

Institute of Forest Genetics and Tree Breeding Coimbatore

The Institute of Forest Genetics and Tree Breeding (IFGTB) is a national Institute established in April 1988 under the Indian Council of Forestry Research and Education (ICFRE). It was formed by up-gradation of the erstwhile Forest Research Centre (FRC), Coimbatore under the Forest Research Institute and Colleges, existing since 15th December 1959. Certain other organizations and schemes viz., Forest Soil-cum-Vegetation Survey (FSVS), Coimbatore, Disease and Insect Survey (DIS), Coimbatore, Indo-Danish Project on Seed Procurement and Tree Improvement (IDPSPTI), Tropical Pines Research Centre (TPRC), Kodaikanal Eucalyptus Research Centre (ERC), Ooty and Environmental Research Station (ERS), Ooty were also merged with the FRC to form the Institute. The Institute conducts national level research on the subjects of Genetics and Tree Breeding of important forest species. In addition, it also attends to the local problems of the States of Tamil Nadu and Kerala and the Union Territories of Andaman and Nicobar Islands, Lakshadweep and Pondicherry.

PROJECTS COMPLETED DURING THE YEAR 2006-2007

Project 1: Estimation of gene diversity and enhancing seed production in seedling seed orchards of *Eucalyptus*, *Casuarina*, *Acacia* and Teak [IFGTB/RP-31/2003-2008]

Findings: The fertility was registered for each tree at the age of eight and nine years in seedling seed orchards of *Eucalyptus tereticornis* and *E. camaldulensis* established at two sites (one moist and one dry) in southern India. The effect of different treatments on tree growth and fertility was studied in one unpedigreed Seedling Seed Orchard (SSO) each of *E. camaldulensis* and *E. tereticornis* in an arid location (Pudukkottai) in southern India. Compared to untreated control, only hormone application showed significant increase in proportion of fertile trees in both species for four successive years. The number of fruits produced per tree also increased significantly with hormone application, though the difference was comparatively less in the fourth year.

Two seedling seed orchards each of *Casuarina equisetifolia* and *C. junghuhniana* established by thinning provenance trials in coastal (Pondicherry) and inland locations (Karunya and Panampally) in South India were evaluated for sex expression and fertility variation. Orchards established in coastal environment had less fertility variation and hence maintained higher diversity in both species. Coastal site had more trees contributing effectively to seed production than inland locations.

Fertility differences between clones were estimated in a 25 years old Clonal Seed Orchard (CSO) of teak at Walayar in Kerala State. There were great differences in fertility between two seedling seed orchards of *Acacia auriculiformis* established in two locations. Thus fertility variation is directly correlated with the location and the climatic conditions each year.

Project 2: Isolation of Somaclonal Variants of *Casuarina equisetifolia* for Salinity Tolerance [IFGTB/RP-8/2002-2007]

Findings: Successful induction of callus and regeneration of shoots was achieved using juvenile cotyledon explants. The species was found to be recalcitrant to regeneration through tissue culture



evident by low shoot regeneration of the callus cultures. Biochemical studies indicated slight increase in the total proteins and proline and decrease in the total amino acids in callus tissues after 24 hours of salt stress. Screening of salt tolerant callus was done. The isolated tolerant callus could not regenerate into plantlets due to recalcitrant nature of callus for regeneration.

Project 3: Identification, isolation, evaluation and mass production of native fungi for the management of teak and *Casuarina* stem borers [IFGTB/RP-21/2002-2007]

Findings: The seven potential isolates of entomopathogenic fungi selected out of fifteen were mass multiplied in media like vegetable waste, rice powder, coffee husk, and sorghum grain media to determine the suitable media for mass production. The fungus grew better on sorghum grain and on coffee husk.

Replicated field experiments at different locations were conducted at one year old teak plantation at Moondamuzhy, Kerala and at a private *Casuarina* plantation at Ulunthurpettai, Tamil Nadu to test the effectiveness of the seven potential isolates of entomopathogenic fungi on the pests *Sahydrassus malabaricus* and *Indarbela quadrinotata*, respectively. Three different concentrations were used in the experiments and effective concentration was determined for controlling the pests. Two commercially available entomopathogenic fungi products (*Beauveria bassiana* and *Metarhizium anisopliae*) were tested against the targeted pests *Sahyadrassus malabaricus* and *Indarbela quadrinotata* (*Casuarina* stem borer) under lab conditions and it was found that both the products were not effective in controlling the pest *S. malabaricus* and less effective in the case of *I. quadrinotata* as compared to the native isolates.

Project 4: Testing of promising plant derived chemicals against key pests (Component: Bioactive compounds from *Acacia nilotica* (Babul) against the major defoliators of forestry tree species) [IFGTB/RP-22/2002-2007]

Findings: *A. nilotica* leaves, flowers, fresh pods, seeds and twigs were extracted and their biopesticidal properties were tested and identified in terms of antifeedancy, ovicidal activity, pupal and larval mortality against teak defoliators. Results indicated the adverse effects of methanol and hexane extracts of *A. nilotica* flowers, pods and seeds on the tested insects, whereas these effects were not expressed by the extracts of twigs.

Individual secondary metabolites such as phenols, phenolics and polyphenols were also isolated and identified from different tissues of *A. nilotica*. The biological properties of these metabolites were evaluated on the teak defoliators, *H. puera* and *E. machaeralis*. Some of the bioactivities expressed by these metabolites include reduction in food consumption index, extended larval duration and high mortality.

Project 5: Testing and evaluation of selected existing control methods for key diseases of *Casuarina* spp. with reference to blister bark and root-rot [IFGTB/RP-24/2002-2007]

Findings: Application of fungicide solution (Bavistin/ Indofil M-45) to the trees of *Casuarina equisetifolia* and *C. junghuhniana* in the field trials was done at periodical intervals. Roots and rhizosphere soil samples collected from the trials were assessed for mycorrhizal colonization of both Ecto- (ECM) and Arbuscular (AM) mycorrhizal fungi. The samples exhibited higher percentage colonization of AM fungi as compared to ECM fungi. The AM fungal genera viz., *Acaulospora* and *Glomus* were found dominant in most of the soil samples analyzed.

Pure culture of the blister bark disease pathogen, *Trichosporium vesiculosum* was raised in the laboratory and subsequently artificially introduced in the soil at the root zone of the trees in the experimental trail site at Panampally, Kerala. After a period of inoculation, few trees of *C. equisetifolia* in various treatments expressed the symptom of blister bark disease. Maximum percent of infection of blister bark disease was recorded on T1 (control) plants and minimum percent infection was observed on T2 (Fungicide treatment). There was no infection/symptom of blister bark diseases in the trees treated with biofertilizers and biocontrol agents during the period of observation.

PROJECTS CONTINUED DURING THE YEAR 2006-2007

Project 1: Genetic improvement of *Eucalyptus tereticornis* through control hybridization and molecular characterization [IFGTB/RP-3/2002-2005] (Extended upto 2008)

Status: Controlled pollination was carried out in Helenvale, Garnet and Orobay provenances of *Eucalyptus tereticornis* with *E. alba*, *E. pellita*, *E. camaldulensis* and *E. globulus* as pollen. About twenty full sib family combinations were performed. Fruit and seed set have been recorded in all the said crosses.

Project 2: Enhancing productivity in *Casuarina* species through inter-provenance and inter-specific hybridization [IFGTB/RP-30/2003-2008]

Status: Pollination experiments were conducted between the two *Casuarina* species, *C. equisetifolia* and *C. junghuhniana*, forty full-sib families were harvested and characterised for morphological traits using image analyzer. Full-sib families were sown in the nursery along with orchard seeds of the two species as control. About 2500 seedlings have been produced and these plants will be tested in two locations to assess their growth performance. Seventy clones of the two species assembled from different locations were planted in a clone bank cum multiplication garden in the Forest Campus for future needs. Outstanding putative hybrid individuals identified in the progeny trial were felled for coppicing.



Control pollinated fruits maturing in a potted *Casuarina equisetifolia* plant.



Project 3: Status and floristic diversity of sacred groves- The only remnants of natural forests in Alappuzha District, Kerala [IFGTB/RP-35/2005-2008]

Status: Alappuzha is the only district in Kerala State without natural forests. The sacred groves of the district attract utmost attention as they are the only remnants of natural forests once present. Visited Cherthala, Ambalappuzha, Karthikappally, Mavelikkara, Chengannur and Kuttanad Taluks in Alappuzha district and enumerated 1127 sacred groves, covering 91 villages and detailed floristic studies were undertaken in selected and permitted groves.

Project 4: Genetic improvement of *Acacia auriculiformis* through half-sib progeny selection [IFGTB/RP-39/2005-2010]

Status: A nursery of half-sib progenies of single tree collections of 133 superior trees selected in first generation orchards based on stem form, branching habit and growth was raised and evaluated for seedling growth. Two progeny trials of these selected trees, one at Panampally and another at Pondicherry were raised.



Two months old progeny trial of *A. auriculiformis* at Panampally (Kerala)

Project 5: Phenotypic selection, reproduction and propagation in *Ailanthus excelsa*: Perspectives for safety matches industry and farmers in Tamil Nadu [IFGTB/RP- 40/2005-2009]

Status: Standardization of vegetative propagation was made and considerable seasonal effect was observed. Over 2000 seedlings have been raised with seeds collected from four different locations of the country for establishing the germplasm bank in Tamil Nadu. Seeds are being collected from the identified phenotypically superior trees in different agroclimatic zones of Tamil Nadu. Highly damaging plant parasite *Helicanthes elastica* (Desr.) Dans. has been identified in *Ailanthus* plantation in southern part of Tamil Nadu.

Project 6: Genetic transformation of *Eucalyptus* and *Casuarina* to enhance salinity tolerance [IFGTB/ PBT/ RP- 6/2002-2005] (extended upto March 2008)

Status: Parameters determining efficient co-cultivation conditions in *Eucalyptus* were assessed. *Agrobacterium* concentration standardised for the survival of co-cultivated explants when compared to *Agrobacterium* concentration at 297,600 CFU/ml. Sonication conditions were optimized. A few regenerants from co-cultivated explants have been obtained in kanamycin selection medium for Osmotin and AtNHX gene constructs. Experiments conducted to study *in vitro* regeneration responses, needle explants from mature trees of *Allocasuarina huegeliana* and *A. littoralis* showed better callusing frequency than the needles of *Casuarina glauca* and *C. junghuhniana*.

Project 7: Studies on the population structure and reproduction of *Pterocarpus marsupium* in Tamil Nadu and Kerala [IFGTB/RP-37/2005-2008]

Status: Based on reconnaissance survey, populations of *Pterocarpus marsupium* for long term phenological and reproductive studies were identified. From the identified populations, 28 individual trees have been marked for periodical phenological observations. As per the forest map of South India

prepared by the French Institute of Pondicherry, *Anogeissus latifolia*, *Pterocarpus marsupium* and *Terminalia* species in the forest type (>600 m above MSL) dry deciduous forests was identified and on the basis of physical barriers separating the distribution of *P. marsupium*, 19 distinct populations on the western aspect of Western Ghats in Tamil Nadu and Kerala have been short listed for further studies.

Project 8: Evolving silvicultural practices for *Casuarina junghuhniana* ssp. *timorensis* [IFGTB/RP-33/2005-2009]

Status: Seed parameters of *Casuarina junghuhniana* ssp. *timorensis* seeds from identified trees at Panampally, Sadivayal and Puducherry were recorded. Nursery trials to study effect of various potting media and container types and sizes on seedling growth performance of *C. junghuhniana* were carried out. Field evaluation trials to understand the silvicultural requirements of the species were established at 2 locations in Puducherry (Forest department land and in a farmers land) and at a location each in Veeravanallur, Kayalpattinam and Vedaranyam. Trial at sites located both at the coast and inland conditions as well as at different latitudes were carried out to understand the silvicultural requirement of the species.

Project 9: Identification of conserved motifs in genes conferring salt tolerance to develop strategies for gene isolation from salt tolerant tree species [IFGTB/RP-38/2005-2008]

Status: Data mining of both nucleotide and protein sequences of genes conferring salt tolerance was carried out for potassium transporters, sodium transporters, calcium transporters, proton transporters and transcription factors. Conserved sequences and primers sets were deduced for the above genes using ClustalW and PriFi software. A prototype database named “TIGBAST” (The *In Silico* Gene Bank for Abiotic Stress Tolerance), which is now able to retrieve information for Sodium antiporter genes, has been developed using the WAMP environment.

Project 10: Studies on seed handling and storage behaviour of important NTFP species [IFGTB/RP-34/2005-2008]

Status: Studies indicated that yellow-green stage of fruit maturity after removing the testa, favoured germination without any pretreatment requirement for *Calophyllum inophyllum*. Mature seeds were found sensitive to moisture reduction. Storing seeds at specific temperature for one month proved promising for prolonging storage in comparison with ambient storage. Seed storage and biochemical basis of *Calophyllum* seed deterioration were studied.

Germination on paper medium or by roll towel method was found suitable indicating the need for ventilation. The sprouted seeds were transplanted to root trainers and found to establish well.

Seed extraction and drying methods were standardized for mature fruits of *Garcinia gummigutta*. Seeds stored at different temperatures were tested for germination and analyzed for biochemical parameters at different storage intervals.

Standardised seeds extraction and processing method for *Sapindus emarginatus*.

Project 11: Natural regeneration studies on important trees in Silent Valley National Park, Kerala [IFGTB/RP-32/2004-2009]

Status: In Silent Valley National Park, the regeneration status of important trees has been studied and the species have been enumerated to assess the natural regeneration status. Laying out of sample



plots and regeneration studies in Poochapara area is in progress.

Project 12: Studies on the diversity of bee fauna of the Nilgiris [IFGTB/RP-36/2005 2008]

Status: Survey was conducted in 9 forest types and in 4 plantations sites in the study areas in Nilgiris. The association of bee species, *Apis cerana*, *A. indica* and *Trigona* sp. on flowers of *Bidens biternata*, was observed. The carpenter bee, *Xylocopa* sp. was also found to visit the flowers of *Grewia* sp., for pollen.

NEW PROJECTS INITIATED DURING THE YEAR 2006-2007

Project 1: Assessment on carbon pool potential of important tree species at different ages, sites and management regimes [IFGTB/RP- 41/2006-2011]

Status: Identified 70 plantations of *Casuarina*, *Eucalyptus* and Teak for carbon sequestration studies and growth parameters were made in selected plantations. Soil samples from these selected plantations were analyzed mainly for carbon and other major nutrients.

Project 2: Assessment of insect pest problems of selected fast growing indigenous tree species in Tamil Nadu and Kerala [IFGTB/RP- 42/2006-2009]

Status: Pest surveys at nurseries, plantations and in natural forest eco-system were carried out in Tamil Nadu and Kerala.

Insect pest species damaging *Dalbergia sissoo*, *Ailanthus excelsa*, *Gmelina arborea*, *Melia dubi*, *Bombax cieba* and *Morus alba* were collected and identified. Necessary data on intensity of attack of the pest, nature of damage caused and abiotic factors was also collected and documented.

Project 3: Origin, distribution and genetic diversity of *Jatropha curcas* in India [IFGTB/RP- 43/2006-2009]

Status: Local provenances were surveyed in Tamil Nadu and identified for assemblage for isozyme studies. Standardised extraction procedures for isozymes and staining procedures for eight isozymes. Seeds and vegetative material were collected from Kerala and maintained in the nursery. Vegetative material obtained from TFRI, Jabalpur and IWS, Bangalore was rooted in the nursery for isozyme studies. Six populations each comprising 30 individuals from the state of Tamil Nadu and two populations from the state of Kerala have been screened for the genetic diversity.

PROJECTS COMPLETED DURING THE YEAR 2006-2007 (Externally Aided)

Project 1: (Phase-I) Evaluation of breeding efficiency and genetic gain in seedling seed orchards of *Eucalyptus* and *Casuarina* in South India (Funding Agency: International Foundation for Science, Sweden) [IFGTB/EF-RP4/2002-2005]

(Phase-II) Estimation of effective population size in progeny of first generation seedling seed orchards of *Eucalyptus* and *Casuarina*

Findings: Five seedling seed orchards of *Eucalyptus* and four orchards of *Casuarina* established

according to breeding programmes in South India were investigated for breeding efficiency and genetic gain before resorting to large-scale seed supply. In *Eucalyptus*, two unpedigreed seedling seed orchards each of *Eucalyptus camaldulensis* and *E. tereticornis* and a provenance - progeny trial of *E. tereticornis* established in different locations in South India were studied for tree growth and seed orchard functions at age four.

Two provenance trials each of *Casuarina equisetifolia* and *Casuarina junghuhniana* were converted to seedling seed orchards after early evaluation and thinning to remove inferior provenances and trees within provenances were included in the study. One of the provenance trials of *C. equisetifolia* located at Sadivayal in Tamil Nadu was established to maintain pedigree information, as provenance progeny trial.

Two genetic gain trials were established for each genus in different locations to test the performance of seeds collected from the seedling seed orchards. A commercially planted *Eucalyptus* clone was also used as a control in one site. The trials were evaluated for first year growth. Survival of this seedlot was also low in both test sites.

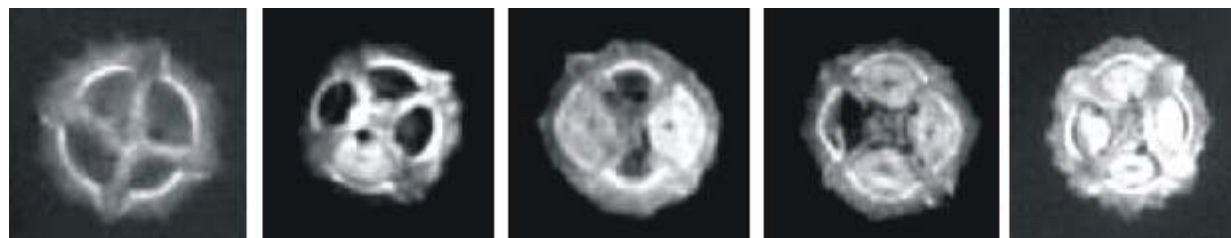
Project 2: Estimation of gene diversity and drift pattern in natural stands and plantations of forest tree species in South India (Funding Agency: SIDA, Sweden) [IFGTB/EF-RP-6/2003-2006]

Findings: Studies aimed at monitoring variation in fertility among trees and clones for different forest species viz. teak, sandal, neem and tamarind situated in Southern India were observed for fertility variations. Fertility variation was generally higher in a natural stand compared to the Seed Production Areas (SPA) in teak even though majority of the trees were fertile in two adjacent years. In teak SPAs there was a positive year to year correlation in fertility parameters like proportion of fertile trees, flowers and fruits produced per tree. The female fertility variation and the fruit set percentage in two successive years were negatively correlated implying that there is a tendency for alternate bearing in the trees in a population.

Selection for tree DBH was observed to reduce the fertility variation as DBH was positively correlated to reproductive output in teak. Fertility variation was found to be low in ten years old Sandal plantations compared to those of Neem and Tamarind.

Project 3: Evaluation of reproductive success in seed orchards of teak in India (Funding Agency: International Foundation for Science, Sweden) [IFGTB/EF-RP-8/2003-2006]

Findings: Fertility variation was studied in two 30 years old Clonal Seed Orchards (CSO) of teak in four consecutive years (2003-2006). CSO I is located in Topslip (Tamil Nadu State) with 15 clones and CSO II in Walayar (Kerala State) with 20 clones. Thirteen clones are common to both the orchards. Flowering was low in all years in both the orchards. Clones differed significantly in reproductive output, a few contributing a major share of flowers and fruits while some did not flower in all four years. Broad sense heritability was moderate for flower and fruit production per tree. A strong positive correlation was found between flower and fruit production assessed in successive years. Diameter showed positive correlation with reproductive traits but clear bole height and height to clear bole ratio were negatively correlated with flowering and fruiting. Fertility variation and group coancestry were higher in poor flowering years than good years as indicated by sibling coefficient values. Between the two orchards CSO II showed about 3 times more fertility variation and group coancestry than CSO I in poor flowering years.



X-radiograph of teak fruit shows variation in seed filling (number of filled seeds in each fruit is given)

Insects visiting teak inflorescence were studied in two clonal seed orchards of teak. Bees, flies and wasps were among the most frequently observed insects in teak Pollen load and a visitation rate of each species differed significantly. Honeybees were found to be the key pollinators of teak. Nectarivorous birds like sunbirds were also found to effect pollination in one of the orchards. Fruit dimensions and weight correlated positively with seed filling. But germination and seed filling were not strongly correlated. Germination of Walayar orchard seeds was poor compared to Nilambur SPA which showed significant germination. These findings indicate that reproductive success in teak seed orchards is limited by several factors. Genetic and silvicultural interventions are essential to promote flowering and fruiting in teak orchards.

Project 4: Full sib production in selected high yielding tamarind clones of Tamil Nadu (Funding Agency: Tamil Nadu Forest Department) [IFGTB/EF-RP-14/2003-2006]

Findings: Tamil Nadu Forest Department addressed a specific need of control pollinating red and other high yielding tamarind varieties for full sib production. Accordingly full sib families were produced by control pollinating red tamarind clones TNRJ-402, TNRJ-403 and TNRN-401 as pollen parents with other high yielding clones. About six full sib families have been transferred to a field trial in State Forest Research Institute, Kolapakkam. About 40 families have been developed as a trial in Forest Campus, Coimbatore for further experimentation.

Project 5: Characterization of tropical and temperate forest seeds with reference to seed storage behavior (Funding Agency: SIDA, Sweden) [IFGTB/EF-RP-10/2003-2006]

Findings: Seed storage behaviour of *Azadirachta indica*, *Persea macrantha*, *Bambusa arundinacea*, *Artocarpus heterophyllus*, *Myristica dactyloides*, *Strychnos nux-vomica*, *Vateria indica*, *Hopea parviflora*, *Embelia ribes*, *Garcinea gumigutta*, *Myristica fragrance*, *Pithcellobium dulce*, *Hydnocarpus alpine* and *Smilax zeylanica* was studied. The germination and storage methods were developed for these species. The seeds were characterized for physical and biochemical traits. The relationship between the seed characters and the ecological characters was studied.

Project 6: Evaluation of superior planting stock of *Acacia mangium* in agroforestry systems at different eco-climatic zones of Kerala and Tamil Nadu [IFGTB/EF-RP11/2003-2006]

Findings: Experimental plots of 2 ha in Tamil Nadu and 2 acres in Kerala have been laid out with seedlings raised using the seeds collected from identified superior trees of *Acacia mangium* (Mangium) in Panampalli, Kerala as well as from Theni, Tamil Nadu along with ramets of superior trees of Mangium were procured from Mysore Paper Mills. Growth data was recorded during the first year. Studies on intercropping of fodder sorghum under one-year-old Mangium based agroforestry system revealed

that on per plant basis there was no difference in height growth as well as dry matter production of fodder sorghum under open field and under mangium based agroforestry system. However, yield of fodder sorghum was slightly higher under open field than under mangium owing to the difference in the total number of plants under open and mangium plot. Among different agricultural crops intercropped with mangium, blackgram, horsegram, fodder sorghum and beans were found to be compatible and onion was observed to be less compatible. Since the biomass and productivity studies of the tree component and economics of cultivation can be estimated only at half the rotation of *Acacia mangium*, i.e., 3 years; extension has been sought from the funding agency.

Project 7: Establishment of agroforestry plantations with medicinal plants and trees for conservation, propagation and utilization [IFGTB/EF-RP-16/2003-2006]

Findings: Established about 4 ha of amla based agroforestry models in 10 farmers' fields with medicinal plants (*Withania somnifera*) and other agricultural crops like red gram, black gram, horse gram, tomato etc. In the amla based agroforestry models, economics of cultivation for various agricultural crops has been worked out and black gram model gives higher economic return to the farmers.

Withania was intercropped under different agroforestry systems and the results showed amla-based agroforestry system registered maximum tuber yield. Effect of different spacing of *Withania* was assessed and the results showed variation in tuber yield under different spacing. Further, in the established amla based agroforestry plots imposed various treatments viz. organic manures like FYM, vermicompost and mulching treatments and assessed the growth performance.

Also, established 2 ha of pungam and neem based agroforestry plots with quality planting material of identified superior parent trees. The effect of pruning on agricultural crop yield under neem based agroforestry has been carried out in five year old neem plot which showed that 100 per cent pruning increased the annual crop yield by 40% compared to shade.



Enhanced intercropping opportunity through canopy management under five years old neem based agroforestry system

Project 8: Development of integrated pest management package for forest nursery insect pests of some economically important tree species (Funding agency: Department of Science and Technology, Government of India) [IFGTB/EF/RP13/2003-2006]

Findings: Identified and standardized integrated pest management measures to develop management package for forest nursery insect pests of some economically important tree species.

First report in India about the incidence of an invasive insect pest *Leptocybe invasa* Fisher and La Salle (Hymenoptera: Eulophidae) in *Eucalyptus* plantations and nurseries in southern India was made besides assessing the nature and extent of damage in *Eucalyptus* clones in plantations.



Project 9: Exploitation of Mycorrhizal systems in the Nilgiri biosphere reserve areas in India [IFGT/EF-RP-15/2004-2007]

Findings: Different ECM and AM fungi collected from different forest ecosystems were identified to genus and species level. Species richness and species dominance of AM fungi in association with the rhizosphere of different host plants was also assessed and recorded. Mass production of different ECM fungi was done for screening experiments in glass house and nursery.

Mass culturing of dominant AM fungi with different host cover crops like Bajra, Maize, Ragi, Sorghum, Wheat and other leguminous plants in a glass house condition revealed that Maize was the most suitable host cover crop.

Screened the efficacy of both ECM and AM fungi on growth enhancement of shola and commercially important plantation species such as *Acacia mearnsii*, *A. melanoxylon*, *Eucalyptus globulus*, *E. grandis*, *E. tereticornis*, *Cupressus macrocarpa*, *Casuarina equisetifolia* and *C. junghuhniana* in nursery condition and the experiment revealed that the seedlings inoculated with mycorrhizal fungi had better growth performance over control.

PROJECTS CONTINUED DURING THE YEAR 2006-2007 (Externally Aided)

Project 1: Germplasm collection and production of improved planting stocks of *Terminalia chebula* Retz and *Terminalia bellerica* [IFGTB/EF-RP-25/2005-2008]

Status: Vegetative propagation in *Terminalia chebula* and *T. bellerica* was attempted through rooting of branch cuttings, *in situ* air layering, grafting (wedge grafting) and budding. Seedlings of both the species were raised in nursery and used as root stock for grafting. Effect of biofertilizers on seedling growth in nursery has been studied. Selection criteria for plus tree selection for fruit yields and quality have been standardized. Methods for estimation of medicinally active major biochemical compounds have been standardized.



Wedge grafted plants of *Terminalia bellerica*

Project 2: Reproduction and Population Structure in *Bruguiera* and *Ceriops*: Implication on Conservation [IFGTB/EF-RP-26/2005-2008]

Status: Studies on reproductive aspects have been initiated in two sites namely Pitchavaram and Rameswaram in Tamil Nadu.

Project 3: Genome evaluation and characterization in *Casuarinas* and *Eucalyptus* for improving productivity and conservation [BT/PR2981/Agr/ 16/223/2002; DBT funded/ 2003 2007]

Status: The project is aimed at developing specific markers for species and traits in *Eucalyptus* and *Casuarina*. Developed three species specific SCAR markers in *C. equisetifolia* and *C. junghuhniana*. In

E. tereticornis, the putative non adventitious root specific SSR marker was validated in provenances and its high correlation with non-rooting trait was ascertained. Further, allelic diversity of CCR gene (involved in the lignin biosynthetic pathway) was determined in the populations of *E. tereticornis* to identify high cellulose specific markers.

Project 4: Identification of broad spectrum antifungal proteins from elite medicinal plants for control of plant pathogens [BT/PR/3444/AGR/16/ 282/2002; DBT funded/ 2003 2007]

Status: An antifungal peroxidase was purified from leaf tissues of *Withania somnifera* by gel filtration, ion exchange and lectin affinity chromatography. The purified protein inhibited the hyphal extension of *Trichosporium vesiculosum*. The effect of the protein on hyphal cell wall was elucidated in SEM studies.

Project 5: Refinement of *in vitro* multiplication protocol for *Bambusa nutans* and *Dendrocalamus giganteus* [IFGTB/EF-RP-17/2004-2007]

Status: Multishoot cultures for two clones of *D. giganteus* and two clones of *Bambusa nutans* were established and high frequency continuous shoot multiplication through axillary bud proliferation was obtained. *In vitro* rooting procedures were refined to obtain high percentage of rooting and acclimatization in *B. nutans*. Indirect organogenesis was obtained in *D. giganteus* for continuous shoot production. Biochemical studies to identify the cause of shoot necrosis were conducted.

Project 6: Field Performance of Micro and Macro-Propagated planting stock of selected five commercially important Bamboo Species [IFGTB/EF-RP 18/2004-2007]

Status: Field demonstration trials were established in an area of 4.0 ha using micropropagated and conventionally raised plants of three species namely *D. strictus*, *D. stocksii* and *B. bambos*. The survival rates were observed. Two years old tissue culture raised plants were tested for shoot production and growth rates.

Project 7: Selection and clonal propagation of commercially important medicinal plants (Funding Agency: National Medicinal Plants Board, Government of India) [IFGTB/EF-RP 19/2004-2007]

Status: Rooting of branch cuttings of *Tinospora cordifolia* was carried out. Phytochemical analysis of the genotype from forest campus completed. Identification of alkaloids, flavanoids and saponins completed. Identification of carbohydrates, proteins, phenols, steroids and tannins etc. was completed. Rooting trials of *Terminallia bellerica* were carried out.

Project 8: Germplasm conservation and establishment of seed stands for production of quality seeds and seedlings [IFGTB/EF-RP-9/2003-2007]

Status: The accessions of 10 medicinal plants assembled and seed stand established under the project are being maintained in the nursery.

Estimation of active principles in *Gymnema sylvestre*, the biochemical screening of secondary metabolites from the gene bank was investigated. The main component in the accessions namely gymnemic acid content was estimated. Significant variations were observed.



Project 9: Eco restoration for Tsunami devastated coastline of Andaman Group of Islands (Funding agency: Department of Biotechnology, Government of India) [IFGTB/EF-RP 20/2004-2007]

Status: To stabilize the vulnerable coastline and to provide employment opportunities to the Tsunami victims and the villagers, the Department of Biotechnology sponsored the project with a target of planting 60 ha area with *Casuarina equisetifolia* in Andaman Group of Islands. The research input is provided in the establishment of nurseries and for the improvement of *Casuarina* seedlings. This year 24.7 ha area is planted in different islands of North Andaman, Middle Andaman and South Andaman. In total so far 31.2 ha has been covered under *Casuarina* plantation. Training imparted to the staff of Forest Department of Andaman Nicobar Islands for production of improved seedlings of *Casuarina*. Employment was generated through various activities.



Casuarina Plantations along the coast at Casuarina Bay (North Andaman)



Plantation near the residential area on the coast at Long Island (Middle Andaman)



Embankment Plantation at Sippighat (South Andaman)



Disbursing wages to the beneficiaries at Casuarina Bay (North Andaman)

Project 10: Establishment of bamboo model plantation in different agro climatic regions of Tamil Nadu using quality planting stock (Funding Agency: Department of Biotechnology, Government of India) [IFGTB/EF-RP- 21/2005-2008]

Status: Quality planting stock in the form of seedlings, macro propagated and tissue culture raised plants of 7 bamboo species viz., *Bambusa balcooa*, *B. vulgaris*, *B. bambos*, *B. nutans*, *B. tulda*,

Dendrocalamus strictus and *D. stocksii* are maintained from various sources. Land offered by farmers for raising of bamboo plantations based on advertisement in local dailies was undertaken for 20 ha in four districts of Tamil Nadu namely Coimbatore, Karur, Cuddalore and Salem apart from the land offered by the Forest Department in Puducherry. After completing field preparatory works including application of farmyard manure and vermicompost, etc., planting was carried out. Tenders have been floated for supply of TC plants for all seven bamboo species and seedlings of *Bambusa bambos* and *Dendrocalamus strictus* are being raised for 2007-2008 planting.

Project 11: Development of yield assessment methods for *Eucalyptus* species and *Anacardium occidentale* using Image analyzer (Funding agency: Tamil Nadu Forest Plantation Corporation-TAFCORN) [IFGTB/EF-RP- 22/2005-2007]

Status: Digital camera was used to estimate basal area of *Eucalyptus* pulpwood plantations. Image of the plantations were taken with flash after sunset. The image profiles were analyzed for RGB values at breast height. The relationship between the light reflectance and the ground distance was analysed. The light reflectance spectrum was analysed as peak values and curve structure. Preliminary studies showed that the basal area could be estimated with an average of 5% deviation from the actual basal area.



Image of *Eucalyptus* plantation taken using SLR digital camera for estimation of basal area measurement

Project 12: Bamboo Location Trials (BLT) (Funding Agency: National Mission on Bamboo Applications (NMBA); Technology, Information, Forecasting and Assessment Council (TIFAC); Department of Science and Technology, Government of India) [IFGTB/EF-RP 23/2005-2007]

Status: Multilocal trials involving 8 species of bamboos viz., *Bambusa bambos*, *B. balcooa*, *B. nutans*, *B. tulda*, *B. vulgaris*, *Dendrocalamus asper*, *D. hamiltonii* and *Guadua angustifolia*, and trials on micro and macro propagated plants, on nutrient management and on organic v/s inorganic farming methods were carried out. The survival rate and the growth performance of different bamboo species at 3 months and 6 months after planting was collected and documented.

Project 13: Development of post harvest techniques for seed production in *Jatropha curcas* [IFGTB/EF-RP24/2005-2008]

Status: Flowering and fruiting phenology studies indicated that *Jatropha curcas* has high reproductive efficiency with reference to the selected locality, Anaikatti. Fruits at yellow stage gave significant germination indicating the attainment of physiological maturity. Studies on effect of fruit colour (maturity) oil content and quality showed that the colour of the fruits processed for oil extraction had



considerable effect on oil characteristics. The results indicate that fruits need to be harvested at yellow stage or when turning black and is safer to avoid collecting fruits at dry stage. Studies on effect of drying method on *Jatropha* oil showed that sun drying proved best for oil recovery and black pulpy fruits responded well for this method of drying. Both Iodine No. and Peroxide value were significantly high in oven drying method indicating detrimental effect on oil and tendency towards rapid rancidification. It is safer to adopt sun and shade drying methods where the oil characteristics are not affected by drying methods. To understand the efficacy of seed coat removal the oil content in shell, kernel and seed as a whole were determined. Studies revealed that shell has very negligible quantity of oil and it is the kernel that contributes the maximum oil content.

NEW PROJECTS INITIATED DURING THE YEAR 2006-2007

(Externally Aided)

Project 1: Differential analysis of transcript expression in *Casuarina: Trichosporium* interaction to isolate defense related genes (Funding Agency: DBT/2006-2009) [BT/PR/5943/AGR/16/531/2005]

Status: Differential display of mRNA was conducted on pathogen elicitor treated and untreated calli of *C. equisetifolia* to identify transcripts specifically expressed during pathogenesis. Sequencing of specific fragments showed the expression of transcripts like Resistance (R) gene, Phenylalanine Ammonia Lyase (PAL) and arabinogalactan protein genes during pathogenesis.

Project 2: Infrastructure development of the Botanical Garden of the Institute of Forest Genetics and Tree Breeding and ex-situ conservation of selected Rare and Threatened species (Funding Agency: MoEF 2007)

Status: Infrastructure development activities are being initiated and 20 individuals of endemic and threatened species, *Phyllanthus narayanaswami* were collected from Ananthagiri Range of Visakhapatnam district and planted in botanical garden for the study of its performance.

Project 3: Bioproduction of secondary metabolites from *Aegle marmelos* (Funding Agency: NMPB) [2006-2009]

Status: Studies on callus induction from various explants were initiated. In the process, different explants of juvenile tissues namely leaf, hypocotyls, root, shoot were tested for callus induction. The explants were inoculated in media containing varying concentrations of different plant growth regulators. Mature leaf tissue collected from standing trees were also tried for callus induction. For qualitative and quantitative assessment of the biomolecules, preliminary screening of alkaloids, flavanoids, anthraquinones, tannins and phenolics were carried out in the leaf and root tissues.

Project 4: Establishment of seed production systems for NTFPs of Attapady Hills (Funding Agency: AHADS) [2006-2008]

Status: Discussions were held with the officials of AHADS regarding the land for planting and for establishment of the SPS. Seeds of *Caesalpinia sappan*, *Oroxylum indicum* and *Saraca asoca* were collected from Kerala and germination studies are in progress.

Project 5: Developing strategies for describing, testing and registering varieties of

forest tree species in India (Funding Agency: Protection of Plant Varieties and Farmers' Rights Authority) [2006-2008]

Status: Selected trial plots of *Eucalyptus camaldulensis*, *E. tereticornis*, *Casuarina equisetifolia* and *C. junghuhniana* were visited in the State of Tamil Nadu. Probable characters which can be used as descriptors for these species were identified. These characters include both vegetative and reproductive characters. The Leica QWin Version 1.0 software for Image analysis was upgraded into Leica QWin Version 3.0 for handling images up to 12 mega pixel size and to measure morphological traits and to digitally store the phenotypes for later reference.

Abstract: No. of Projects

	No. of projects completed in 2006-2007	No. of ongoing projects in 2006-2007	No. of projects initiated in 2006-2007
Plan Projects	5	12	3
External Projects	9	13	5
Total	14	35	8

EDUCATION AND TRAINING

Training Organized

1. Dr. B. Nagarajan and A. Nicodemus provided training on tree improvement to field staff of Tamil Nadu Forest Department on 8th and 9th January 2007.
2. Conducted five awareness programmes for farmers on 'Cultivation of medicinal plants under farm land conditions' in various villages in Theni district of Tamil Nadu state. About 200 farmers participated in the awareness programme and various resource persons from IFGTB delivered



Awareness programme to farmers and women self help groups on 'Importance of medicinal plants cultivation' under NMPB funded project



lectures on their respective fields related to medicinal plants cultivation under the National Medicinal Plants Board funded project.

3. Shri S. Saravanan, Scientist C delivered lecture on Tree Crop Interactions and Promising Agroforestry Models for Higher Returns Under Farmland, in the training programme organized for farmers from Pondicherry on 12th and 13th November 2006 at IFGTB.
4. Dr. C. Buvaneswaran, Scientist C delivered lecture on 'Agroforestry practices in coastal areas' on 24th November 2006 during the training to farmers organized by Pondicherry Forest Department in Pondicherry.
5. Dr. C. Buvaneswaran, Scientist C delivered lecture on "Agroforestry Systems for Sustainability" in the training programme on 'Tree Improvement and Productivity Enhancement' organized for officials of Tamil Nadu State Forest Department at IFGTB from 8th to 12th January 2007.
6. Shri M. Maria Dominic Savio, Scientist C conducted training programme on "Nursery Management" for the frontline staff of the Department of Environment and Forest, Andaman and Nicobar Islands at Long Island, Mayabunder, Diglipur and Hut Bay during April 2006.
7. Practical demonstration on "Nursery techniques and vegetative propagation" was organized for the Forest Ranger trainees of Tamil Nadu Forest Academy, Coimbatore during May 2006.
8. A training programme on "Nursery and plantation techniques for forest trees" was organized on 5th June 2006 as part of World Environment Day celebrations for the farmers from in and around Coimbatore in which 35 farmers participated.
9. A two day training programme on "Improved nursery practices and plant protection measures" was organized on 15th and 16th June 2006 for the officials of Andhra Pradesh Forest Department.
10. Nursery activities including vegetative propagation techniques was explained to the IFS probationers of 2005-2007 batch during their visit to IFGTB, Coimbatore during September 2006.
11. Shri M. Maria Dominic Savio, Scientist-C delivered a lecture on "Improved nursery techniques" to the staff of Puducherry Forest Department at Coimbatore on 13th November, 2006. Shri C.K. Jayachandran RA Gr. I (SG) and Shri G. Ponraj, Gr. I (SG) gave practical demonstration on nursery techniques and vegetative propagation the staff of Puducherry Forest Department at Coimbatore on 14th November 2006.
12. Shri M. Maria Dominic Savio, Scientist-C delivered a lecture on "Improved nursery techniques" to the farmers of Puducherry at Puducherry on 22nd November 2006.
13. Shri M. Maria Dominic Savio, Scientist-C delivered a lecture on "Selection of non mangrove species for bioshield programme" to the elected representatives of Panchayats of Nagapattinam and Karaikal on 28th November 2006 at Karaikal in a training programme organized by the M.S. Swaminathan Research Foundation, Chennai.
14. Shri K. Ravichandran, Assistant Silviculturist (General) gave a lecture on "Plantation Management" to the Forest Rangers of Tamil Nadu Forest Department, in the training programme on Tree Improvement and Productivity enhancement held from 8th to 12th January 2007.
15. Dr. C. Kunhikannan, Scientist-D delivered a lecture on 'Biodiversity of rain forest with special reference to Silent valley National Park' in Refresher course for Forest officials at State Forest Service College, Coimbatore on 11th July 2006.
16. Dr. B. Gurudev Singh, Scientist-E and Smt. R. Anandalakshmi, Scientist-C served as resource persons in the two day training programme at the farmers of Pondicherry held at IFGTB on 1st and 2nd August 2006 and presented the papers on Production of quality seeds and Seed collection, processing and storage of selected agroforestry species respectively.

17. Dr. B. Gurudev Singh was invited by TERI, New Delhi as resource person for training on “Neem selection, seed handling and propagation” on 5th and 6th July 2006.
18. Shri N.P. Mahadevan, Research Officer delivered a lecture on Seed collection, processing, germination and storage of selected medicinal species at the Office of the Conservator of Forests, Genetics Division, Tamil Nadu Forest Department, Bharathi Park Road, Coimbatore 641 043 on 6th February 2007 in the Medicinal Plants and Tree Growers' Meeting.
19. The Institute arranged the following training programmes for 6 college students from Tamil Nadu and Kerala states:
 - “Phytochemical aspects and instrumentation methods” during May and June 2006.
 - “Age correlated bioactivity of yellow oleander *Thevetia peruviana* yellow oleander” August to November 2006.
 - “Chemical profiles of *Cassia auriculata*: bioefficacy against pest and diseases” December to March 2007.
 - “Antogonistic Activity of seeds of *Pongamia pinnata*, *Ricinus communis*, *Datura alba* and their fatty acids” December to March 2007
 - “Essential oil of *Coleus forskohlii* roots: sentinels of plant defense” January to March 2007.
 - Analyzing the selected textile fibers for their chemical constituents and microscopical appearance from 23rd to 30th March 2006.
20. Conducted Project Trainings for 5 college students from Tamil Nadu on “Mycorrhizal Biofertilizers Techniques i.e. Isolation, Identification, Multiplication and Application”.

Training received

1. Dr. A. Balu, Scientist-E attended a training on Negotiating Strategies in Work Environment for Scientist organized by the Administrative Staff College of India (ASCI), Hyderabad, A. P., from 23rd October to 3rd November 2006.
2. Dr. V. Mohan, Scientist E attended training on “Intellectual Property Rights and World Trade Organization Related Issues” organized by the Administrative Staff College of India (ASCI), Hyderabad, A. P., from 30th October to 3rd November 2006.
3. Dr. A. Karthikeyan, Scientist C attended a training on Molecular Taxonomy of Fungi at Thapar University, Patiala, Punjab during 19th to 24th March 2007.
4. Dr. B. Gurudev Singh participated in the programme on “Negotiating Strategies in Work Environment for Scientists”, sponsored by DST, Govt. of India at ASCI, Hyderabad, from 23rd October to 3rd November 2006.
5. Smt. R. Anandalakshmi, Scientist C participated and presented a note on “Quality seed production for oil yield in *Jatropha curcas*” in the experts group discussion on Non-edible grade vegetable oils as a source of decentralized power production conducted by the Ministry of Non-Conventional Energy Sources at Rajaji Bhavan, Chennai on 24th April 2006.

PUBLICATION

Books

Sivakumar, V. B., Gurudev Singh, R. Anandalakshmi and K. Vanangamudi (2006): Seed pelleting for aerial seeding. In: K. Vanangamudi, N. Natarajan, A. Bharathi, R. Umarani, K. Natarajan and T. Saravanan (eds.). Advances in Seed Science and Technology, Vol.1. Recent Trends in Seed Technology and Management, Agrobios (India), Jodhpur, pp.241-245.

News Articles



1. Nicodemus, A. 2006. High yielding and drought tolerant casuarina. Science and Technology Supplement, *The Hindu* dated 31st August 2006.
2. Cost effective way to tackle mine spoils' published in Indian Express (Coimbatore Ed.) dated 16th December 2006.

CONSULTANCIES

1. Dr. C. Kunhikannan rendered his services as a team member for preparation of Catchment Area Treatment Plan for proposed bauxite mining areas in Arakku valley (Chitamgondi, Galikonda and Raktakonda) Vishakhapatnam district, Andhra Pradesh for APMDC under ICFRE consultancy.
2. Dr. C. Kunhikannan rendered his services as a team member for conducting Environmental Impact Assessment (EIA) of proposed bauxite mining areas in Arakku valley (Chitamgondi, Galikonda and Raktakonda), Vishakhapatnam district, Andhra Pradesh for APMDC under ICFRE consultancy.
3. Consultancy services were rendered to the MoEF to carry out mid term evaluation of the centrally sponsored scheme "National Afforestation Programme (NAP)" being implemented under the decentralized system of Forest Development Agency in Tamil Nadu and Kerala.

PATENTS

Patent titled "A process for *in vitro* plantlet production of the bamboo, *Oxytenanthera stocksii*" with the financial assistance from National Research Development Corporation, New Delhi was granted to the Institute of Forest Genetics and Tree Breeding, Coimbatore on 31st August 2006 for a term of 20 years.

CONFERENCES/MEETINGS/WORKSHOPS/SEMINARS/SYMPOSIA/EXHIBITIONS

Participation

National

1. Dr. A. Nicodemus participated in the Interactive Seminar on Technology Improvement on 12th and 13th December 2006 held at Biotechnology Research Centre, Tirupati (AP).
2. Dr. B. Nagarajan and Dr. V. Sivakumar participated in the Interactive Seminar on Technology Improvement on 21st and 22nd December 2006 held at Regional Forest Research Centre, Rajahmundry (AP).
3. Dr. B. Nagarajan, Dr. A. Nicodemus and Shri D.R.S. Sekar participated in the Seminar on "Increasing Forest Productivity: Genetic and Breeding Options" from 21st to 23rd February 2007 held at TFRI, Jabalpur.
4. Dr. A. Nicodemus, V. Sivakumar, M.T. Hegde, Kannan C.S. Warriar and A. Mayavel participated in the National level consultative meeting on DUS testing of forest trees on 27th and 28th February 2007 held at Tamil Nadu Agricultural University, Coimbatore.
5. Dr. N.V. Mathish and Dr. Modhumita Dasgupta attended "Safety Assessment and Regulations of GM Crops with a special focus on Cartagena Protocol on Biosafety" held on 2nd and 3rd August

2006 at TNAU, Coimbatore.

6. Dr. Modhumita Dasgupta attended “Safety Assessment and Regulations of GM Crops” held on 27th March 2007 at TNAU, Coimbatore.
7. Dr. N.V. Mathish and Dr. Modhumita Dasgupta attended National Seminar on “Patenting in Biotechnology” organized by Department of Biotechnology and NRDC, New Delhi on 26th October 2006 at Hyderabad.
8. Dr. Rekha R. Warriar participated as a resource person and delivered a lecture in the Indo-Korean Joint Seminar on “Secondary Metabolites Sources and Production Process” by Dept. of Biochem. and Biotechnology, Avinashilingam University and Department of Oriental Medicinal Material and Process, Kyunghee University, South Korea organized at the Avinashilingam University Coimbatore on 14th February 2007.
9. Dr. Rekha R. Warriar attended a conference on “ Nutraceuticals and the Future of Medical Science” organized by Dept. of Biochemistry, Kongunadu Arts and Science College, Indian Pharmacological Society of Biological Chemist, Nutrition Society of India at Kongunadu Arts and Science College, Coimbatore on 22nd and 23rd February 2007.
10. Dr. Modhumita Dasgupta delivered lecture on “Biotechnological tools for identification of desired traits for commercial application and genetic improvement” in compulsory training course for IFS officer on “Biotechnology for Forest Conservation” held at IWST, Bangalore from 15th to 19th January 2007.
11. S. Saravanan, Scientist 'C' participated and presented a paper on 'Economic Evaluation of Teak and Casuarina based agroforestry systems in western agro-climatic zone of Tamil Nadu' in the National symposium on 'Agroforestry for livelihood security, environment protection and bio-fuel production' held at National Research Centre for Agroforestry, Jhansi from 16th to 18th December 2006.
12. Dr. C. Buvaneswaran, Scientist 'C' attended and presented a paper on 'Superior Planting Stock Production in Pungam (*Pongamia pinnata* L. Pierre)' in the national level seminar on 'Tree improvement for sustained productivity' from 4th to 6th November 2006 at JNKVV, Jabalpur.
13. Dr. C. Buvaneswaran, Scientist 'C' attended and presented a paper on 'Tree improvement for carbon sequestration' in the regional conference on 'Production forestry and carbon sequestration' on 14th and 15th November 2006 organized by ATREE, Bangalore.
14. Shri. R.S.C. Jayaraj, IFS, Silviculturist, Dr. C. Buvaneswaran, Sc-C and Shri. S. Saravanan, Sc-C attended the 'National Workshop on Tree Cultivation on Private Lands' organized by the Tamil Nadu Forest Department on 24th and 25th February 2007 at Chennai.
15. Dr. A. Balu, Scientist E attended and acted as a resource person and delivered a lecture on “Insect Pest Problems of Plantation Forestry and Their Management” in the interactive seminar for senior level officers of AP Forest Department held at Rajahmundry on 22nd and 23rd December 2006.
16. Dr. A. Balu, Scientist E participated as a resource person and delivered a lecture on “Biological control of Forest Insect pests in the training Range Officers of Tamil Nadu Forest Department on Tree improvement and productivity enhancement organized by the Institute from 8th to 12th January 2007.
17. Dr. A. Balu, Scientist E attended and acted as a resource person and delivered a lecture on Procedural formalities for filing application conduct of inspection and lab analysis and issue of



PSC for export of plants and plant based products in the Seminar cum Discussion Meet on Export of Agricultural Commodities organized by the Tamil Nadu Agricultural University and Michigan State University, USA. on 26th March 2007.

18. Dr. S. Murugesan, Scientist E and Dr. K. Panneerselvam, Scientist-B attended the National seminar on "Convergence of Technologies for organic horticulture" on 20th and 21st July (two days), organized by South Indian Horticultural Association (SIHA) and Tamil Nadu Agricultural University, Coimbatore. Sponsored by National Centre for Organic Farming, Ghaziabad, National Horticultural Board, Guragon.
19. Dr. S. Murugesan, Scientist E attended the Seminar on "Agilent Technology Food Safety (Agilent Asia-Pacific-Food safety Seminar) held at Le Royal Meridian, Chennai on 23rd July 2006.
20. Dr. S. Murugesan, Scientist E attended the Seminar on "Preparation of Samples for HPLC" on 28th July 2006 held at Residency, Coimbatore.
21. Dr. S. Murugesan, Scientist E attended the VII Annual Discussion Meeting in Entomology on "Semiochemicals in Crop Protection: Ongoing Technologies" on 2nd December 2006, at Chennai, organized by Prof. T.N. Ananthakrishnan, Ex-Director of ZSI and Entomology Research Institute, Chennai. He presented a paper on "Exploiting Chemical Ecology for sustainable pest control against forest pests.
22. Dr. S. Murugesan, Scientist E delivered lecture on "Role of Chemical Ecology in HPR" for CAS training Course (20th January 2007) on "Recent advances in HPR to insects and mite Pests" from 3rd to 23rd January 2007 by Centre of Advanced Studies in Entomology, TNAU, Coimbatore.
23. Dr. S. Murugesan, Scientist E and Dr. K. Panneerselvam, Scientist-B attended Indo-Korean joint seminar on "Secondary Metabolites sources and production process" by Dept. of Biochem. and Biotechnology and Department of oriental Medicinal Material and process, Kyunghee University, South Korea on 14th February 2007.
24. Dr. S. Murugesan, Scientist E and Dr. K. Panneerselvam Scientist-B attended the National Conference on "Nutraceuticals and the future of Medical Science" organized by Dept. of Biochemistry, Kongunadu arts and Science College, Indian Pharmacological Society of Biological Chemist and Nutrition Society of India.
25. Dr. S. Murugesan, Scientist E and Dr. K. Pannerselvam, Scientist-B, attended the UGC sponsored National Symposium on "Need based Modern Trends in Ethno Medicine Research (Ayush Remedies-2007) organized by the PG and Research Dept of botany, Kongunadu arts and Science College, Coimbatore.
26. Dr. V. Mohan, Scientist E participated in "Task Force/ Brain storming session on Integrated Nutrient Management (INM) in and other crops" held at Kerala Forest Research Institute (KFRI), Peechi, Kerala on 10th August 2006.
27. Dr. V. Mohan, Scientist E participated and presented the highlights of the research work and the new project proposals in the RAG meeting held at IFGTB, Coimbatore during 22nd August 2006.
28. Dr. V. Mohan, Scientist E, participated and presented the paper on "Factors influencing resistance / susceptible to diseases" and conducted the Proceedings of the session in the National Conference on "Molecular Pathogenesis" organised by the Karpagam Arts and Science College, Coimbatore on 15th and 16th September 2006.
29. Dr. V. Mohan, Scientist E participated and delivered a Lead Lecture on "Disease problems and

their management in nursery and plantations of South India” in National Conference on “Recent Trends in Mycological Research” and “33rd Annual Meeting of the Mycological Society of India” held at JJ College of Arts and Science, Pudukkottai, Tamil Nadu on 28th and 29th December 2006.

30. Dr. V. Mohan, Scientist E, participated as a Resource Person and delivered a Lecture on “Identification and selection of research problem and preparation of thesis” in National Seminar on “Research Methods in Biological Sciences” held at Dr. G.R. Damodaran College of Science, Coimbatore, Tamil Nadu on 9th and 10th January 2007.
31. Dr. V. Mohan, Scientist E participated as a Resource Person and delivered a Lead Lecture on “Biodiversity of mycorrhizal flora in the Nilgiri Biosphre reserve area of South India” in Workshop on Perspectives of Biodiversity Conservation: Status of species richness in protected areas” sponsored by the Ministry of Environment and Forests, Govt. of India, held at Kongunadu Arts and Science College, Coimbatore-29, Tamil Nadu on 8th and 9th February 2007.
32. Dr. Prasanth Jacob, Scientist-D participated as a resource person and delivered a lecture on “Insect problems in nurseries and their control” in the Training Programme on Improved Nursery Technique/Plant protection measures in nursery to forest officials of Andhra Pradesh Forest Department conducted at IFGTB, Coimbatore. (June 2006).
33. Dr. Prasanth Jacob, Scientist-D participated as a resource person on and delivered a lecture on “Insect pests of forests and their management” in the one day Seminar on Animal Behaviour at Kongunadu Arts and Science College, Coimbatore (September 2006).
34. Dr. Prasanth Jacob, Scientist-D participated as a resource person and delivered a lecture on “Insect problems in nurseries and their control” in the Training Programme on Tree Improvement and Productivity Evaluations to forest officials of Tamil Nadu Forest Department conducted at IFGTB, Coimbatore (December 2006).
35. Dr. Prasanth Jacob, Scientist-D participated as a resource person and delivered a lecture on “Insect problems in nurseries and their control” in the Interactive Seminar for senior level Officers of Andhra Pradesh Forest Department conducted at Warrangal (December 2006).
36. Dr. K. Panneerselvam attended the Herbal conference held from 14th to 16th April 2007 at Tamil Universtiy, Tanjore.
37. Shri.R.Raja Rishi, R.O. participated in the exhibition conducted at TNAU on the occasion of 8th Agriculture Science Congress from 15th to 17th Feb.07.
38. Shri R.S.C. Jayaraj IFS, C.F. attended the training programme on Financial Management and Audit Sensitization at the National Academy of Audit and Accounts, Shimla from 17th to 21st July 2006.
39. Shri R.S.C. Jayaraj IFS, C.F. attended the workshop on Standardization of remote sensing and GIS techniques for reporting on the wildlife areas of South East Asian countries conducted by WWF India, at Ooty, Nilgiris on 31st August 2006.
40. Shri R.S.C. Jayaraj IFS, C.F participated in the training cum workshop on “Integrating conservation and development” conducted by WWF- India at New Delhi on 8th and 9th November 2006.
41. Shri. R.S.C. Jayaraj IFS, C.F and Shri. M. Maria Dominic Savio, Scientist C participated in the National Workshop on Bamboo Location Trials, Bambusetum and Propagation held at Kerala Forest Research Institute, Peechi held on 21st and 22nd December 2006.



42. Shri R.S.C. Jayaraj IFS, C.F attended the National workshop on “Tree culture outside forest” organized by the Tamil Nadu Forest Department at Chennai on 24th and 25th February 2007.
43. Smt. R. Anandalakshmi, Scientist-C participated and presented a note on Quality seed production for oil yield in *Jatropha curcas* in the experts group discussion on “Non-edible grade vegetable oils as a source of decentralized power production” conducted by the Ministry of Non-Conventional Energy Sources at Rajaji Bhavan, Chennai on 24th April 2006.
44. Dr. C. Kunhikannan, Scientist-D attended the National Seminar on Environmental Health: New Challenges in Human Rights held at N.S.S. College, Nenmara, Palakkad District, Kerala on 19th and 20th June 2006 and presented a paper “Solid waste management: status and strategies”.

International

1. Dr. K. Palanisamy, Scientist E participated in an International Symposium on Tree Breeding at Korea Forest Research Institute, Suanbo, South Korea on 15th to 16th June 2006 and delivered special lecture on Tree Improvement in India.
2. Dr. S. Murugesan, Scientist E attended the International Conference on “3rd Nutraceutical Summit” from 15th to 17th November organized by CFTRI, Mysore with MM Activ-Sci-Tech Communication Co. and CSIR at Mumbai.

AWARDS

Dr. N.V. Mathish was awarded fellowship by the Department of Biotechnology, Ministry of Science and Technology, under the scheme “Specialized training of young scientists in niche areas of biotechnology” to pursue a project on “Development of post-transcriptional gene silencing approaches as a tool for the functional analysis of symbiotic genes in the tropical actinorhizal tree *Casuarina glauca*” at the Institute de Recherche pour le Developpement (IRD), Montpellier Cedex 5, France for one year.

DISTINGUISHED VISITORS

1. Shri M. Selvaraj, Hon'ble Minister of Forests, Govt. of Tamil Nadu inaugurated the Microscopic Laboratory in the Institute and also visited the Gass Forest Museum on 10th July 2006.
2. Shri Hans Raj Josan, Hon'ble Minister of Forests, Govt. of Punjab visited the Institute on 14th October 2006.
3. Dr. S. Nagarajan, Chairperson, PPV & PRA, New Delhi visited the Institute on 29th August 2006.
4. Shri G.K. Prasad, IFS, DG (Forests) and Special Secretary, Govt. of India visited the Institute on 19th January 2007.
5. Prof. V.L. Chopra and Shri B.N. Yugandhar, Members of Planning Commission, Govt. of India visited the Institute on 15th February 2007.

MISCELLANEOUS

Sports

Smt. V. Banumathy, LDC won Gold Medals both in womens classic and rapid chess events during XV All India Forest Sports Meet held at Jaipur, Rajasthan from 6th to 10th February 2007.

Service Rendered

Plants and plant products slated for export were examined and subjected to the appropriate quarantine measures. About 247 Phyto-sanitary Certificates were issued to various organizations and individuals.

Insect pest problem in casuarina plantation referred by the Andaman Forest Department was investigated and suitable management practices were suggested.

Maintenance of Seed Bank

1. Seeds of various important species viz. *Acacia auriculiformis*, *A. mangium*, *Casuarina equisetifolia*, *Eucalyptus camaldulensis* and *E. tereticornis* etc. were collected from CPTs, SSPA/SSO/CSO/ Provenance Trial Plots at different localities of Tamil Nadu, Andhra Pradesh, viz. Panampally, Pudukottai, Pondicherry, Sadivayal, Tholpetty etc. About 55 kg seeds of the above species were supplied to other divisions of the Institute, SFDs, Paper mills and NGOs on request and on payment and revenue of about Rs.2.64 lakhs was earned for the Institute.
2. Seed testing for viability, seed count, and purity were conducted and provided the test results to various clients and researchers.

