %) was found to be the optimum. The electrophoretic of serum protein obtained from the fraction treated and control mice were compared. The concentration of one of the proteins was found to be decreased and another one was increased in the treated mice serum. Studies are in progress to identify the proteins.

In another plan-funded programme entitled, 'Pharmacological evaluation of *Hemidesmus indicus* (L.) R. Br. root (extract/active fraction) for its utility as a phytomedicine to improve efficacy of ORS' the active principle/compound (a coumarino-lignoid) from the water extract of *H. indicus* (root), was isolated chromatographically. This isolate was found to be stimulating water and electrolyte absorption from rat small intestine and colon. Under this programme a patent entitled, 'A novel oral rehydration agent for enhancement of water and electrolyte absorption in acute diarrhoea' was filed. The abstract of the patent: The invention relates to a product, water and electrolyte absorption enhancer (WEAE), from the medicinal plant *Hemidesmus indicus* R. Br. root. WEAE was obtained by activity guided isolation from the water extract of *Hemidesmus indicus* root. WEAE effectively stimulated water and electrolyte absorption from rat small intestine and colon sacs. An intra jejunal sac dose of 50 ìg/ml or an oral doze of 5 mg/kg was found to be sufficient to provide optimum stimulation of water and electrolyte absorption. WEAE remarkably enhanced the efficacy of Oral Rehydration Salts (ORS) solution in rat intestine. WEAE (drug) also showed remarkable anti-oxidant properties. Further, it was found to be devoid of any toxicity in the preliminary short term toxicity evaluation in mice. WEAE appears to be a coumarin whose structure is yet to be characterized. WEAE, among other things, can be used to enhance the efficacy of ORS in case of water and electrolyte loss due to diarrhoea and vomiting, especially in children.

In a Ph. D. programme, the anti-hyperlipidemic properties of *Averrhoa bilimbi* L. fruit was established in rats and the active principle was isolated. *A. bilimbi* fruit and its extracts were screened for anti-hyper cholesterolemic activity using Triton-induced hypercholesterolemia in rats as a model. The fruit and its water extract, but not alcohol and hexane extracts, showed remarkable anti-hypercholesterolemic activity. An active fraction which showed activity at a low dose of 0.8 mg/kg was purified from the water extract. An active component was isolated from the active fraction, which showed optimum activity at a dose of 0.3 mg/kg. The efficacy of the fruit was tested in chronic high fat diet fed hyperlipidemic rats. The fruit (125 mg/kg) as well as its water extract (50 mg/kg) were found to be effective in lowering lipids in the high fat diet fed rats. The fruit was subjected to preliminary general toxicity evaluation in mice. Oral administration of the fruit homogenate daily for 15 days did not result in any toxic symptoms up to a dose of 1 g/kg studied. Thus, this fruit is a promising nutraceutical which can be used as a dietary ingredient to prevent as well as treat hyperlipidemia.

As part of another Ph. D. programme, the anti-diabetic activity against alloxan-diabetic rats and hypoglycemic property in glucose loaded rats of ethanol extract of a fern, *Hemionitis arifolia* (Burm. f.) T. Moore , were found recently (Fig. 5). Follow up studies resulted in the isolation of an active fraction and an active principle. The active ethyl acetate fraction exhibited promising anti-diabetic activity in streptozotocin diabetic rats at a dose of 50 mg/kg, (per oral) as judged from levels of blood glucose, liver glycogen and serum lipids. Intra-peritoneal as well as oral administration of the active fraction was found to be effective in glucose tolerance test. The fraction showed anti-hyperglycemic effect in intra-peritoneally glucose loaded rats also. The fraction did not influence insulin release into the medium from cultured â-cells of rat islets. However, the fraction stimulated glucose uptake in isolated rat hemi-diaphragm suggesting a direct effect of the drug (without the involvement of insulin) on glucose uptake. Daily administration of the active fraction (up to four times higher than the therapeutic dose) to normal mice for 30 days did not show any toxicity. The active fraction was subjected to Thin Layer Chromatography (TLC). The fraction was separated into several components by TLC and the component with an Rf value of 0.28 was found to be the active ingredient and it showed positive reaction to steroid.



ETHNOMEDICINE AND ETHNOPHARMACOLOGY

In the programme for baseline documentation of Traditional Knowledge related to plants used for food and medicine, preparation of the 1st draft of the data base has been completed based on the data gathered from the 70 Gramapanchayaths (5 each in all 14 Districts of Kerala). The team entrusted with the documentation programme interviewed 1297 informants and systematically documented 7667 information based on 625 medicinal plant species used as single drugs. Apart from this, 3333 combinations were also recorded. Out of these, 1532 (single -1083, combinations-449) information were documented from the tribal communities. The team also recorded 650 information (non tribal-232, tribal - 418) based on the plants used for edible purposes.

During the reporting period, we completed the systematic documentation of traditional knowledge related to plants used for food and medicine of 10 Gramapanchayaths of Kasaragod District. The team interviewed 302 informants and documented 2017 information related to plants used for medicinal purpose and 124 information related to plants used for edible purpose. Apart from this we have also completed the draft data entry of Chemnad, Kumbala, Madhur, Meenja, Mugral-puthur and Puthige Gramapanchayaths of Kasaragod District. During the field trip the team recorded the uses of certain important / lesser known / hitherto unknown plant species having anti-cancer, anti-diabetic, wound healing, anti-poisonous, immuno-enhancing, anti- fatigue and anti-diarrhoeal properties. The documentary film on traditional knowledge 'FROM HAZE...LIGHT!' (English and Malayalam version) was

Field level systematic documentation of Traditional Knowledge

officially released by the Hon'ble Education Minister, Shri. M. A. Baby, during the 20th Kerala Science Congress.

Ethnopharmacological screening of 20 ethnomedicinally important plant species are in progress. Following leads were obtained from these species.

	Name of the Plants		Activity
1.	*Spilanthus ciliata* Kunth	:	Hepatoprotective
2.	*Capparis brevispina* DC.	:	Hepatoprotective
3.	*Rhinacanthus nasutus* (L.) Kuntze	:	Hepatoprotective, wound healing
4.	*Decalepis arayalpathra* (J. Joseph & Vajravelu) Venter	:	Anti ulcer, anti-tumour
5.	*Cyclea peltata* Diels	:	Anti-ulcer, hepatoprotective
6.	*Pilea microphylla* (L.)Liebm.	:	Antidiabetic
7.	*Smilax zeylanica* L.	:	Anti-hyperglycaemic
8.	*Caesalpinia pulcherrima* (L.) Sw.	:	Anti-hyperglycaemic
9.	*Glycosmis pentaphylla* (Retz.) DC.	:	Wound healing
10.	*Justicia gendarussa* Burm .f.	:	Anti-inflammatory
11.	*Drynaria quercifolia* (L.) J. Sm.	:	Anti-inflammatory, Analgesic
12.	*Cissampelos pareira* L.	:	Anti-inflammatory, analgesic
13.	*Clerodendrum infortunatum* L.	:	Anti-inflammatory, analgesic
14.	*Naravelia zeylanica* (L.) DC.	:	Anti-inflammatory, analgesic
15.	*Vitex altissima* L. f.	:	Anti-inflammatory, analgesic
16.	*Erythrina indica* Lam.	:	Anti-inflammatory, analgesic
17.	*Lepianthes umbellata* (L.) Raf. ex Ramamoorthy	:	Anti-inflammatory, analgesic
18.	*Commiphora caudata* (Wight & Arn.) Engl.	:	Anti-inflammatory, analgesic
19.	*Mimusops elengi* L.	:	Anti-inflammatory, analgesic
20.	*Ficus benghalensis* L.	:	Anti-inflammatory, analgesic

Caesalpinia pulcherrima (L.) Sw.

Mimusops elengi L.

Justicia gendarussa Burm .f.

Pilea microphylla (L.)Liebm.

Erythrina indica Lam.

Black bulbul on *Cullenia exarillata* Robyns
S Suresh

CONSERVATION BIOLOGY

Study on Plant-pollinator interactions, sexual systems and level of gene flow in four endemic species of Western Ghats in Silent Valley continued. Gene flow, the successful movement of genes via seed and pollen, is a primary determinant of genetic and species diversity in plant communities. Due to high rate of destruction and fragmentation of tropical forests, many tropical plants have dwindling population and some species may be more affected by demographic stochasticity and genetic drift. Altered patterns of gene flow and genetic structure have implications for mating systems, levels of inbreeding and maintenance of genetic diversity. Hence, it is essential to study different aspects involved in gene flow mechanisms such as breeding system, pollination system, seed dispersal system and genetic and population structure of a species in order to evolve effective conservation strategies. Such a study was undertaken by scientists of the Division with respect to four species endemic to the Western Ghats (*Palaquium ellipticum* (Dalz.) Bail., *Cassine kedarnathii* Sasi. & Swarup., *Cullenia exarillata* Robyns and *Janakia arayalpathra* Joseph & V. Chandras.). Of these, the first three species occur in Silent Valley rain forests.

During the period under report, 10 field trips extending from seven to 14 days were conducted to Silent Valley forests. Phenology, pollination mechanism and seed dispersal system of *Cassine* and *Palaquium* were studied. As in the previous year, *Cassine* showed asynchrony in flowering and fruiting. Floral morphology, pollen production, stigma receptivity, visitation of animals and their role as pollinators and or seed dispersers of *Cassine* and *Palaquium* were investigated in detail. Repetition of artificial pollination experiments confirmed that *Palaquium* and *Cassine* are out crossing species.

Observation of animal visitors showed that *Cassine* was visited by 14 species of insects, five species of birds, rodents and bats. Of these, insects, honey bees, carpenter bees and wasps facilitated cross pollination in *Cassine*. High rate of seed predation by rodents, especially spiny dormouse and an unidentified insect larva, was observed in this species. Seed dispersal studies showed that bats rarely acted as a seed disperser of *Cassine*. On the other hand, *Palaquium* was visited by 11 species of insects, 14 species of birds and seven species of mammals. Of these, insects and birds

P S Jothish

Palaquium ellipticum (Dalz.) Bail.

P S Jothish

Lion Tailed Macaque, a flower and fruit predator of *Palaquium*

indirectly assisted in pollination process, as they helped to release pollen into the air. Of the seven species of mammals interacted with *Palaquium*, bats were effective seed dispersers while Malabar Giant Squirrel acted as seed predator. Other animals such as Bonnet Macaque, Lion Tailed Macaque, Nilgiri Langur and Civet acted as seed predators as well as seed dispersers. Besides the above work, DNA was isolated from 36 leaf sample accessions of *Cassine* and 98 accessions of *Palaquium* collected from different areas of Silent Valley in order to study the genetic structure and the result of gene flow pattern among populations of *Cassine* and *Palaquium* in the study area.

Study on *Cullenia exarillata*, the third species of this programme, was initiated. Preliminary works such as selection of study plots, marking of individuals in the plots, measuring of their height and dbh were carried out. Two one acre plots, one at Aruvanpara and other at Sairandhri in Silent Valley were selected. At Aruvanpara plot 35 individuals and at Sairandhri plot 58 individuals of *Cullenia* were recorded.

Crabs play a key role in mangrove ecosystem influencing nutrient cycling and altering forest structure. This project handled by the Division 'Plant-Crab Association in the Mangrove Ecosystem of Kerala' investigates these aspects in the mangrove forests of Kerala.

During the period under report, experiments on leaf translocation, litter consumption and seedling predation of mangroves by crabs were studied in the mangrove ecosystem at Kunhimangalam, Kannur district. Activity

S. Sarvesh

Kunhimangalam mangrove

S. Suresh

Vanishing patches of mangrove in Kunhimangalam

of the dominant crab *Neosarmatium smithi* on leaves and seedlings of three dominant mangrove species (*Avicennia officinalis* L., *Rhizophora mucronata* Lam. and *Excoecaria agallocha* L.) were carried out. Leaf translocation studies showed that at an average, 3.2g of *Avicennia*, 3.31g of *Excoecaria* and 1.42g of *Rhizophora* leaves were translocated by a single crab per day. The crabs preferred *Excoecaria* leaves to that of other two species. Experiments on litter translocation and consumption showed that *Neosarmatium smithi* consumed 13.6g dry weight of *Avicennia*, 11.8 g of *Excoecaria* and 6.1g of *Rhizophora* leaf litter for a period of ten days. Besides, litter production by the dominant mangrove species per square meter of mangrove forest was studied to compare it with litter consumption by crabs.

S. Suresh

Setting up an experiment to study mangrove-crab interaction

S. Suresh

Neosarmatium smithi (H. Milne Edwards) - a dominant crab species

Predation of mangrove seedlings by crabs influences the mangrove forest structure, species structure and the dominance of species in the mangrove ecosystem. Study on seedling predation by *Neosarmatium smithi* showed that *Rhizophora* seedlings experienced highest mortality due to predation, followed by *Aegiceras corniculatum* and *Avicennia officinalis*. Crabs preferred younger seedlings to older ones.

Kunhimangalam harbours 5 km^2 of mangrove forests, the largest and one of the least disturbed mangrove ecosystem in Kerala (See page 27) . Ten species of true mangroves have been recorded from Kunhimangalam. *Avicennia officinalis* L., *Aegiceras corniculatum* (L.) Blanco, *Excoecaria agallocha* L., *Rhizophora mucronata* Poir. are the most dominant among them. Three types of vegetational structure are identified in this ecosystem based on species dominance. They are (i) *Rhizophora* dominant area occupying the fringe followed by *Avicennia officinalis* and *Aegiceras corniculatum* towards the land side (ii) *Avicennia* and *Excoecaria* mixed stands with representations of *Avicennia marina, Rhizophora mucronata, Aegiceras corniculatum* and *Acanthus ilicifolius* (iii) Mixed area comprising almost all the representative species. This ecosystem harbours 10 species of crabs, of which Blue (*Sesarmops intermedius)* and Red (*Parasesarma plicatum)* crabs are the most dominant and litter dependent species. There are two species of fiddler crabs (*Uca lactea annulipes, U. triangularis bengali*) thriving on detritus material, which are plenty along the banks of estuaries.

S. Suresh

Sesarmops intermedius (Dehaan) on *Acanthus ilicifolius*

The project to bringout an interactive CD on 'Flowering Plants of Kerala' was undertaken in 2006. This work was completed during the period under report. The CD provides details like correct botanical name, important synonym/s, habits, distribution in the world, the Western Ghats, Kerala, references to good descriptions and illustrations, phytogeographical information, threat category, flowering and fruiting seasons, Malayalam names and uses of 5023 taxa of flowering plants (4677 species, 57 subspecies and 289 varieties) in 1416 genera under 188 families.

The CD has multiple entry points that allow a user to access the data by choosing any given character in the database. It interacts with the user through four windows. **Search** window provides full details of a species. **Basic Search** offers an entry to the species list by entering species name or local name in search box. **Advance Search** provides a multi point entry into the database. It has an introductory portion **About the CD** which gives a brief introduction about the methodology besides a User's Key. There is a fifth window which provides a provision to update the database. This is for the database administrator for editing and updating the database.

Knowledge on dispersed pollen has wide application in fields like forest history, pollination biology, aerobiology, melittopalynology, conservation biology (especially in fields like animal food habits and pollination) and gene flow system. Keeping this in view, the Division undertook a project on pollen of the Western Ghats trees. As part of the programme polliniferous materials of 26 tree species from various localities in the Western Ghats were collected. About 356 pollen slides belonging to 66 species were prepared by standard acetolysis method. LM studies of 38 species were carried out and SEM works of 21 species were completed during this year.

In the programme on Database on the Western Ghats flora data on 117 species from Karnataka part and on 180 species from Tamil Nadu part of the Western Ghats were gathered and analyzed during the period under report. The work focuses on: legitimate name, important synonyms, reference to good descriptions and illustrations, distribution in the World and the Western Ghats, nativity, endemicity, exotic nature, uses and local names. Rest of the work is in progress.

PLANT SYSTEMATICS & EVOLUTIONARY SCIENCE

The research activities of the Division are mainly focused on Survey, Exploration and Documentation of floristic wealth of Kerala and other adjacent States. It also concentrates on biodiversity evaluation of different ecosystems, assessment of threat status of endemic and RET species, reproductive biology, rescue and restoration of rare and endangered species etc. Recently the Division was entrusted with the responsibility of establishing molecular taxonomy and macrofungi Laboratory. The division during the period under report handled 10 externally funded projects.

As part of the enriching the herbarium study on the systematics of specific groups of plants, 52 field trips were conducted to different forest types in the Western Ghats covering all seasons. The explorations resulted in the collection of 6120 specimens belonging to 2519 species of which 1540 species were critically studied and identified. These collections included 161 endemics and 67 RET species of the Western Ghats. The collection assumes significance especially upon the phytogeographical distribution and conservation aspects.

Systematic studies of the genus *Cinnamomum* led to identification of 45 specimens representing 7 species which included, *C. chemungianum* Mohanan & Henry, *C. dubium* Nees, *C. riparium* Gamble, *C. sulphuratum* Nees, *C. travancoricum* Gamble, *C. verum* J.S. Presl, etc. A study on the genus *Sonerila* helped identification of 24 specimens belonging to 7 species viz., *Sonerila barnesii* C.E.C. Fisch., *S bruñonis* Wight & Arn., *S. rotundifolia* Bedd., *S. sahyadrica* Giri & Nayar, *S. tinneveliensis* C.E.C. Fisch., *S. wallichii* Bennt., *S. zeylanica* Wight & Arn., etc. Survey for the sedge flora of Nilgiri Biosphere Reserve resulted in the collection of 600 specimens of 110 species which includes 10 rare and little known species.

The systematic study on balsam resources of the Western Ghats was continued. This year the exploration was concentrated on highlands of Northern and Central Western Ghats. A field gene bank was established to grow balsams in *ex situ* condition to popularize rare and ornamental balsams. Among the 70 wild balsams, 24 species were found having potential ornamental value and can be grown throughout the year. In addition, 19 cultivars are also grown in the field gene bank.

Rediscovery

Sonerila devicolamensis Nayar – Rediscovered after type
Sonerila barnesii C.E.C. Fisch. - Rediscovery after type
Cinnamomum travancoricum Gamble – Rediscovery after 113 years
Lepironia articulata (Retz.) Domin - Rediscovery and new distributional record

New distributional records

Decaspermum - A new generic record for India
Impatiens trichocarpa Hook.f. – A new record for Maharashtra
Memecylon capitellatum L. - A new record for Kerala
Memecylon royenii Blume - A new record for Kerala
Xanthophyllum manickamii Murugan – A new record for Kerala

Under systematic studies of the Dioscoreaceae of the Western Ghats 22 species, 6 varieties of *D. pentaphylla* L. and 2 varieties each of *D. bulbifera* L., *D. esculenta* (Lour.) Burkill and *D. oppositifolia* L. were identified. The survey interestingly led to the collection of 12 imperfectly known taxa and efforts are being continued to establish their taxonomic identity. In addition, anatomical characters are worked out for 16 species and a key is prepared for easy identification.

Molecular taxonomic studies were initiated during this year on species of the genus *Memecylon* (Melastomataceae). Specimens of 25 species and accessions such as *M. umbellatum* Burm. f., *M. capitellatum* L., *M. grande* Retz, *M. edule* Roxb., *M. lushingtonii* Gamble, *M. flavascens* Gamble, *M. talboltianum* Brandis, *M. grassile* Bedd., *M. sivadasanii* N. Mohanan, Ravi, Kiran Raj & Shaju , *M. agastyamalayanum* Santhosh, Raju & Shanavas, *M. kollimalayanum* M.B. Viswan., *M. courtallensis* C. Murugan, G.J. Jothi & V. Sundaresan, *M. royenii* Blume, *M. sisparense* Gamble, *M. molestum* (Clarke) Cogn., *M. lawsoni* Gamble, *M. depressum* Benth. ex Triana, *M. deccanensis* Clarke, *M. heyneanum* Benth. ex Wight & Arn., *M. subramanii* A.N. Henry were collected from forests of Agastyamala, Kasargod, Silent Valley, Munnar, Athirapally Vazhachal, Wayanad, Kannur, Thirunelveli, Kollimalai, Alagarkoil, Dindugal, Courtallum hills etc. DNA isolation, specific marker selection etc. are in progress.

As part of the programme on Reproductive Biology of RET balsams to find out the reasons for narrow distribution of rare and endemic balsams in the Western Ghats, two rare and endangered balsams, *I. grandis* Heyne ex Wallich and *I. phoenicea* Bedd., were studied. Exploration trips were conducted and viable populations of candidate species identified. Their natural habitats were marked for monitoring the population dynamics. The morphological characters, protrandrous nature, PO ratio indicative of cross pollination in them. The major pollinators are honey bees, hawk moths and

A.G. Pandurangan

Impatiens campanulata Wight

R. Ramasubramoni

Impatiens pulcherrima Dalzell

S.K. Kuffadi

Impatiens lawii Hook. f. &Thomson

butterflies and their frequent inter plant movements facilitate cross pollination. Experiments demonstrated that *I. phoenicea* and *I. grandis* reproduced by means of cross pollination. In natural condition, *I. phoenicea* and *I. grandis* produce 18-30% fruit set. In artificial cross-pollination (geitonogamy and xenogamy) the fruit set rate enhanced up to 38-44%. In all the cases, the fruit set was not observed in self pollination. Pollen fertility and viability test confirmed 79% viability in *I. grandis* and 66% viability in *I. phoenicea* and the viability gradually reduced on successive days after anthesis. Percentage of seed germination in *I. phoenicea* and *I. grandis* was only 12-23%. The other alternative method vegetative propagation for these two species was standardized using IAA and IBA. In case of *I. grandis* 250ppm of IAA and in *I. phoenicea* 150ppm of IBA were found more suitable than other hormone.

Under the programme Quantitative assessment and mapping of NWFPs in Southern Kerala, the study covered over 5000 km^2 were covered assessing the NWFPs in 12 Forest Divisions in 6 districts. The study resulted in the identification, assessment and gathering knowledge on distribution range of 130 NWFPs currently available in these districts. Traditional harvesting techniques and their impacts on the ecosystems and communities were analyzed. Quantum of collection, period of availability, selective collection, destructive collection etc. were noticed in some way or other depending upon the market demand. Based on these observations, a strategy has been proposed for sustainable harvesting and utilization of NWFPs in Southern Kerala.

Under the Biosphere Reserve Programme, TBGRI functions as one of the 6 co-ordination centres established by the Ministry of Environment and Forests. Each center has the responsibility of preparing status report and database with respect of Agasthyamalai, Nilgiri and Gulf of Mannar Biosphere Rerserves in UNESCO's format for recognition. Under this programme the flora of Nilgiri Biosphere Reserve was compiled based on field survey and consultation of more than 500 research papers published since 1890. The study delimited that the reserve harbours 3500 species of flowering plants. The data analysis shows that Fabaceae dominates with 333 species followed by Poaceae (243), Orchidaceae (175), Asteraceae (154), Cyperaceae (145), Rubiaceae (144), Acanthaceae (134) and Euphorbiaceae (122). The flora contains more than 800 endemic plants of the Western Ghats of which 135 are strictly endemic to Nilgiris and 55 are known under RET category. The temperate montane vegetation (Sholas) is the notable characteristic of NBR which harbours 424 species over 2000m above MSL. Based on the present studies, it has been estimated that the reserve harbours 27% of the flowering plants of India and 80% of the Western Ghats.

Preparation of UNESCO's Nomination report for Agasthyamalai BR was done. 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. have already been compiled.

Herbarium Management and Development: The herbarium was shifted from semi permanent building to the new block which was constructed with the financial assistance from the MoEF, New Delhi. After the shifting, about 18,500 herbarium specimens and 25,000 duplicate specimens were rearranged. The works carriedout during the period under report are as follows.

1. Specimens in the herbarium as on March 2008	:	20,370
2. No. of specimens processed	:	11,250
3. Mounted for filing	:	3,450
4. Unmounted for reference	:	2,550
5. No. of specimens incorporated	:	730
6. Number of Nomenclature Correction carried out	:	800
7. Specimens received for incorporation	:	260
8. Identification and labeling	:	360
9. Indexing of General Herbarium specimens	:	1,350
10. Number of sheets renovated	:	4,000
11. Maintenance & Fumigation of Herbarium specimens	:	20,370
12. Number of enquiries attended	:	1,300

Survey and exploration resulted in the addition of 34 taxa thus far unrepresented in TBGRI Herbarium (TBGT). Inventory and documentation helped to access some important plant taxa such as *Antistrophe serratifolia* (Bedd.) Hook. f., *Aporusa bourdillonii* Stapf, *Buchanania barberi* Gamble, *Capillipedium assimile* (Steud.) A. Camus, *Carex speciosa* Kunth, *Cinnamomum chemungianum* Mohanan & A.N. Henry, *C. riparium* Gamble, *Coffea travancorensis* Wight & Arn., *Cucumella silentvalleyi* Manilal, T. Sabu & P. Mathew, *Dimeria copeana* Sreek., V.J. Nair & N.C. Nair, *D. fuscescens* Trin., *D. namboodiriana* Ravi & Mohanan, *Diospyros trichophylla* Alston, *Eria reticosa* Wight, *Garcinia imbertii* Bourd., *G. morella* Descr., *G. travancorica* Bedd., *Hydnocarpus pendulus* Manilal & Sabu, *H. macrocarpus* (Bedd.) Warb, *Humboldtia bourdillonii* Prain, *H. unijuga var. trijuga* J. Joseph & Chandras., *Impatiens campanulata* Wight *Impatiens grandis* Heyne ex Wallich, *I. kulamavuensis* Pandurangan & V.J. Nair, *I. lawii* Hook f. & Thomson, *I. phoenicea* Bedd., *I. pulcherrima* Dalzell, *I. travancorica* Bedd., *Ischaemum travancorense* Stapf ex C.E.C. Fisch, *I. vembanadense*

T. Shaiju

Lepironia articulata (Retz.) Domin

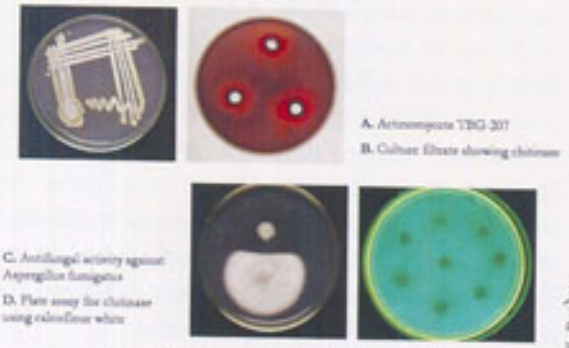
T. Shaiju

Sauropus saksenianus Manilal *et al.*

Patil & D'cruz, *Ixora agasthyamalayana* Sivad. & Mohanan, *I. polyantha* Wight., *Lagenandra meeboldii* (Engl.) C.E.C Fisch, *L. nairii* Ramam. & Rajan, *Lepironia articulata* (Retz.) Domin, *Medinilla anamalaiana* Sasi & Sujan., *Morinda reticulata* Benth., *Pothos armatus* C. E. C. Fisch., *P. crassipedunculatus* Sivad. & Mohanan, *P. keralense* Pandurangan & V.J. Nair, *Phaeanthus malabaricus* Bedd., *Sauropus saksenianus* Manilal *et al.*, *Smithia venkobarowii* Gamble, *Soneria versicolor var. axillaris* Gamble, *Syzygium bourdillonii* (Gamble) Rathakr. & N.C. Nair, *Tabernaemontana gamblei* Subram. & A.N. Henry, *Thottea barberi* (Gamble) Ding Hou, *Xanthophyllum manickamii* Murugan, etc.

As part of the studies on Keratinolytic Properties of Actinomycetes, a *Streptomyces* strain S13A5 isolated

from soil was found to possess good keratinolytic activity and was able to utilize feather as sole carbon and nitrogen source. The strain could be placed under griseus series as its 16S rDNA sequence showed 99% similarity with *S. griseus* and *S. flavofungini*. Maximal proteolytic activity was observed at pH 10.5 and at 30°C with 0.25% feather as substrate on 5th day after inoculation under submerged fermentation. Enhanced protease production could be achieved with sodium nitrate (0.24%), magnesium sulphate (0.03%) and feather (0.8%). Protease production was the highest on 7th day after inoculation with solid state fermentation. Inhibitor studies indicated the presence of serine and metalloproteases in the culture supernatant. Proteolytic activity was stable over a wide range of temperature (20-60°C) and pH (7-11). The inability of the extracellular proteases to effect complete degradation of feather in the absence of reducing agents like å-mercaptoethanol suggested the involvement of additional mechanism for disulfide reduction innate of microbial cells. The proteolytic pattern obtained with gelatin zymogram showed the presence of four or more proteases in the culture filtrate. It could be summarized that this keratinolytic *Streptomyces* sp. S13A5 could very well be utilized for degradation of keratinous waste like feather to produce industrially valuable peptides and aminoacids. Also this strain was able to produce different proteolytic enzymes under both submerged and solid state fermentation. Significant increase in production of proteolytic enzymes and thus improved keratin degradation was achieved with changes in nutritional conditions. Its functioning at a wide range of alkaline pH makes it a better source for alkaline proteases potent for application in processes with extreme pH like that of leather processing and detergent applications.



Chitinolytic properties of actinomycetes

Chitinolytic properties of 50 strains of Actinomycetes isolated from soil of sacred groves of south Kerala were screened and 10 prominent strains were identified. The protein collected from all strains in colloidal chitin broth was also screened for the chitinase activity. The precipitated protein showed chitinase property confirming exracellular production of chitinase production. Using the crude protein and the strain itself was subjected to antifungal analysis. Most of the strains showed antifungal property due to chitinase produced by the strains. Chitinase production of two strains was studied in detail. The production of enzyme was maximum on 4th day. These 2 strains are producing maximum enzyme in alkaline pH 8 and both the strains can tolerate wide range of pH conditions from 3-12. Morphology and taxonomy were done using the ISP agar media. These two strains were tentatively identified as

C.K. Prakeep

Leucocoprinus bresadolae (Schulzer) Moser

C.K. Prakeep

Leucocoprinus sp. nov.

C.K. Pradeep

Filoboletus manipularis (Berk.) Singer

Streptomycetes species. Due to their ability to use different types of chitin substrates including shrimp chitin crab shell chitin, colloidal chitin and fungal cell wall chitin they have large potential application in industries and in phytopathological application as antifungal agents.

A culture collection of Actinomycetes (120 Nos.), Aspergillus (61 Nos.) etc are maintained in the lab in addition to the strains used for antifungal and antibacterial screening. Regular monitoring, periodic sub-culturing and enrichment of cultures are in progress.

Under the programme Survey, Inventory and Evaluation of mushrooms of the Western Ghats of Kerala 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 Achenkovil, Aryankavu, Kallar, Kulathupuzha, Shendurney, Thenmala, Wayanad and the Iringole sacred grove. The collections were systematically analyzed and identified following standard taxonomic methods. Based on the studies four research papers were finalized for publication. The details are given below.

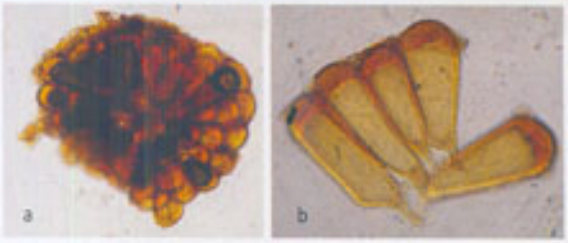
Total collections made during the period	:	645
Collections identified to genera	:	645
Families represented	:	18
Genera represented	:	58
Total collections identified to species	:	303
No. of species obtained	:	213
New records for India	:	06 spp. and 2 varieties
New species recognized	:	04
Wild edible species collected	:	12
Toxic species identified	:	13
Bioluminescent	:	03
Total accessions maintained in the mushroom herbarium	:	10918

MICROFUNGI AND LICHENS

In connection with the survey of Microfungal flora of the Western Ghats, extensive field collection trips were made to different forest areas in Kerala, *viz.* Silent Valley National Park, Aralam Wild Life Sanctuary, Irutti, Kannur, Wyanad, Neriyamangalam, Idukki, Nilakal, Ponthenpuzha Reserve Forest, Athirappally, Vazhachal, Malakkappara forests, Udumban chola, Neryamangalam, Adimali, Munnar, Alapuzha, Kuttikkanam, Moozhiyar, Sabarimala Forests, Pathanamthitta, Peppara and Neyyar Wildlife Sanctuary, Bonacaud, Ponmudi, Kallar, Palode, Peringammala, Nanniyode, Vithura, Meenmutty and Braemore. The team made 576 collections and identified 425 taxa. Of them, 7 species were found new to science. All these collections are deposited at TBGT and part of them are in Herbarium Cryptogamae Indiae Orientalis (HCIO), IARI, New Delhi.

Vanilla plantations located in Kollam, Thiruvananthapuram and Pathanamthitta districts were visited. Stem rot and leaf rot diseases were found in some plantations of Pathanamthitta Dist. It is noticed that disease outbreak begins during or just after the rainy season. Plantations with poor drainage were also found infected. Diseases are spreading mainly through the planting clones.

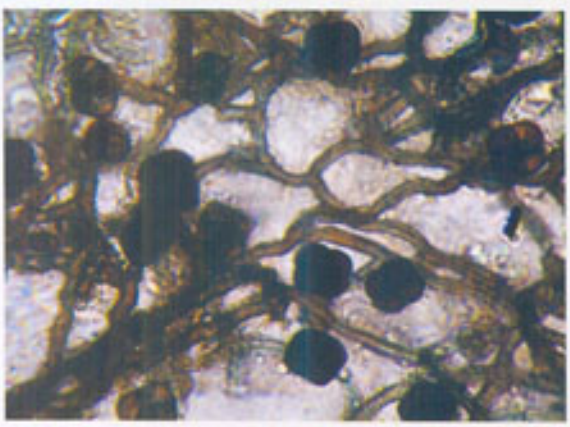
Sampling spots for Endomycorrhizal studies were selected from each forest division in Silent Valley National park, namely, grass lands, evergreen forests and shola forests. Dominant plants were noted in the experimental spots. Rhizosphere soil and root samples were collected from the individual spots. Spore count was detected by using wet sieving and decanting method. Healthy spores were collected from the decanted suspension and the spores were separated mechanically. The spores which appear alike were inoculated into separate pots filled with potting mixture. Spores were mass multiplied by using host plants, viz., *Sorghum*, Maize, *Crotalaria* and *Desmodium*. Spores were re-isolated by wet sieving and decanting method after three months. Permanent slides of mycorrhizal fungi were prepared. The isolated spores were found belonging to the genera *Acaulospora, Gigaspora, Glomus* and *Scutellospora*. Fifty pots have been maintained as germplasm for AM fungi. Spore count showed a maximum range in evergreen forests and minimum in grassland but the shola showed a level in



Glomus taiwanesis (Wu & Chen) Almeida & Schenk
a. Sporocarp showing the spores in a ball;
b. Spores with hyphal attachment

between. Spore frequency is maximum in rainy season and minimum in summer season. AM fungi root colonization is more in evergreen forests than in grasslands.

A degree of AM fungal association with five medicinal plants in the Western Ghats part of Kerala has been worked out. In *Janakia arayalpathra,* number of AM spores varied from 38-300 spores/100g of soil. The highest spore count was found from November to March and the lowest count from June-August. In *Holostemma ada-kodien,* maximum spore count was found in January and minimum in July. In *Heracleum condolleanum,* maximum spore count occurred in November and December and minimum in June. In *Celastrus paniculatus,* maximum spore count was recorded from December to February and minimum in June. In *Nothopodytes nimmoniana,* maximum spore count was seen during March and minimum from June to August.



The genus *Sarcinella*

stem rot disease of *Vanilla*

The survey and exploration of lichens resulted in collecting 1600 specimens. Of them, 900 were identified. Critical study revealed that there were 140 macro lichens and 100 micro lichens. Materials are deposited at TBGT and part of them in National Botanical Research Institute (NBRI), Lucknow under LWG.

LIBRARY

During the period from 2007 to 2008 library subscribed to 100 journals (foreign and Indian) and purchased 192 books. Books were accessioned, classified and catalogued. Database was updated. Journals were registered and added to the journal database. Based on request from scientists, photocopies of articles were procured and provided. Back volumes of journals were bound, accessioned and shelved.

Total books	8387
Journals subscribed	100
Reports added	22
Reprints added	8
Back volumes added	164

Services provided

- Indexing
- Selective dissimination of information
- Current awareness
- Conference alert
- Newspaper clippings
- Photocopying
- Internet services

PLANT NOVELTIES

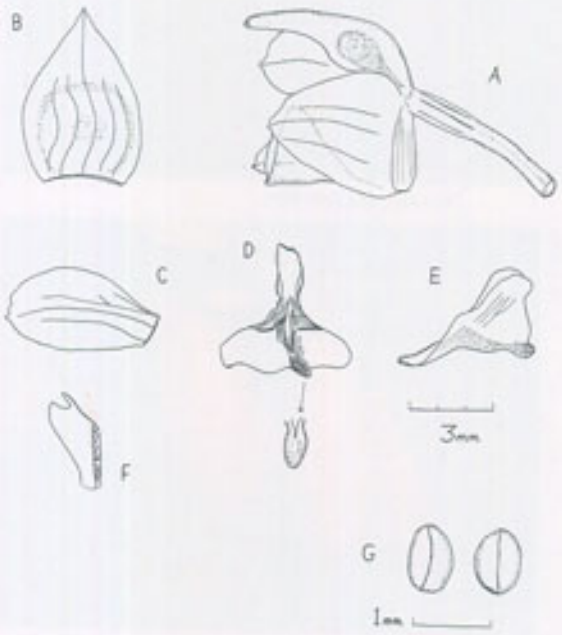
Our Scientists described one new genus *Sivadasania* and three new species during this period:

***Sivadasania* Mohanan & Pimenov (Apiaceae) 2007**

This new genus was erected based on *Peucedanum josephianum* Chowdhery & Wadhwa reported from Agastyamala, Western Ghats.

***Dendrobium hkinhumense* Ormerod & Sathish (2008)**

This is a new species described based on a collection by Kingdon-Ward (21198, BM) made on 21st July 1953 from North Triangle (Hkinhum), at 1370 m Myanmar.



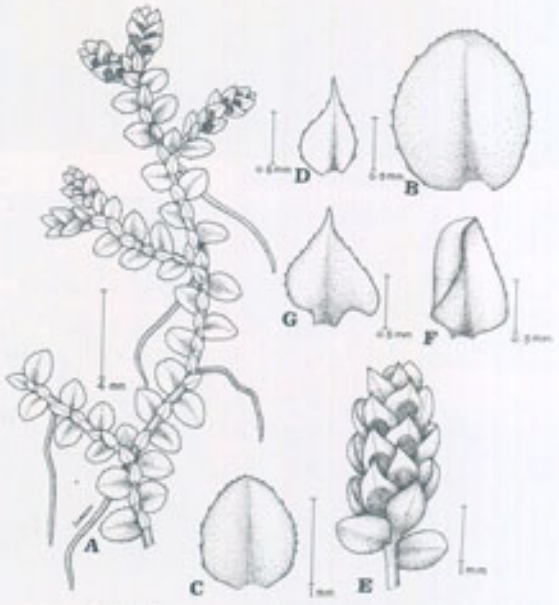
Dendrobium hkinhumense Ormerod & Sathish

***Gastrodia silentvalleyana* Sathish, Sibi & Suresh (2008)**

This new species is a saprophytic orchid discovered from Silent Valley National Park, Palakkad district, Kerala at 1040 m. It was seen on a thick layer of litter under the heavy shade of the endemic tree cassine kedarnathii Sasi & Swarup

***Selaginella agastyamalayana* Raju Antony, A.E. Shanavaskhan & G. Sreekandan Nair (2007)**

Described based on a collection by Raju Antony from Agastyamala at 1750 m. This species is allied to *S. miniatospora* (Dalz.) Bak.



Selaginella agastyamalayana Raju, Khan & Nair

PLANTS IN BLOOM

Among the many introductions that flowered at TBGRI the following are the prominent ones

Curcuma alismatifolia

Very popular in Asia and Europe this Thai species yields beautiful cut flower and is much sought after in commercial circles. We got a few rhizomes from Queen Sirikit Botanic Garden, Thailand and has flowered for the first time here attracting many visitors. It has deep purple-violet flowers and large purplish-pale or violet bracts and coma. Found only in the open, deciduous forests in the lowlands of Central Thailand and Cambodia, this species has become very popular with several cultivated clones giving its a popular name Siamese Tulip. It is well suited in Indian conditions and can be a promising flori culture crop.

Our collection of carnivorous plants was enriched with the introduction of several species of Nepenthes,Sarracenia, Drosera, etc. Nepenthes rafflesiana seedlings in flask generously gifted by Mr. K. Natarajan (Natural Synergy, Chennai) flowered this year attracting many a visitor. The Thai species, N. mirabilis which suffered a set back last year, recouped and grown to full size.

Curcuma pauciflora

One of the commonest species of Thailand and this is widely cultivated as a cut flower. Its green bracts, white coma and purple and white flowers are characteristic.

C. Sreeenivasan

Curcuma alismatifolia Gagnep.

C. Sreeenivasan

Curcuma parviflora Wall.

M. Sabeena

Nepenthes rafflesiana Jack. - inflorescence

M. Sabeena

Nepenthes mirabilis (Lour.) Druce

PLANTS OF ANDAMAN & NICOBAR ISLANDS

Plant Genetic Resources Division maintains a separate collection of plants of Andaman & Nicobar Islands. This work started before the tsunami of 2004 and has been enriching the garden with its unique flora. We set aside an area for conservation and display of plants from these islands. Most of the plants introduced here have completely adapted to the new home and are growing very well. We plan to complete the collection with all the endemics along with useful and interesting plants in future. Our present collection includes 116 species in 96 genera belonging to 57 families.

Sinu Kumar

Cycas zeylanica (J. Schust.) Lindstr. & K.D. Hill (Male plant)

Sinu Kumar

Cycas zeylanica (J. Schust.) Lindstr. & K.D. Hill (Female plant)

Sinu P. Mathew

Hornstedtia fenzlii (Kurz) K. Schum

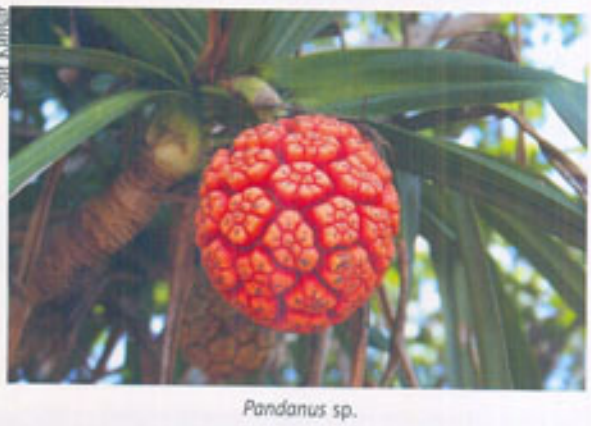
Sinu P. Mathew

Kortholsia rogersii Becc.

Sinu Kumar

Phoenix sp.

Sinu Kumar



Pandanus sp.

EXTENSION AND TRAINING ACTIVITIES

A project on cultivation of high value medicinal and aromatic plants raised through conventional and non conventional methods for empowerment of rural women in the selected localities of Kerala. It is a novel participatory programme for self income generation. The area selected for implementing the programme was the Kanjikuzhi Grama Panchayath in Alappuzha district. This was initially funded by DBT and then by TBRI. During the period the misting facility was installed in the mist chamber. The nursery work was entrusted to the selected five women beneficiaries and the planting work was started at the nursery site. Planting materials of the selected medicinal plants (*Plumbago rosea, Kaemferia galanga, Aloe vera* and *Asparagus racemosus)* were collected and propagated at TBGRI. They were then supplied for establishment in the nursery site at Kanzhikkuzhi. In addition micropropagated plants of *Holostemma annulare* established in the field were distributed to the selected women beneficiaries. As part of this project, local awareness classes on medicinal plant cultivation were conducted at Kanjikuzhi Panchayat and 80 new women beneficiaries were selected for the third year.

INTRA AND INTER INSTITUTIONAL COLLABORATIONS

Gujarat State Biotechnology Mission requested TBGRI to help in the development of a seed / genebank facility for the forest genetic resources of Gujarat to ensure conservation. Dr. P. N. Krishnan, Biotechnology Division and Dr. C. Anilkumar, Seed Bank visited Gandhinagar and discussed with the authorities. A draft MoU was prepared and this will be finalized when the sector specialist from GSBTM visit TBGRI.

Indian Institute of Bioresources and Sustainable Development, Imphal contacted the Bioinformatics Centre for collaboration in development of a software for the database initially for the Zingiberaceae. The Bioinformatics Centre of TBGRI would initiate the programme incorporating Dr Mathew Dan of TBGRI as the taxonomic expert for the Zingiberaceae. Consultation is in progress. This year DBT sponsored inter institutional collaborative project. "Studies on the antiviral properties of some medicinal plants" involving TBGRI (Dr A. Subramoniam, PI) and Sree Chitra Tirunal Institute of Medical Sciences and Technology (SCTIMST with Mrs Molly Antony as CO-PI) was successfully completed (Rs. 20 Lakhs).

NOTABLE ACHIEVEMENT

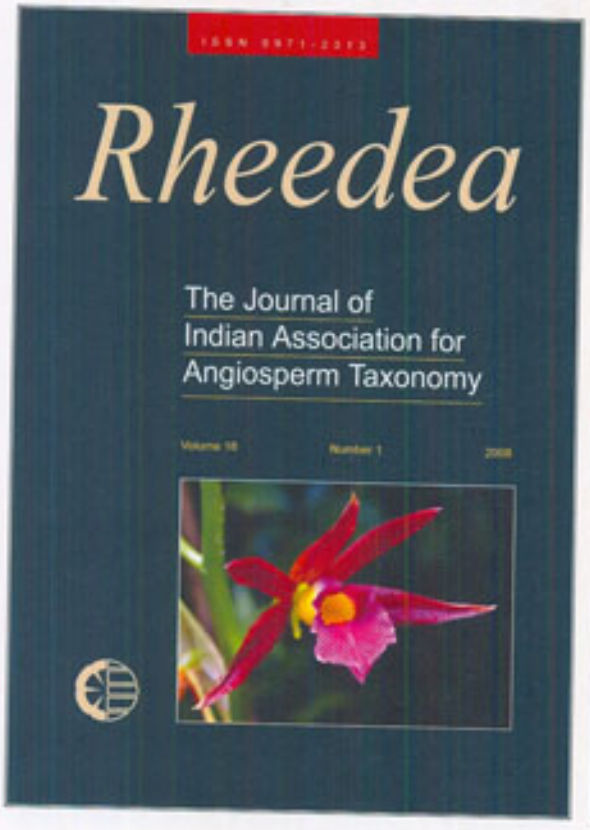
The Ministry of Environment and Forests, Govt. of India, in recognition of TBGRI's contribution in *ex situ* plant conservation has declared TBGRI as lead garden for the peninsular India to help various smaller gardens to achieve the Global Strategy for Plant Conservation (GSPC). Under this programme development of RET species park, conservatories for specialized groups of plants, public amenities, up gradation of herbarium, development of environmental education programmes etc are contemplated. This programme would help TBGRI to serve the present day needs of conservation education vis-à-vis the application centre CBD as well as in the context of the present WTO regime which encompasses conservation policy. The institute would receive financial assistance to the tune of 76.14 lakhs for the next 3 years to accomplish the above tasks.

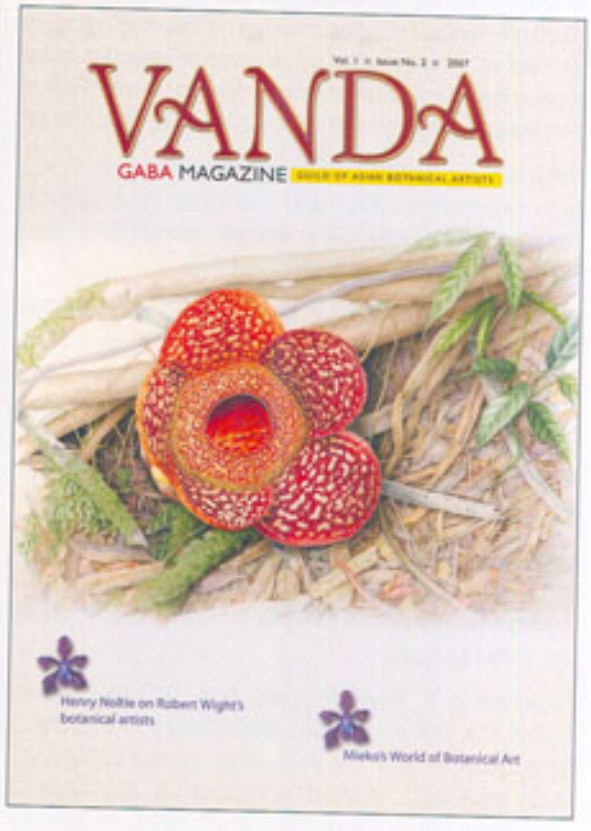
PATENT FILED

A novel oral rehydration agent for enhancement of water and electrolyte absorption in acute diarrhoea. (Inventors: A. Subramoniam, S. Ajikumaran Nair, V. P. Sandhya, S. Anilkumar, V. George, S. Rajasekharan and S. Ambili (2008)

PUBLICATIONS

Two international journals are published from TBGRI :





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   Journal of the Indian association for Angiosperm Taxonomy (IAAT), Calicut
   T.S. Nayar (Executive Editor)
   C. Sathish Kumar, K.C. Koshy (Assistant Editors)

2. ***Vanda Magazine***
   Published by Lalita Rochanakorn,
   Guild of Asian Botanical Artists (GABA),
   Based at Queen Sirikit Botanic Garden,
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   C. Sathish Kumar (Editor)

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Sabulal B, Dan M, John A J, Kurup R, Chandrika S P & George V 2007. Phenylbutanoid- rich rhizome oil of *Zingiber neesanum* from Western Ghats, southern India. *Flavour and Fragarnce Journal* **22**: 521-524.

Sabulal B, Dan M, Pradeep N S, Kurup S R and George V 2007. Chemical composition and antibacterial activity of the volatile oils from the rhizomes and leaves of *Ammomum hypoleucum* Thwaites. *J. Essent. Oil Res.* **19**: 279-281.

Sabulal B, George V, Pradeep N S, Dan M 2008. Volatile oils from the root, stem and leaves of Schefflera *stellata* (Gaertn.) Harms (Araliaceae): Chemical characterization and antimicrobial activity. *J. Essent. Oil. Res.* **20**: 79 –82.

Sabulal B, Kurup S R, Sumitha B and George V 2007. Chemical composition of the leaf oils of *Myristica malabarica* Lam. and *Gymnacrathera canarica* (King) Warb. *J. Essent. Oil. Res.* **19**: 323-325.

Shareef S M and Sam P Mathew 2007: Edible wild relatives of Indo- Malesian fruit trees endemic to the Western Ghats of the Peninsular India. *J. Non-Timber Forest products* **14** (1): 57-62.

Shareef S M, Kalesh K S, Mohandas A and G M Nair 2007. Germplasm conservation of edible fruit plants of the Myrtaceae through field gene bank. *J. Econ. Taxon. Bot.* **1** (31): 398-401.

Shine V J, Shyamal S, Latha P G and S R Suja 2007. Gastric Antisecretory and antiulcer activity of *Decalepis arayalpathra*. *Pharmaceutical Biology* **45**: 210-216.

Sreedevi S, Krishnan P N and Pushpangadan P 2008. Cadmium induced oxidative damage and antioxidant responses in roots of Black gram [*Vigna mungo* (L.) Hepper]. *Indian J Plant Physiology* **13**(1):1-7.

Sreekala A K, Rama Subbu R, Kulloli S K and Pandurangan A G 2007. Pollination Biology of *Impatiens henslowiana* Arn. (Balsaminaceae). *Ind.J.Bot.Res.* **3**(1): 165-171.

Sreekumar S, Biju C K, Hari Sankar G and Krishnan P N 2007. LitFriend: A Software package for personalized management of bibliographic information and its citation. *Curr. Sci.* **93**(4): 456-458.

Sreelekshmi R, Latha P G, Arafat M M, Shyamal S, Shine V J, Anuja G I, Suja S R and Rajasekharan S 2007. Anti-inflammatory, analgesic and anti-lipid peroxidation studies on stem bark of *Ficus religiosa* Linn. *Natural Products Radiance* **6**(5): 337-381.

Subhisha S and Subramoniam A 2007. Promising anti-fungal activities of *Hyophila involuta*, a moss. *Biomedicine* **27**: 117-122

Subramoniam A, Madhavachandran V, Ravi K and Anuja V S 2007. Aphrodisiac property of the elephant creeper *Argyreia nervosa*. *Journal of Endocrinology and Reproduction* **11**: 28-31.

POPULAR ARTICLES /MEDIA INTERACTIONS

Rajasekharan S & Latha P G 2008. "Ethnomedicine and Lead-based Product Development, Technology Transfer and Benefit Sharing". Published in the Souvenir released in connection with an International Seminar, Organized by Kerala Agricultural University, Thrissur.

C. Sathish Kumar 2008. *Ennum Poovidum Ormakal* - Vanda Usha named after Mrs K.R. Narayanan blooms in Singapore. *Malayalam Manorama* (*Sree*: Sunday Magazine, 10 February): 12-13.

C. Sathish Kumar 2008. An Introduction to biodiversity. *Aksharakairali* **5**(12): 22-25.

Rajasekharan S gave an interview (30 min) on 'Thulasi- an Important Medicinal Plant" in the *Farm and House* programme of All India Radio, Thiruvananthapuram on 11th June 2007.

Rajasekharan S gave an interview (30 min) on "Popularization of cultivation of Medicinal plants and income generation. Under the serial programme "Nammude Thottam Nadinte Nettam" Jointly Sponsored by Kerala State Horticulture Missio and AIR –in the *Farm and House* programme of All India Radio, Thiruvananthapuram on 11th January 2008.

Rajasekharan S gave an interview (30 min) on "Cultivation and Utilization of Medicinal Plants" under the serial programme "Pacha" (Green) sponsored by Kerala Agricultural University, Telecast by Kairali TV on 2nd October 2007.

Rajasekharan S gave an interview (30 min) on "Medicinal plants for primary Health Care" under the serial programme "Pacha" (Green) sponsored by Kerala Agricultural University, Telecast by Kairali TV on 8th November 2007.

SEMINAR/CONFERENCES / WORKSHOP/TRAINING COURSES ORGANIZED

- National Technology Day Celebrations at TBGRI, on 11th May 2007.
- National workshop on "Biodiversity Database Organization and its Management" for senior scientists, professors and college lectures, from 16th to 20th July, 2007.
- A one day training programme on conservation and utilization of medicinal plants, organized for rural people on 6th July 2007. 250 saplings of ten medicinal plant species were distributed to the trainees, as part of popularizing herbals in homeyards.
- Practical training for the preparation of home remedies under the 'Herbs for All and Health for All' programme at Malappandaram tribal settlement, Achancoil, Kollam on 22-23rd October 2007.
- 'Udyana sangamam' (a participatory programme) for School students, at TBGRI on 6th November 2007.
- Special interactive session for the Traditional Knowledge holders/providers at Mangalpadi Gramapanchayath Kasaragod District on 1st December 2007; Meencha Gramapanchayath Kasaragod District on 2nd December 2007; Vorkadi Gramapanchayath Kasaragod District on 4th December 2007 and Manjeswarm Gramapanchayath Kasaragod District on 4th December 2007.
- Brainstorming Workshop on *Hortus Malabaricus* based CCHP project at Chaliyam near Calicut

  Upon the request of the state Forest Department, TBGRI undertook the task of conducting a national level brainstorming workshop at Calicut on 7 December 2007 with experts from different parts of India to pool their ideas for the establishment of a Centre for Conservation of Heritage Plants (CCHP) at Chaliyam. The workshop was inaugurated by Shri Benoy Viswom, honourable Minister for Forests and Housing who informed his chance meeting with the Dutch ambassador-designate at New Delhi and his sure support for *Hortus Malabaricus* based conservation Centre. Representatives of the area also stressed the need to develop the Centre. Dr M. Sanjappa, Director of Botanical Survey of India, Kolkata who visited Chaliyam along with other members spoke on the new initiative and lauded the efforts. Dr M. K. Janardhanam, Professor, Goa University, Dr D. Narasimhan of Madras Christian College, Dr K. R. Shasidharan, IFGTB, Coimbatore, Dr N. Sasidharan, KFRI, Peechi, Dr M. Sivadasan, Dr M. Sabu and Dr A K Pradeep, Calicut University and scientists of TBGRI, Dr S. Ganeshan, Dr T S Nayar, Dr P J Mathew, Dr K C Koshy, Dr C. Sathish Kumar and others also spoke on the occasion.

Shri Benoy Viswom, Hon. Minister for Forests & Housing inaugurated the workshop

Dr. M. Sanjappa, Director, Botanical Survey of India spoke on *Hortus Malabaricus*

- Organized Science Day Celebration at TBGRI, 28th February, 2008

- National workshop on "Biodiversity Database Organization and Management" for senior scientists, professors and college lecturers, from 12th to 14th March, 2008.
- Training programme for M.Sc. Phytomedical Technology students of Mar Athanasius College, Kothamangalam conducted from 11-13th April 2008.

Brainstorming Workshop at Calicut

Dr T. S. Nayar

Dr P. J. Mathew

Dr D. Narasimhan

Dr M. Sabu

Proposed site of CCHP at Chaliyam

Experts at Chaliyam

Dr S. Rajasekharan conducts an interaction meeting with Traditional Knowledge holders

PARTICIPATION IN SEMINARS, SYMPOSIA/CONFERENCES/WORKSHOPS

Anil John J, George V, Sethuraman M G and Pradeep N S 2007. Composition and antibacterial activity of leaf oils of four *Neolitsea* species from Kerala: a Comparative Study. Paper presented in the 28th Annual Conference of Indian Association of Biomedical Scientists, Bharathidasan University, Tiruchirappalli.

Anil Kumar C 2007. Participated in the Second Annual Meet of the Indian Botanical Society on November 2, at Department of Botany, University of Kerala.

Anil Kumar C 2007. Participated in the workshop on Intellectual Property Rights for public R&D Labs under EU–India Trade and Investment Development Programme at Regional Research Laboratory (CSIR) Trivandrum.

Anuja G I, Rajasekharan S, Anti-inflammatory and analgesic properties of *Drynaria quercifolia* (Linn) J. Smith., a medicinal pteridophyte of traditional importance. pp 616- 618.

Biju C K 2007. "Biodiversity database organization in MS access". Paper prewsented at Rural Agricultural work experience programme organized by Kerala Agricultural University, College of Agriculture, Padanakkad, 6th September.

Biju H 2007. Attended training programme on identification of Lichens at NBRI, Lucknow, April 10- May13.

Biju H 2008. Attended Workshop on "Lichen Diversity, Significance and Taxonomy", at KFRI, Peechi, Jan.10-11.

Deepa S, Pradeep C K and Vrinda K B 2007. 'Ectomycorrhizal fungi in Eucalyptus plantations in southern Kerala'.

George V 2007. Standardisation of Single and Compound Drugs. Paper presented at National Seminar on Drvya Guna. Pankaja Kasturi Ayurveda Medical College, Thiruvananthapuram, Dec. 15-17.

George V and Anil John J 2007. *Saraca asoca* - an excellent Biosynthesiser of Phytochemicals. Paper presented at National Seminar on Conservtion, Cultivation and Sustainable Utilisation of *Saraca asoca*. Kerala Forest Research Institute, Peechi, October 16-17.

Gopan Raj, Pradeep N S, George V, and Sethuraman M G 2007. Chemical composition and antimicrobial activity of essential oils from two *Syzygium* species. Paper presented at 28th Annual Conference of Indian Association of Biomedical Scientists, Bharathidasan University, Tiruchirappalli.

Hosagoudar V B 2007. "Fungi and Forests". Keynote address delivered on in the National Seminar on "Forests and Microbial Diversity". Mangalore University, Post Graduate Department of Microbiology, Field Marshal Kariappa College, Madikeri, Karnataka, Dec. 29.

Hosagoudar V B 2008. Fungal Diversity with reference to Meliolales" invited lecture delivered at P.G. Department Studies in Botany, Karnataka University, Dharwad, February.

Hosagoudar V B and Archana G R 2007. 'Collection, Identification and Documentation of Meliolaceous fungi'. Paper presented at the Second Asian Congress of Mycology and plant pathology, organized by Indian Society of Mycology and Plant Pathology, Osmania University, Hyderabad, Dec.19-22.

Hosagoudar V B and Archana G R 2007. 'Identification Manual of Meliolales'. Paper presented at the Second Asian Congress of Mycology and plant pathology, organized by Indian Society of Mycology and Plant pathology, Osmania University, Hyderabad, Dec.19-22.

Hosagoudar V B, Jacob Thomas and Robin P J 2007. 'Additions to foliicolous fungi of Shillong, Meghalaya'. Paper presented at the Second Asian Congress of Mycology and plant pathology, organized by Indian Society of Mycology and Plant Pathology, Osmania University, Hyderabad, Dec.19-22.

Indhuja S, Shiburaj S, Pradeep N S and Abraham T K 2007. 'Studies on keratinolytic activity of a *Streptomyces* sp. S13A5 and the extracellular proteases associated with feather degradation'. Paper presented at the International Symposium on New Horizons in Biotechnology, Organised by BRSI & NIIST, Trivandrum.

Jayan T S, V K Sasikumar and S Rajasekharan 2008. "Comprehensive Study of Chikungunya Fever and its Management with Ayurvedic Medicines - with Special Reference to Preventive Aspects and Action Plan" Compandium on the special theme, 20th Kerala Science Congress, pp.152-164.

Koshy K C 2007. Attended the Seminar on "Biodiversity –Major Challenges for Conservation and Sustainable Utilization" held in connection with the International Biological Diversity Day Celebrations at Science and Technology Museum, Thiruvananthapuram.

Koshy K C 2007. Attended the WGDP Review and Evaluation of R& D Projects held at Institution of Engineers (India) Hall, Thiruvananthapuram and presented presented a Consolidated Report of the Project titled Bamboo and Reed Resource Enhancement in Kerala.

Koshy K C 2008. Attended the "WGDP State level seminar on Watershed Management" at Science and Technology Museum,Thiruvananthapuram.

Krishnan P N 2007. Attended review meeting of Bioinformatics centers at DBT, New Delhi.

Krishnan P N 2007. Role of Bioinformatics on Biodiversity'conservation, lecture presented at IBS Thiruvanathapuram Chapter, November.

Krishnan P N 2007. Role of Bioinformatics on management of Biodiversity',Invited lecture presented at Academic Staff College. Kerala University, Thiruvananthapuram, June 25.

Krishnan P N 2007. Role of Bioinformatics on management of Biodiversity. Invited lecture presented at J J College of Arts and Science, Puthukottai, Tamilnadu, January 25, 2007.

Krishnan P N 2008. Bioinformatics- an Introduction. Lecture delivered at St Peter's College, Kolencherry, January 1st.

Krishnan P N 2008. Visited Gujarat State Biotechnology Mission, Gandhinagar for discussionon establishing a Seed/Gene bank for Gujarat state, February.

Krishnan P N and Sreekumar S 2008. Attended the BTIS Net Coordinators meet at CSRTI, Mysoore on 4th and 5th February.

Latha P G 2007. "Medicinal Properties and Pharmacology of *Saraca asoca*" Invited talk at National Seminar on Conservation, Cultivation and sustainable utilization of *Saraca asoca*, organized by KFRI during 16-17th October.

Latha P G 2007. Glimpses of Ethnopharmacology at TBGRI. Invited lecture presented at SN College, Chempazhanthi, Thiruvananthapuram in October.

Latha P G 2008. Ethnopharmacological techniques" Lecture Presented for M.Sc, Phytomedical Technology Students of Mar Athanasius College, Thiruvalla, MG University, 13th April.

Mathew Dan 2007. Medicinal Plant Taxonomy. Invited talk delivered in National seminar on Dravyaguna Vijnana held at Pankajakasthuri Aurveda Medical College, Thiruvananthapuram.

Mathew Dan 2008. Biodiversity Conservation. Invited talk delivered in a Seminar organized by Govt. higher Secondary School for Girls, Malayinkeezhu, Thiruvananthapuram.

Mohanan N 2007. Biodiversity and sustainable Utilisation. Invited talk presented at Golden Jubilee Celebration of Sacred Heart College, Thevara, Ernakulam in November.

Mohanan N 2007. Plant Taxonomy. Invited lecture presented at SN College, Chempazhanthi, Thiruvananthapuram in October.

Mukunthakumar S 2007. Attended training in "Molecular characterization and diagnostics techniques for plant viral and fungal pathogens" at NRC Banana, Tiruchirapalli, Tamil Nadu.

Mukunthakumar S, Praveen G, Krishnan P N and Seeni S 2007. Banana and plantain - Status of conservation at TBGRI. Paper presented in National Conference on Banana, pp. 31. NRC Banana, Tiruchirappalli, Tamil Nadu.

Muraleedharan Unnithan 2008. Attended Preparatory Workshop on *Hortus Malabaricus* organized by Regional Museum of Natural History, Mysore at Cochin, in March.

Navas M, Mathew Dan, Ushakumari J and Rajasekharan S 2007. Anatomical studies on the medicinal plant *Hygrophila auriculata*. Paper presented in the UGC National Seminar on Recent Advances in Medicinal Plant Research organised by Department of Botany, Annamalai University, Abstracts p:96

Nayar T S 2007. Botany of Blue and Green in Ancient Art Forms of Kerala. Paper presented at The Culture of Indigo: Exploring the Asian Panorama – Aspects of Plant, Product and Power. India International Centre, New Delhi, 29 November - 1 December.

Nayar T S 2007. Co-chaired a session at National Conference on Wetlands, Science and Society – An

Assessment of their Integration. INSA, New Delhi in December.

Nayar T S 2008. Plant – Crab Interaction in Mangrove Ecosystem with A Case Study from Kerala. Paper presented the at IUCN and MFF Workshop on 'Conservation and Management of Mangrove Ecosystems in India at GEER, Ahmedabad, in February.

Padmesh P, Reji J V, Purushothama M G and Seeni S 2007. Isolation and characterization of Polyketide Synthase (PKS) genes involved in hypericin biosynthesis from *Hypericum hookerianum*. Paper presented in the 4th Asia Pacific Conference on Plant Tissue Culture and Agribiotechnology held at Kuala Lumpur, Malaysia in June.

Pandurangan A G 2007. 'Global warming and its impacts'. Paper presented during the workshop on Global warming organized by Kerala Forest and Wildlife department in Thiruvananthapuram.

Pandurangan A G 2008. 'Convention on Biological diversity and issued on IPR' Paper presented at the orientation course for Govt. College Teachers of Bharathiyar University in Coimbatore, Tamil Nadu.

Pandurangan A G 2008. 'Emerging trends in biodiversity conservation'. Paper presented at the orientation course for Govt. College Teachers of Bharathiyar University in Coimbatore, Tamil Nadu.

Pandurangan A G 2008. Present scenario on Biodiversity, Biotechnology and Environmental Management. Special lecture delivered during the National seminar organised by J J College of Arts and Science, Pudukottai, Tamil Nadu .

Pradeep C K and Vrinda K B 2007. Ectomycorrhizal fungal diversity of three different forest types of Kerala. Paper presented at the National Symposium on Microbial Diversity and Plant Health, organized by the Indian Mycological Society, Kalyani, West Bengal.

Pradeep N S, Renju Krishna V and Shiburaj S 2007. 'Genetic similarity among environmental isolates of *Aspergillus* sp. Paper presented at the National Symposium on Microbial Diversity and Plant Health' organised by Indian Mycological Society, Calcutta, at BCKV, Kalyani, West Bengal.

Pradeep S, Latha P G, Suja S R 2008. Antidiabetic activity of *Pilea microphylla* in alloxan induced diabetic rats. Paper presentd at the 20th Kerala Science Congress, Thiruvananthapuram, pp 613 – 615.

Praveen G, Mukunthakumar S, Anandhu M D and Seeni S 2007. Flow cytometry- An ideal cytogenetic tool for rapid genome analysis in *Musa* (Banana). Paper presented in National Seminar on Environmental Sustainability of Western Ghats of India. pp: 13-14. NMCC, Tamil Nadu.

Praveen G, Mukunthakumar S, Krishnan P N and Seeni S 2007. Induced variation studies in two diploid south Indian cultivars of *Musa*. Paper presented in National Conference on Banana. pp. 72. at NRCBanana, Tiruchirappalli, Tamil Nadu.

Praveen V P 2008. Predatory effect of the crab *Neosarmatium smithi* on *Avicennia officinalis* seedlings. Poster presented the at National Workshop on Mangroves in India: Biodiversity, Protection and Environmental Sciences at IWST, Bangalore in February.

Rajasekharan S 2007. Attended as Expert in WHO Guidelines Workshop on Panchakarma, organized by CCRAS/Department of Ayush New Delhi, at Kottakal, Malappuram on 4th September.

Rajasekharan, S 2007. Systematic Documentation of Traditional Knowledge Related to Plants Used for Food and Medicine. Invited talk presented in connection with World Local Knowledge Day Celebrations, Organized at Govt. Ayurveda College, Thiruvananthapuram on 22nd August.

Rajasekharan, S 2007. Asoka (*Saraca asoca*) in classical (Ayurveda) and Oral Health Tradition. Invited talk presented in National Seminar on Conservation, Cultivation and Sustainable Utilization of *Saraca asoca*, organized by KFRI on 17th October.

Rajasekharan, S 2007. Attended as expert member in National seminar on Revitalizing Agro-biotechnology for Alleviating Poverty and Hunger, Organized by MS Swaminathan Foundation, Kalpeta, Wayanad during 24-25 November.

Rajasekharan, S 2007. Conservation and sustainable Utilization of Medicinal Plants. Invited talk presented in Seminar on Conservation and Sustainable Utilization of Plant Diversity, Organized by TBGRI at Malila Gramapanchayath, Kollam on 14th December.

Rajasekharan, S 2007. Conservation and sustainable use of Medicinal and Aromatic Plants. Invited talk presented at Seminar organized in connection with 50th Anniversary function of Forest Department, at Thiruvananthapuram on 25th April.

Rajasekharan, S 2007. Traditional Knowledge Associated with biodiversity –Access and Benefit Sharing. Presented invited talk in National Biodiversity Authority Consultation Workshop on Agro-biodiversity Hot Spot: Access and benefit Sharing, organized by National Biodiversity Authority at Annamalai University, Tamil Nadu, during 19-20 July.

Rajasekharan, S 2007. Traditional Knowledge associated with biodiversity and case study on benefit sharing" Invited talk presented at National Training Programme for IFS officials, at KFRI, Peechi, Thrissur on 10th August.

Rajasekharan, S 2007. Traditional knowledge. Key note address presented in Seminar and Training programme jointly organized by National Innovation Foundation and Peerumedu Development Society at Peerumedu, Idukki during 19-20 May.

Rajasekharan, S 2008. Ayurveda and Hortus Malabaricus Invited talk presented at Environment Development Centre, CRMNHD, Ernakulam Organized by CRMNHD in collaboration with IROM-NATHIST International Council of Museum's Committee for Collections and Museum's of National History, in 15th March.

Rajasekharan, S 2008. Research and Finance. Invited talk presented in National Seminar on IPR Knowledge Commons Towards a Policy for Kerala, at Thiruvananthapuram in 21st February organised by State Planning Board.

Rajasekharan, S 2008. Traditional Knowledge and Drug Development. Invited lecture for M.Sc, Phytomedical Technology Students of Mar Athanasius College, Thiruvalla on 13th April.

Rajasekharan, S 2008. "Geographical Indications and Traditional Knowledge" Invited talk presented in Seminar on IPR, at Mannam Memorial NSS College, Kottiyam, Kollam during 17-18 March.

Rajasekharan, S 2008. Traditional Knowledge Associated Biodiversity with special reference to Ethnomedicine. Presented invited lecture at National Conference on Cultivation, Processing and Bio-prospecting of Ethnomedicine held at Shri Parasakthi College for Women Courttallam, Tamil Nadu during 24-26 March.

Rajasekharan, S, George V, Navas M & Mathew Dan 2007. Forest wealth for people's welfare-pilot participatory programme on conservation and sustainable utilization of medicinal and aromatic plants- a case study. Paper presented at the one day seminar to Commemorate 50 Years of first Kerala Government, held at Kanakakkunnu Palace, Thiruvananthapuram, on 25th April.

Rajkumar, G 2008. Attended a short term training programme on 'Environmetal Impact Assessment of water resources projects' conducted by CWRDM, Kozhikkode.

Rama Subbu R, Kulloli S K, Sreekala A K and Pandurangan A G 2008. Reproductive biology of *Impatiens platyadena* Fischer (Balsaminaceae) - a critically endangerd balsam of Western Ghats. Paper presented in seminar rganized by J.J. College of Arts and Science, Pudukkottai, Tamil Nadu.

Rameshkumar K B and George V 2007. Phytochemical investigation of *Garcinia imberti* - a Western Ghats Endemic Species. Paper presented at XVII Swadeshi Science Congress, Guruvayurappan College, Calicut.

Rameshkumar K B, Mathew P J and George V 2007. Discovery of a potential genotype of 'black pepper' (*Piper nigrum* L. 'PMM') from the Western Ghats. Paper presented in the 20th Kerala Science Congress, Thiruvananthaapuram.

Sathish Kumar C 2007. Pollination in *Paphiopedilum druryi* (Beddome)Stein (Orchidaceae). Invited lecture presented in the 3rd International Symposium on Conservation and Diversity of Asian Orchids at Tsukuba Botanical Garden, Japan during 15-16 December.

Sathish Kumar C 2008. *Biodiversity of Indian Orchids.* Invited lecture presented at SVRNSS College, Vazhoor, Kottayam, February.

Sathish Kumar C 2008. *Orchid Breeding in India.* Lecture delivered at TOSI Seminar, 10-12 April, Bangalore.

Seeni S 2007. Biosafety concerns in tissue culture industry. Invited talk presented during the National level training workshop on Biosafty regulatory Framework: Assessment decision, implications and public-private interface held at Centre for Biodiversity and Forest Studies, Madurai Kamaraj University, Tamil Nadu in September.

Seeni S 2007. *In vitro* conservation and sustainable utilization of medicinal plants. Invited lecture presented at J.S.S. College of Arts and Science, Pudukottai, Tamil Nadu in November.

Seeni S 2007. Presented the progress report of the species recovery project at the DBT group monitoring Workshop held at Anamalai University, Tamil Nadu in December.

Seeni S 2008. Process and herbal product development through biotechnological means. Paper presented during the National Conference on cultivation, processing and bioprospecting of medicinal plants, at Parasakthi College for Women, Courtallam, Tamil Nadu in March.

Shanij K 2008. 'A study on the Density of two mangrove Crabs: *Neosarmatium smithi* and *Parasesarma plicatum* (Crustacea; Decapoda; Grapsidae) in the Mangrove Forests at Kunhimangalam, Kerala'. Poster presented the at National Workshop on Mangroves in India: Biodiversity, Protection and Environmental Sciences at IWST, Bangalore in February.

Shine V J, Latha P G, Shyamal S 2008. Hepatoprotective Effects of *Cyclea peltata* (Poir.) Hook. F. & Thoms., in alcohol intoxicated rats. Paper presented at 20th Kerala Science Congress Thiruvananthapuram, pp 628 – 630.

Shyamal S, Latha P G, Shine V J. Hepatotoprotective Studies of *Ixora coccinea* on aflatoxin - induced liver damage in Wistar Rats. 20 th Kerala Science Congress 29 -31, January 2008, Trivandrum. (Attended).

Sini Sadasivan, Anuja G I, Suja S R. Wound Healing Profile of *Rhinacanthus nasuta* L. on different wound models in Wistar rats. Paper presented at 20th Kerala Science Congress Thiruvananthapuram, pp. 602– 604.

Sreekumar S 2007. Bioinformatics an overview. Invited talk presented at Rural Agricultural work experience programme organized by Kerala Agricultural University, in September.

Sreekumar S 2007. Biodiversity with special reference to agriculture. Invited talk presented at Rural Agricultural work experience programme organized by Kerala Agricultural University, in September.

Subramoniam A 2008. 'Experimental Pharmacology and *in vitro* bio-assays in the development of natural product drugs. Iinvited guest lecture presented at Symposium on Frontiers of Natural Product Chemistry, Madurai Kamaraj University, Tamil Nadu.

Subramoniam A 2008. Focus on Herbs and Phytochemicals. Invited guest lecture presented in the National Seminar on 'Recent Trends in Pharmaceutical Research', Organized by Nehru College of Pharmacy, Trichur, Kerala in March.

Subramoniam A 2008. Herbal Drug Research. Invited lecture given in the Annual Conference of Indian Pharmacological Society (Southern) at JIPMER, Pondicherry in July.

Subramoniam A 2008. Traditional Medicinal Plants in Phytomedicine Development. Invited lecture delivered in the Seminar on Streamlining Indian Tradicinal Knowledge towards Formulating a Suigenisis Regime' Organized by Amity Institute for Herbal and Biotech Products, Thiruvananthapuram in May.

Sudha C G 2007. *Agrobacterium* mediated Genetic Transformation in Medicinal Plants. Invited talk presented at Golden Jubilee Celebration of Sacred College, Thevara, Ernakulam in November.

Sudha C G, Mathew G, Rajamanickam R and Nair G M 2007. Putrescine induced shoot formation in chlorophyllous plant. Paper presented at Global Summit on Medicinal and Aromatic Plants at Chiang Mai, Thailand

Suja S R, Latha PG, Pushpangadan P 2007. Effect of *Spilanthes ciliata* H.B.K. on Hepatotoxicity And Antioxidant Defense In Carbon Tetrachloride Induced Liver Damage In Wistar Rats. Paper presented at 20th Kerala Science Congress Thiruvananthapuram, pp 625 – 627.

Vrinda K B and Pradeep C K 2007. A new edible ectomycorrhizal mushroom from Western Ghats of Kerala. Paper presented at National Symposium on Microbial Diversity and Plant Health, organized by the Indian Mycological Society at Kalyani, West Bengal.

AWARDS/HONOURS/MEMBERSHIPS/NEW PH. D.

S. Ajikumaran Nair received the best oral presentation Prize in the Annual Conference, Indian Association of Biomedical Sciences, 2007 for the research paper: 'S. Ajikumaran Nair and A. Subramoniam (2007) Anti-diabetes activities of *Hemionitis arifolia* (Burm.) Moore: efficacy evaluation in type-2 streptozotocin diabetic rats and isolation of active component'

V. George was elected as Fellow of the Indian Association of Biomedical Scientists (FABMS).

P.A. Jose recognized as Research Guide in Botany, University of Kerala, Thiruvananthapuram.

P.N. Krishnan chaired a session of the National Symposium organized by Department of Botany, Kerala University.

P.N. Krishnan served as an Examiner for Ph D Viva Voce of Madurai Kamaraj University.

P.N. Krishnan served as examiner for Viva Voce of the Final M.Sc. Bioinformatcs, Calicut University.

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

P.N. Krishnan was nominated as Member, Faculty of Sciences, Calicut University

P.G. Latha, Member, Exhibition and Showcasing Committee, 20th Kerala Science Congress 2008.

P.J. Mathew served as examiner for Ph. D. degree fot thesis 'In vitro culture studies, identification and quantification of secondary metabolites in *Andrographis echioides* (L.) Nees', Department of Floriculture and Landscaping, Tamil Nadu Agricultural University, Coimbatore.

N. Mohanan, Expert Member, Garden Committee, CESS, Thiruvananhapuram.

P. Padmesh served Chairman, Board of Examination for III semester M.Sc Bioinformatics, Calicut University.

A.G. Pandurangan selected as Chairman, Multidisciplinary Committee constituted by KSEB for the Environmental clearance of Athirapally Hydro Eelectric Project.

A.G. Pandurangan selected as Committee Member in Trade Regularization in Medicinal Plants of Kerala, State Forest Department.

A.G. Pandurangan selected as Member, Expert committee on Medicinal Plants, National Biodiversity Authority, Chennai.

A.G. Pandurangan selected as Member, Expert committee to finalize the determination of equitable benefit sharing, National Biodiversity Authority, Chennai.

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

S. Rajasekharan nominated as a Member, Management Committee, TBGRI.

S. Rajasekharan nominated as an Invitee, Rural Technology Development Programme, KSCSTE.

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

S. Rajasekharan nominated as Chairman, Special Theme, Kerala's Health Challenge: Emerging and Re-emerging infections. 20th Kerala Science Congress 2008.

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

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

S. Rajasekharan nominated as Member, Patent Cell, KSCSTE.

S. Rajasekharan nominated as Member, State Medicinal Plant Board, Kerala.

S. Rajasekharan nominated as Subcommittee Member, Access and Benefit Sharing, National Biodiversity Authority, Chennai.

K.B. Rameshkumar received Young Scientist Award at the 20th Kerala Science Congress in Environment and Forestry.

C. Sathish Kumar awarded Dr T N Khoshoo Award by the The Orchid Society of India.

C. Sathish Kumar bestowed with an Honorary Membership of American Association of Botanical Artists (ASBA), for his contribution to botanical art.

Dr C. Sathish Kumar receives Dr T.N. Khoshoo Award

Dr A. Subramoniam receives Dr Mukherjee Prize from the Governor of Haryana

C. Sathish Kumar served as examiner for Ph. D. Degree, for thesis titled "North Western Himalayan Orchids: Taxonomic Assessment and Ecological Adapatations", Panjab University, Chandigarh.

C. Sathish Kumar presented a concept note and Master Plan for developing a Centre for Conservation of Heritage Plants (CCHP) under Kerala Forest Department, at Chaliyam, north Keala.

A. Subramoniam awarded Dr B Mukerjee Prize of Indian Pharmacological Society (IPS).

A Subramoniam was selected as an Expert Committee Member in the preparation of a Draft Proposal for setting up Centre for Excellence and Technology for Medicinal & Aromatic Plants in Punjab under the Punjab State Council for Science and Technology.

A. Subramoniam, Member, Governing Body, Amala Cancer Research Centre (ACRC), Trichur.

C.G. Sudha chaired one oral session of the International Conference, Global Submit on Medicinal and Aromatics Plants held at Chiang Mai University, Thailand.

C.G. Sudha was selected as member of Board of Studies for Plant Biology and Plant Biotechnology of Holy Cross college, Manonmaniam Sundaranar University, Tamil Nadu.

TBGRI received 'Best Pavilion Award' in connection with 'Palode Cattle Fair 2008'.

THESIS/PROJECT EVALUATION AND PAPER REVIEWS:

- Dr C. Anil Kumar provided technical suggestions to the Forest Department of Gujarat State for organizing a Seed Bank in the department.
- Dr C. Anil Kumar reviewed one manuscript for the journal *Rheedea*.
- Dr B. Sabulal reviewed manuscript for Journal of Separation Science, USA -1
- Dr V. George reviewed manuscript for journal Biochemical Systematics and Ecology, USA -1
- Dr K.C. Koshy reviewed one manuscript for *Plant Systematics and Evolution* and one for *Current Science*.
- Dr C. Sathish Kumar reviewed five papers for *Indian Forester*, one paper for *Scientia Horticulturae*, three papers for *Rheedea* and two papers for *VANDA Magazine*.
- Dr C. Sathish Kumar reviewed One project proposal for DST.
- Dr A. Subramoniam reviewed manuscripts for BMC Complementary and Alternative Medicine, USA – 1; Clinical Medicine and Research – 1; Evidence based CAM, UK – 1; Journal of Ethnopharmacology – 2; Indian Journal of Pharmacology – 6; International Journal of Green Pharmacy – 7 and Phytotheraphy Research, UK - 1

PARTICIPATION IN EXHIBITIONS

- "Madathara Mela 2007" during 01-08 April 2007 at Madathara, Kollam District; organized by Pourasamithy, Madathara.
- "Trivandrum District Farmers Meet" at Anadu during 4-8 July 2007, Organized by the Department of Agriculture.
- "Suvarna Varsham" Exhibition at Marine Drive, Kochi during 20-25 August 2007. Organized by Kochi City Police.
- "Swasraya Bharath 2007" – National Self-Reliance Week- Celebration at Kochi during 9-15 October 2007, Organized by Swadeshi Science Movement.
- "Agriculture Fair" – Karavaloor Gramapanchayath, Pathanamthitta District during 7-9 November 2007.
- Silver Jubilee Celebration Mulamana Higher Secondary School during 15-17 November 2007.
- "Pala Flower Show" during 27-31 December 2007, Organized by Pala Horticulture Society.
- "Dimensions 2008" Educational and Science Technology Exhibition during 24-28 January 2008 at University College, Organized by Kerala University Students Union.
- 20th Kerala Science Congress during 28-31 January 2008 at Nalanchira, Thiruvananthapuram.
- National Exhibition on 'Biodiversity India' Exhibition at Malabar Botanical Garden during 9-13 February 2008.
- "Palode Agriculture Fair" during 7-15 February 2008, Organized by Palode Pourasamithy.

TBGRI display at Malabar Botanical Garden, Calicut

PEOPLE AND TBGRI

Students of Govt. H S S
Konni, Pathanamthitta, Kerala

Teachers Traininees of T T C School
Panavur, Thiruvananthapuram, Kerala

Students of AS H S S
Paripally, Kollam, Kerala

Medical students of Govt. Ayurveda College
Thiruvananthapuram, Kerala

Medical students of Indigenous Medicine
Horana-vidyodaya Ayurvedic Medical College, Srilanka

Plus two students of Mannaniya College
Pangode, Thiruvananthapuram, Kerala

Students of Govt. H S S
Malayankil, Thiruvananthapuram, Kerala

Students of Christ Nagar School
Thiruvananthapuram, Kerala

Teachers trainees of Marthoma Teachers Training College
Konni, Pathanamthitta, Kerala

Students of G H S S Bharathannoor,
Thiruvananthapuram, Kerala

Students of Salvation Army HSS
Kaudiar, Thiruvananthapuram, Kerala

Students of S N V H S S
Kadakavoor, Thiruvananthapuram, Kerala

Students of Govt. H S S Karingannoor,
Thiruvananthapuram, Kerala

Students of Govt. H S S Tholikode
Thiruvananthapuram, Kerala

Members, Y M C A, Vallinadu, Vattappara,
Thiruvananthapuram, Kerala

B.Sc. Students of S N Arts & Science college,
Pathanamthitta, Kerala

Students of Govt. H S S, Neyyattinkara,
Thiruvananthapuram, Kerala

Medical Students of Medical College,
Thiruvananthapuram, Kerala

Students of Govt. V H S S, Pettah,
Thiruvananthapuram, Kerala

Students of Govt. H S S,
Thiruvananthapuram, Kerala

Students of St.Thomas HS Netta,
Kanyakumari, Tamil Nadu

Students of Pemiyel Cottage,
Kulathupuzha, Kollam, Kerala

Students of S N V G H S S Kadakkavoor,
Thiruvananthapuram, Kerala

Students of P T M T T I Maruthoorkonam,
Balaramapuram, Thiruvananthapuram, Kerala

Students of Trivandrum tuitioncentre, Nedumangadu,
Thiruvananthapuram, Kerala

Students of S R U P S, Pathanamthitta, Kerala

Students of Govt. H S, Aylara, Kollam, Kerala

Students of S F S CBSE School, Venganoor,
Thiruvananthapuram, Kerala

Students of Govt. H S S, Anchal, Kollam, Kerala

Students of Govt.Hss, Airoorppara, Pothankode,
Thiruvananthapuram, Kerala Students of

Students of H S S, Ambalathara,
Thiruvananthapuram, Kerala

Students of Govt. H S S, Pettah,
Thiruvananthapuram, Kerala

Students of Govt. L P S Udhiyaramoola,
Thiruvananthapuram, Kerala

Students of Sevabharathi H S S, Attingal,
Thiruvananthapuram, Kerala

Students of Govt. L P S Bharathannoor,
Thiruvananthapuram, Kerala

Students of Govt. H S S .Koodal,
Pathanamthitta, Kerala

Students of Govt. H S S Yeroor Anchal kollam

Rangers Trainees of Forest School,
Arippa, Kollam, Kerala

Students of Govt. H S S Nagaroor,
Thiruvananthapuram, Kerala

Students of Govt. Girls H S S Nemam,
Thiruvananthapuram, Kerala

Students in the Garden

B.Sc. Botany Students of S N Collage, Kollam, Kerala

Students of Manjappara V H S S, Manjappara, Ayoor, Kollam, Kerala

Students of Govt. G H S S, Kanyakulangara, Vembayam, Thiruvananthapuram, Kerala

Students of Govt. L P S Konni, Pathanamthitta, Kerala

Students of S N D P U P S, Malayalappuzha, Pathanamthitta, Kerala

Students of Govt. U P S, Nilamel, Kollam, Kerala

Students of Govt. V H S S, Vaykon, Thiruvananthapuram, Kerala

Sc. Botany Students of Sengurthan College, Tiruchengode, Tamil Nadu

Students of Govt. H S for Girls, Chavara, Kollam, Kerala

Students of G H S Madathara, Thiruvananthapuram, Kerala

Students of Womens College, Chennai, Tamil Nadu

Students of A K M V H S S Thadikadu, Anchal, Kollam, Kerala

Scientists of Vetenary Biological Institute, Palode, Thiruvananthapuram, Kerala

Students of R R V G H S S Kilimanoor, Thiruvananthapuram, Kerala

M. Sc. Botany Students of Kakatiya University, Andrapradesh

Students of S N H S S, Poonkode, Chadayamangalam, Kollam, Kerala

Students of Govt.U P S, Koliyakode, Thiruvananthapuram, Kerala

Students of Govt. U P S, Jawaharcolony, Palode, Thiruvananthapuram, Kerala

Students of Govt.U P S, Peroor, Vadassery, Kilimanoor, Thiruvananthapuram, Kerala

Students of Vaiga Vidhyalayam, Nemam, Thiruvananthapuram, Kerala

Students of S V L P S Chadayamangalam, Thiruvananthapuram, Kerala

Students of National College, Madathara, Kollam, Kerala

Students of Govt.U P S, Paluvally, Pacha, Thiruvananthapuram, Kerala

Students of Universisy College, Thiruvananthapuram, Kerala

Students of G M L P S Navayikulam, Kollam, Kerala

Students of Govt. U P S Jawaharcolony, Thiruvananthapuram, Kerala

Students of St.GeorgeSchool, Alampara, Parassala, Thiruvananthapuram, Kerala

Students of H S S Iqbal, Peringamala, Thiruvananthapuram, Kerala

Students of S V H S Poonkode, Chadayamangam, Thiruvananthapuram, Kerala

Students of G H S S Avanavancheri, Attingal, Thiruvananthapuram, Kerala

Students of Govt.Town U P S, Kottarakkara, Kollam, Kerala

B. Sc. Botany students of Students of N M C College, Marthandam, Kanyakumari, Tamil Nadu

Staff of Kerala State Nirmithi Kendra, P T P Nagar, Thiruvananthapuram, Kerala

Students of Marbasilios School, Pooyappally, Kollam, Kerala

Prof.Cheng Sen Li and team, Chinese Academy of Sciences, China

FACILITIES/ EQUIPMENTS

Automated DNA Sequencer

Gradient PCR

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 DT_1
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
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
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
Liquid Nitrogen Plant
Liquid Scintillation Counter
Lyophiliser- Hetosic Model FD. 2.5 with Vacuum Pump
(Pfeiffer- BZ43)
Microcentrifuge
Midterm Storage Room (15ºC/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
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
Shaker NBS
Shakers
Submarine Gel Electrophoresis
Super Cold Refrigerators (-20°C),
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 CO_2 Incubator

LIST OF EXTERNALLY FUNDED PROJECTS DURING 2007-08

Sl. No.	Code	Project title	Name of funding agency
1	A-13	All India Coordinated Research Project on Orchids	MoEF, Govt. of India
2	A-19	Establishment of Sub-Distributed Information centre at TBGRI under Bio informatics Programme	DBT, Govt. of India
3	A-28	National Gene Bank for Medicinal and Aromatic plants(III phase)	DBT, Govt. of India
4	A-30	Bamboo and Reed Resource Enhancement in Kerala	Planning & Economic Affairs Department, Govt. of Kerala
5	A-33	Ex-situ Conservation and Sustainable Utilisation of Rare, Endemic and High-Value Medicinal Plants of Southern Western Ghats through In Vitro Multiplication and Evaluation of Quality Retention-A Lab to Land Programmme	Planning & Economic Affairs Department, Govt. of Kerala
6	A-42	Establishment of seed bank, propagation and ex situ conservation of endemic and threatened species of W. Ghats	MoEF, Govt. of India
7	A-49	Isolation and characterization of genes involved in the regulatory stps leading to the biosynthesis of hericin using transcript profiling technology and metabolic engineering of andrographolides accumulation in Andrographis paniculata Nees by modulation of the isoprenoid precursor pool with expression of plasticidal Deoxyxylulose phosphate synthase and cytosolic HMG CoA reductase	DBT, Govt. of India
8	A-50	Metabolic engineering of Andrographolioles Accumulation in *Andrographis paniculata* Nees by modulation of the isoperenoid precursor peal with expression of palastidial Deoxyxylulose phosphate synthase and cytosolic MMG CoA reductase	DBT, Govt. of India
9	A-55	Collection, propagation, reintroduction and popularization of Ten endemic trees species of western ghats.	Planning & Economic Affairs Department, Govt. of Kerala
10	A-56	Tissue culture multiplication for mass production of selected economically important bamboos.	Planning & Economic Affairs Department, Govt. of Kerala
11	A-59	Development of Scientifically validated Nutraceuticals from selected medicinal plants of Western Ghats	DBT, Govt. of India
12	A-61	Hepatoprotective studies on three selected medicinal plants of Kerala	DBT, Govt. of India
13	A-62	Studies on Reproductive Biology of selected rare, endemic and horticulturally promising balsams from W. Ghats	DST, Govt. of India
14	A-64	Infectivity and effectiveness of Arbuscular mycorrhizal fungi on some medicinal plants of W. Ghats	Forest Dept. Govt. of Kerala
15	A-65	Plant Crab Association in the Mangrove Ecosystems of Kerala	MoEF, Govt. of India
16	A-66	Establishment of MMPG at TBGRI, Palode.	NBRI, Lucknow
17	A-67	*Ex situ* conservation of Arborescent crop relatives of Western Ghats, giving emphasis to endemic and RET species	NBRI, Lucknow
18	A-68	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.	MoEF, Govt. of India

19	A-69	Lead Coordination institution for Agasthyamalai, Nilgiri and Gulf of Mannar Biosphere Reserves	MoEF, Govt. of India
20	A-71	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
21	A-72	Toxic and Hallucinogenic Mushrooms of Kerala	Planning & Economic Affairs Department, Govt. of Kerala
22	A-73	Antiulcer and wound healing properties of three selected Medicinal plants of the W. Ghats, Kerala	Planning & Economic Affairs Department, Govt. of Kerala
23	A-74	Toxicological Evaluation of herbal products	Amity Institute for Herbal & Biotech Products Development
24	A-75	Search for bioactive molecules from genus Ganoderma (Polyporaceae) occurring in South India	DST, Govt. of India
25	A-76	Conservation of Endemic Cycads in India **Workshop**	INDO-US Science & Tech. Forum
26	A-77	Collection, Identification and concumentation of Folicolous Fungi, Endomycorrhizal Fungi and Lichens in Silent Valley National Park	MoEF, Govt. of India, New Delhi
27	A-78	National programme on recovery of red-listed species (*Coscinium fenestratum, Paphiopedilum druryi, Dialium travancoricum* and *Poeciloneuron pauciflorum*) through application of biotechnology tools	DBT, Govt. of India
28	A-79	Biodiversity Conservation and Characterization using Biotechnology tools' **Short term training course**	DBT, Govt. of India
29	A-80	Diversity and distribution of Asterinaceous fungi in India	MoEF, Govt. of India
30	A-81	Inventory and conservation status of mushrooms of Wayanadu area of Kerala	MoEF, Govt. of India
31	A-82	Bioprospecting of selected gingers from W. Ghats : Morphological characterization and chemical prospecting	DBT, Govt. of India
32	A-83	Brain storming session on Biodiversity Conservation through Biotechnological Interventions - **Two days programme**	DBT, Govt. of India
33	A-84	Standardization of agrotechnological packages of practices and establishment of demonstration plots for commercial cultivation of *Plectranthus vettiveroids*	National Medicinal Plants Board, Govt. of India
34	A-85	Studies on the aphrodisiacs properties of vandal tessellate flower extract for determining its utility as commercially viable standardized phytomedicine	DST, Govt. of India
35	A-86	DNA Barcoding in Bamboos	DBT, Govt. of India
36	A-87	DNA Barcoding of selected species of *Dendrobium* – an orchid	DBT, Govt. of India
37	A-88	Systematic and phytogeographic evaluation of grasses and sedges of Kerala portion of Nilgiri Biosphere Reserve	Kerala Forest Dept., Govt. of Kerala
38	A-89	Studies on seed biology and nursery practices of *Conscinium fenestratum* and *ex situ* conservation of the species through establishment of field gene bank and seed bank	Kerala Forest Dept., Govt. of Kerala
39	A-90	Proposals for preparation of master plan for establishment of a centre for conservation of heritage plants	Kerala Forest Dept., Govt. of Kerala
40	A-91	RET Medicinal plants conservation and utilization in South and North East India	National Medicinal Plants Board, Govt. of India

ADMINISTRATIVE BODIES 2007-2008

KERALA STATE COUNCIL FOR SCIENCE, TECHNOLOGY AND ENVIRONMENT

Hon. Chief Minister, Government of Kerala	President
Minister for Industries, Government of Kerala	Vice-President
Minister for Finance Government of Kerala	Vice-President
Minister for Agriculture Government of Kerala	Vice-President
Minister for Health Government of Kerala	Vice-President
Minister for Education Government of Kerala	Vice-President
Minister for Forests Government of Kerala	Vice-President
Minister for Water Resources Government of Kerala	Vice-President
Vice-Chairman, Kerala State Planning Board	Vice-President
Chief Secretary to Government of Kerala	Vice-President
Dr E P Yesodharan	Executive Vice-President
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
Member Secretary, KSCSTE	Secretary

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, KSCSTE	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 (Convenor)	Member

LIST OF PERSONNEL

DIRECTOR
Dr S Ganeshan

BIOTECHNOLOGY AND BIOINFORMATICS DIVISION

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

CONSERVATION BIOLOGY DIVISION

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 DIVISION

Dr S Rajasekharan	Scientist F, Head
Dr P G Latha	Scientist E2
Mr K Radhakrishnan	Scientist A
Mr A Subash Baby	Pharmacist
Dr T G Vinod Kumar	JSA (On leave)
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 DIVISION

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 Dheuvan 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 A Hussain	Tech. Officer
Mr K Selvaraj	Labour Supervisor
Mr J Michael	Garden Maistry
Mr B Jayakumar	Gardener
Mr P Manikandan Nair	Gardener
Mr C Sudarsanan	Gardener
Mr K Vijayakumar	Gardener
Mr B Harilal 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)

VISITORS MANAGEMENT CENTRE

Mr K G Ajith Kumar	Public Relations Officer
Mr S S Dayal	Asst. Publications Officer
Mr V Prem Kumar	Asst. Publications Officer

Dr S Binu	SSA
Mr K J Lathan Kumar	Tech. Officer
Mr S Suresh Kumar	Asst. Artist
Mr C Suseendran	Photographer
Mr K Narendran Nair	Gardener
Mr P Rajendran	Driver

PHYTOCHEMISTRY AND PHYTOPHARMACOLOGY DIVISION

Dr V George	Scientist F, Head (Retired on 29/02/2008)
Dr A Subramoniam	Scientist E2 & Head (01/03/2008 onwards)
Dr B Sabulal	Scientist B
Mr K B RameshKumar	JSA
Mrs B S Geetha	JSA (Deputation to KSCSTE)
Mr J Anil John	Tech. Officer
Mr Gopanraj	Tech. Officer
Mr S Ajikumaran Nair	Tech. Officer (On deputation to KSCSTE)
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 DIVISION

Dr P J Mathew	Scientist C, Head
Dr K C Koshy	Scientist C
Dr C Sathish Kumar	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 Muraleedharan 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 M. K Sreekumar	Tech. Officer (On deputation)
Mr P Mony	Garden maistry (Retired on 31/05/2007)
Mr K C Thomas	Gardener
Mr G Manoharan	Gardener
Mr N Venugopalan Nair	Gardener
Mr N Salahudeen	Gardener
Mr P Shaji	Gardener
Mr K Asok kumar	Gardener
Mr S Ajayakumar	Gardener
Mr G Sudarsana Kurup	Gardener
Mr C Murali	Gardener
Mr B Jayalal kumar	Gardener
Mr M Shajahan	Gardener
Mr Asokachandran Nair	Gardener
Mr S Thulaseedharan	Gardener
Mrs Kanakasundaram	Lab. Attendant

PLANT SYSTEMATICS AND EVOLUTIONARY SCIENCE

Dr A G Pandurangan	Scientist E2, Head
Dr K B Vrinda	Scientist B
Mr G Rajkumar	SSA
Dr M Rajendra Prasad	JSA (On deputation to KSCSTE)
Dr A K Sreekala	JSA
Dr S Shiburaj	JSA (On deputation to KSCSTE)
Dr N S Pradeep	JSA
Mr T Shaju	JSA
Dr C K Pradeep	JSA
Dr A Nazarudeen	JSA (On Leave)
Mrs V S Usha	Herbarium Assistant (On deputation)
Mrs M P Geethakumari	Tech. Officer
Mrs K P Deepthi Kumari	Tech. Officer
Mr R Thulaseedharan	Gardener
Mr P Prabhakaran	Gardener
Mrs Kumari Girija	Sweeper

MICRO FUNGI LABORATORY

Dr V B Hosa Goudar	Scientist C
Mr H Biju	Tech. Officer
Mr A Sabeena	Tech. Officer
Mr K Anil Kumar	Gardener
Mr V Gireesh kumar	Lab Assistant

LIBRARY AND INFORMATION SERVICES

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

ART AND PHOTOGRAPHY

Mr K P Pradeep Kumar	Artist/Photographer

ADMINISTRATIVE STAFF

Mr V V Ramachandran	Registrar
Mr K M A Rahman	Senior Welfare Officer (On deputation to CWRDM)
Mrs S Radhalekshmy Ammal	P A to Director
Mrs R Sarala Devi	Section Officer (Retired on 31/05/2007)
Mr Suresh Chandran	Section Officer
Mrs S Meenakumary	Office Asst. Grade III
Mr K Vijayan	Office Asst. Grade III
Mr M Anilkumar	Office Asst. Grade IV
Mr M Sulfikar	Office Asst. Grade IV
Mrs B S Ajanthakumary	Office Asst. Grade IV
Mr K Mohammed Habeebulla	Office Asst. Grade IV
Mr T S Sunil kumar	Office Asst. Grade IV
Mrs C Gracy	Stenographer Gr I
Mrs R Prasannakumary	Stenographer Gr II
Mrs N Rajalekshmi Ammal	Typist Grade I
Mrs R Subha Sankar	Computer Operator
Mr K Gopakumar	Tech. Officer
Mrs P S Shyladevi	Typist
Mr K P Elias	Store Assistant
Mr B R Dinesh	Record Keeper
Mr M Ramaswamy	Driver Gr I
Mr V Rajendran Nair	Driver Gr I
Mr R Gopinathan Nair	Driver Gr I (Retired on 29/02/2008)
Mr A Salim	Driver Gr I
Mr D Mohanachandrakumar	Driver Gr I
Mr T Mohanakumar	Driver
Mr V Sudheeshkumar	Driver
Mr C Sathyan	Helper Gr I
Mr B Vijaya Kumar	Helper Gr I
Mrs R Valsaladevi	Helper
Mr M Shajahan	Helper
Mr S R Kamalesh Kumar	Gardener (on other duty)
Mr P Vijayakumar	Security Guard (on other duty)

ENGINEERING SECTION

Mr P P Markose	Tech. Officer
Mr S Ajith	Tech. Officer
Mr V S Suresh Kumar	Tech. Asst.
Mr P Ajith Kumar	Tech. Asst.
Mrs M R Geetha	Tech. Asst.
Mr G Ajayakumar	PABX Operator
Mr M Madhusoodhanan Nair	Pump Operator
Mr Prabhakaran Nair R	Plumber
Mr A Thankappan	Painter
Mr P S Hanikumar	Label writer
Mrs K Lali Kutty	Sweeper
Mrs Baby Girija	Sweeper
Mr V Gangadhara Pillai	Sweeper/Cleaner

SECURITY

Mr V Jayadhar	Security Officer
Mr P RChandrasekharan Nair	Security Guard (Sergeant)
Mr S Chandran	Security Guard
Mr P Jain	Security Guard
Mr K Mohanan	Security Guard
Mr P Ramachandran Nair	Security Guard (Retired on 30/11/2007)
Mr G Somasekharan Nair	Security Guard
Mr C Stanley	Security Guard
Mr K Krishnankutty Nair	Security Guard (Retired on31/04/2007)
Mr R Rajan	Security Guard
Mr K Ramachandran Nair	Security Guard
Mr V Sreedharan Nair	Security Guard
Mr A Subairkunju	Security Guard
Mr C Sukumaran Nair	Security Guard (Retired on 31/07/2007)
Mr T Sukumaran Nair	Security Guard
Mr B Surendran Nair	Security Guard
Mr K Surendran Nair	Security Guard
Mr S Venugopalan Nair	Security Guard
Mr B Venukrishnan Nair	Security Guard
Mr P Vijayakumar	Security Guard
Mr G Viswambharan	Security Guard
Mr K Balakrishnan Nair	Security Guard (Retired on 31/05/2007)

PUTHENTHOPE EXTENSION CENTRE

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