

## CHAPTER 3.2

# Institute of Forest Genetics and Tree Breeding Coimbatore

The Institute of Forest Genetics and Tree Breeding (IFGTB) is a national institute formed in April 1988 under the Indian Council of Forestry Research and Education (ICFRE), an autonomous Council under the Ministry of Environment and Forest, Government of India. It was formed by up-gradation of the Forest Research Centre (FRC), Coimbatore under the Forest Research Institute and College, existing since 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.

## PROJECTS COMPLETED DURING THE YEAR 2005-2006

### **Project 1: Genetic variability and selection in natural population of *Artocarpus* spp. [IFGTB/RP1/2000-2006]**

**Findings:** Natural populations of *Artocarpus integrifolia*, *A. hirsuta* and *A. lakoocha* have been identified in Tamil Nadu and Kerala. Within population variation are being compared between populations.

A progeny trial of selected trees in different populations of *A. integrifolia* was raised in Kolli hills. A Seed Production Area (10 ha) of *A. hirsuta* has been established at Palode (Kerala). Isozyme standardisation was done for two enzymes. Genetic distance was calculated between identified populations of *A. integrifolia*. The natural regeneration status of all three *Artocarpus* spp. was studied at Topslip area.

### **Project 2: Evolving Clonal Propagation Technology for Teak to Improve Productivity [IFGTB/RP2/2000-2006]**

**Findings:** Clonal propagation technology for superior Teak trees and clonal seed orchard seedlings has been developed. Superior Teak trees with good stem form, height and girth were selected in different locations of Kerala and being multiplied clonally and assembled in the clone bank. The rooting performance of different Teak clones has been studied. Field trials were established with improved planting stock of Teak in Kerala and Tamil Nadu and evaluated. The growth performance were assessed. A clonal trial of Teak established at Nilambur (Kerala) was evaluated and compared with the traditional plantation raised through Teak stumps.

### **Project 3: Selection of potential mycorrhizas and other beneficial microbes for the reclamation of bauxite mine spoils [IFGTB/RP10a/20022005]**

**Findings:** Tree species such as *Acacia auriculiformis*, *Casuarina equisetifolia*, *Eucalyptus camaldulensis* and *E. tereticornis* were raised successfully with mine spoils as a potting medium with the biofertilizers amendment of (*Arbuscular mycorrhiza*) AM and other microbes. Thereafter, the seedlings were directly transplanted (1.5 acre) at bauxite mine spoils Yercaud for reclamation.



The growth and survival of the seedlings is found satisfactory. The biomass of the seedlings also recorded increase due to nutrient supply from the biofertilizers. This technique is cost effective for reclamation of mine spoils without using top soils.

#### **Project 4: Study on market dynamics relating to important non timber forest produce in Tamil Nadu [IFGTB/RP19/2002-2006]**

**Findings:** Information on collection, quantity, marketing structure, middleman role etc were gathered from 18 LAMPS' from the past 12 years data with information on socioeconomic details of local tribal people who are dependent on NTFP collection and related activities. Details of NTFP production, sale and participation of VFC and NTFP seedlings planted under JFM activities have been collected from Madurai, Coimbatore and Salem divisions.

### **PROJECTS CONTINUED DURING THE YEAR 2005-2006**

#### **Project 1: Genetic improvement of *Eucalyptus tereticornis* through control hybridization and molecular characterization [IFGTB/RP3/2002-2005]**

**Status:** Controlled pollination experiment was conducted in a control selfed *E. tereticornis* family pollen parent of *E. saligna* was control pollinated with *E. tereticornis* and five hybrid families have been harvested. Two full sib trials (28 months old) have been evaluated and 15 hybrids in combinations of *E. tereticornis* x *E. pellita*, *E. tereticornis* x *E. grandis* and *E. tereticornis* x *E. alba* have been selected for clonal propagation.

#### **Project 2: Enhancing productivity in *Casuarina* sps. through inter-provenance and inter-specific hybridization [IFGTB/RP30/2003-2008]**

**Status:** Inconsistency in rooting of matured cladode cuttings from 10 years old trees of *Casuarina junghuhniana* sub sp. *timorensis* was overcome by coppicing and pollarding selected trees and rooting coppice shoots with 80-90% success. Rooted cuttings are assembled in a potted orchard and involved in inter-provenance and interspecific control pollination experiments. Evaluated open pollinated progeny of hybridization orchard in field tests for growth, form and flowering traits and identified putative interspecific hybrids.

#### **Project 3: Estimation of gene diversity and enhancing seed production in seedling seed orchards of *Eucalyptus*, *Casuarina*, *Acacia* and *Teak* [IFGTB/RP31/2003-2008]**

**Status:** Fertility studies were taken up in Acacia and Eucalyptus orchards established at different locations for the second successive year. In the moist location at Panampalli in Kerala, *E. camaldulensis* showed a high proportion of fertile trees whereas *E. tereticornis* had low proportion of fertile trees. In the dry site at Pudukkottai in Tamil Nadu, proportion of fertile trees was low in both *E. camaldulensis* and *E. tereticornis*. In *Acacia auriculiformis*, 60% of the trees effectively contributed in seed production at Panampally whereas only 12% of the trees contributed in effective seed production at a comparatively dry location (Sadivayal) in Tamil Nadu.

#### **Project 4: Genetic transformation of Eucalyptus and Casuarina to enhance salinity tolerance [IFGTB/RP6/2002-2005]**

**Status:** Superior genotypes identified were screened for *in vitro* regeneration responses. Clones showing the highest and lowest response for axillary bud induction were identified. Different parameters determining optimum cocultivation conditions for introduction of Osmotin gene in *Eucalyptus tereticornis* were assessed. Hypocotyl tissues of Casuarina were assessed for *in vitro* regeneration response in different plant growth regulator combinations.

#### **Project 5: Isolation of somaclonal variants of *Casuarina equisetifolia* for salinity tolerance [IFGTB/RP8/2002-2007]**

**Status:** *Casuarina equisetifolia* appeared to be recalcitrant to the somatic embryogenesis. Several media and hormone combination tested for obtaining regeneration of callus. Increasing concentration of Cytokinins (BAP and Kinetin) upto 5.00 ppm also failed to regenerate the callus. Fresh inoculation carried out for obtaining callus for regeneration and screening experiments. 72 hrs of treatment resulted in death of the callus in all the treatments. Screening of callus tissues in the salt/ sea water containing media continued.

#### **Project 6: Identification, isolation, evaluation and mass production of native fungi for the management of teak and ratalna stem borers [IFGTB/ RP21/2002-2007]**

**Status:** Four isolates of entomopathogenic fungi (3 isolates trapped from the soil samples and 1 isolate from the cadaver) were identified authentically as *Beauveria bassiana* ( 2 isolates), *Trichoderma harzianum* (1) and *Paecilomyces variotii*(1).

Out of 15 isolates of entomopathogenic fungi so far obtained, 7 of them (5 trapped from the soil samples and 2 isolates from the infested cadavers) were selected as potential through lab tests against the targeted pest *Indarbela quadrinotata* and *Sahydrassus malabaricus*.

The seven potential isolates were also tested for pathogenicity on the third targeted pest teak stem borer *Alcterogystica cadamiae* in lab condition and found none of them effective.

In order to understand the epidemiology of the promising isolates against the targeted insects in the field condition, a preliminary field level experiment in respect of *S. malabaricus* with *Clerodendrum viscosum* as a primary host plant was carried out. Spot application on the frass mat made by the insect at the entry hole and injection through the bore hole. The results indicated that the injection method was found effective resulting 100% mortality with all the three concentrations used. .

The 7 potential isolates (5 trapped from the soil samples and 2 isolates from the infested cadavers) at three different concentrations were also evaluated under field conditions on the targeted pest *Indarbela quadrinotata* with *Casuarina equisetifolia* as a host plant at a coastal plantation of Tamil Nadu and *Sahydrassus malabaricus* with teak as host plants at an inland plantation at Ranni Division Kerala.. In the case of *I. quadrinotata* the spore solution was



sprayed on the frass tunnel made by the larvae. The results indicated that the spore concentrations  $10^{10}$  and  $10^8$  were effective in controlling the pest causing 100% larval mortality. Where as the lower concentration  $10^6$  was less effective causing only 25% larval mortality.

In the case of *S. malabaricus* the spore solutions were applied by three different methods. The results indicated that the second and third methods were effective resulting 100% mortality with all the three concentrations used.

Standardized a method of mass production of entomopathogenic fungi on a cheaper media of coffee husk waste derived out of coffee fruits.

**Project 7: 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/RP22/2000-2005]**

**Status:** The possibility of using natural extracts of different tissues of *A. nilotica* to reduce insect damage, especially in the forestry insect pests and as antimicrobial activity by inhibiting mycelial growth of some of the fungal isolates. Comparative studies on testing of biopesticidal properties of hexane, methanol and ethyl acetate extracts of *A. nilotica* leaves, flower, pods, seeds and twigs at different doses were tested at different developmental stages. Of these, Hexane extract exhibited toxic effect and induced larval mortality due to larval weight loss, antifeedancy, ovicidal and pupal mortality in the case of teak defoliators. Twigs did not express any toxic effect in terms of antifeedant and other biological properties. The possible factor relating to the lower survival and reduced growth of larvae are due to the antibiotic effect of some secondary metabolites. The present investigation considerably substantiates the hypothesis that plant allelochemicals may have chronic effect on the growth of herbivores.

**Project 8: Testing and evaluation of selected existing control methods for key diseases of *Casuarina* spp. With reference to blister bark and root-rot [IFGTB/RP24/2002-2007]**

**Status:** Scheduled fungicide applications to the saplings at the experimental trials of *Casuarina equisetifolia* at Panampally, Kerala and *Casuarina junghuhniana* at Pondicherry were done and further surveys at periodical intervals for the occurrence of the targeted diseases blister bark caused by *Trichosporium vesiculosum* and root-rot caused by *Ganoderma lucidum* carried out at these trials.

Persistence of inoculated ecto- and endomycorrhizal fungi in the roots and rhizosphere soils of the treated saplings was analysed and found that the AM fungi associated well with the roots and the rhizosphere soils as compared to ectomycorrhizal fungi.

**Project 9: Natural Regeneration Studies on Important Trees in Silent Valley National Park, Kerala [IFGTB/RP32/2004-2009]**

**Status:** Sample plots of 50 m x 50 m were laid out, four each in different ecosystems like forest and grasslands, and one in Forest Grassland Ecotone at Sairandri area in Silent valley National Park for the study of natural regeneration of trees

of Silent valley. Observations on number of individuals of trees, seedlings and saplings, their Girth at Breast Height (GBH) of trees, etc. was recorded for trees species. Initial observations revealed that natural regeneration of dominant evergreen species are well except for few species. Edge species regenerate well in grasslands.

## NEW PROJECTS INITIATED DURING THE YEAR 2005-2006

### **Project 1: Evolving silvicultural practices for *Casuarina junghuhiana* ssp. *timorensis* [IFGTB/RP 33/2005-2009]**

**Status:** The project envisages evolving silvicultural techniques for *Casuarina junghuhiana* ssp. *timorensis* in terms of both nursery and plantation techniques. To study the nursery requirements of the species 59 seed lots weighing around 115 kg were collected from identified trees from Panampally, Sadivayal and Pondicherry. After processing of the fruits around 5.75 kg seeds were obtained. Seeds have been sown in the nursery beds for carrying out various nursery trials to assess the potting media requirements, container requirements as well as bio fertilizer requirements of the species.

### **Project 2: Studies on seed handling and storage behaviour of important NTFP species [IFGTB/RP 34/2005-2008]**

**Status:** Fruits of *Calophyllum inophyllum* were collected at different maturity stages from Courtrallam area and tested for germination capacity. Germination test was conducted on sand medium in the nursery beds during the month of September. Stony seeds significantly recorded the highest germination compared to other maturity stages.

Mature fruits collected from Anaikatti during November were also tested for germination after depulping. Pretreatments with various media soaking in cowdung slurry were imposed and compared with control. Germination percentage were recorded by the pretreatments respectively while control showed 100% germination. Studies indicate that yellow-green stage of fruit maturity favours germination without any pretreatment requirement for *Calophyllum inophyllum*.

Fruits of *Decalepis hamiltonii* were collected, germination studies are being carried out.



Gradation in fruits of *Calophyllum*  
(green, black and bat eaten fruits)



### **Project 3: Status and Floristic Diversity of Sacred Groves The Only Remnants of Natural Forests in Alappuzha District, Kerala [IFGTB/RP35/2005-2008]**

**Status:** Enumerated 292 sacred groves, covering 25 villages. Considerable variations were observed with respect to extent of these groves and species composition. A total of 125 species (Trees 64, Shrubs 46 and Herbs 15) of flowering plants belonging to 61 families were identified from these sacred groves.

### **Project 4: Studies on the diversity of bee fauna of the Nilgiris [IFGTB/ RP36/2005-2008]**

**Status:** Information on the study area was collected from the Divisional Forest Officers of the Nilgiri South, North and Gudalur Forest Division, Wildlife Warden, Mudumalai Wildlife Sanctuary and Mukurthi National Park. The extent of forest types, grasslands and forest plantations were collected from the forest offices. Obtained the necessary permission from the Principal Chief Conservator of Forests and Chief Wildlife Warden, Tamil Nadu Forest Department, Chennai, to carry out the fieldwork.

### **Project 5: Studies on the population structure and reproduction of *Pterocarpus marsupium* in Tamil Nadu and Kerala [IFGTB/RP37/2005-2008]**

**Status:** Initial reconnaissance surveys have been carried out in Siruvani forests of Coimbatore division to identify populations for long term phenological studies as well as for reproductive studies. The distribution of the species i.e its occurrence from the foothills up to 2000 mts altitude were carried out to assess the population structure.

### **Project 6: Identification of conserved motifs in genes conferring salt tolerance to develop strategies for gene isolation from salt tolerant tree species [IFGTB/RP38/2005-2008]**

**Status:** Data mining of both nucleotide and protein sequences of gene conferring salt tolerance was carried out. Thirty sequences of AtNHx and 5 sequences of Osmotin have been downloaded from available databases in the world wide web. Multiple sequence analysis of these sequences is being carried out to identify conserved regions in these gene sequences. A format for a structured database comprising 29 different fields for both the nucleotide and protein sequences has been designed for development of the database.

### **Project 7: Genetic improvement of *Acacia auriculiformis* through half-sib progeny selection [IFGTB/RP39/2005-2010]**

**Status:** Tree selection was carried out in two seedling seed orchards established by IFGTB at Karunya and Panampally. A total of 150 trees were selected based on stem form, branching habit and growth from these orchards. Single tree seed collections from selected trees were made during February and March 2006. Half-sib progenies will be raised through these single tree seed collections.



### **Project 8: Phenotypic selection, reproduction and propagation in *Ailanthus excelsa*: Perspectives for Safety Matches Industry and Farmers in Tamil Nadu [IFGTB/RP 40/2005-2009]**

**Status:** Reconnaissance survey has been completed in different agroclimatic zones of Tamil Nadu. A total of 125 phenotypically superior trees have been identified in different locations. Collection of phenological data, seeds/planting materials are being carried out from the different identified populations as well as from the Tamil Nadu Forest department plantations.

### **PROJECTS CONTINUED DURING THE YEAR 2005-2006 (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**

**Status:** Fertility difference between trees was estimated in four seed production areas and a natural stand of Teak in South India.



3 years Genetic gain trail of  
Casuarina - Sadivayal, Tamil Nadu



**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-RP6/2003-2006]**

**Status:** Two genetic gain trials each of Eucalyptus and Casuarina that were established in different locations to test the performance of seed collected from the seedling seed orchards were evaluated for the second year growth. Significant difference in growth between progeny of Eucalyptus orchards was observed at the dry site at Karunya in Tamil Nadu. The differences were not significant in the comparatively moist site at Dandeli. The difference between Casuarina orchard progeny was significant at Karunya but not at Pondicherry.

**Project 3: Evaluation of reproductive success in seed orchards of Teak in India (Funding Agency: International Foundation for Science, Sweden) [IFGTB/EF-RP8/2003-2006]**

**Status:** Fruit morphology was characterized through image analyzer and seed filling quantified to X-radiography for all the seed sources. Germination potential and seedling production in each seed source were determined through nursery experiments. Principal pollinators of teak were identified based on frequency of visit, foraging behaviour and pollen load carried by different species collected from seed orchards. Pollination by nectarivorous birds in Teak was reported for the first time.

**Project 4: Full sib production in selected high yielding Tamarind clones of Tamil Nadu (Funding Agency: Tamil Nadu Forest Department) [IFGTB/EF-RP14/2003-2006]**

**Status:** Control pollination programs were conducted in 30 high yielding Tamarind clones belonging to Vellore, Hasanur and Periakulam regions of Tamil Nadu. Hybridisation experiments to combine the red tamarind with high pulp yielding clones were carried out in five different agro climatic zones. Forty full sib control pollinated families have been harvested. A full sib progeny trial cum seedling seed orchard consisting six control-pollinated families was established during February 2006 at the State Forest Research Institute Campus, Kolapakkam in Tamil Nadu.

**Project 5: Germplasm collection and production of improved planting stocks of *Terminalia chebula* Retz and *Terminalia bellerica* [IFGTB/EF-RP-/2005-2008]**

**Status:** Reconnaissance survey was carried out to identify the populations of *Terminalia chebula* and *T. bellerica* in Kerala and Tamil Nadu. Vegetative propagation of both the species through branch cuttings has been attempted. Seed samples have been collected from five populations for raising seedlings and further characterization.

**Project 6: Reproduction and Population Structure in *Bruguiera* and *Ceriops*: Implication on Conservation [IFGTB/EF-RP-/2005-2008]**

**Status:** Studies on population structure and phenology were initiated in *Ceriops tagal* in Pitchavaram, Tamil Nadu. The species shows very patchy distribution, family structures are very rare. Flowering is noticed during April-May. Fruiting continues through October-November.



**Project 7: Genome evaluation and characterization in Casuarinas and Eucalyptus for improving productivity and conservation (Funding Agency: Department of Biotechnology, Government of India) [IFGTB/EF-RP5/2002-2005]**

**Status:** The project aimed at identifying DNA markers for economically important traits like adventitious rooting in cuttings and pulping trait in *Eucalyptus tereticornis*. Three putative RAPD markers and four specific SSR markers were identified in non-rooting clone of *E. tereticornis*. Two putative RAPD markers were also identified in 100% rooting clones. These putative markers will form the foundation for generating trait specific markers which in future will lead to marker assisted selections in improvement programmes.

**Project 8: Identification of broad spectrum antifungal protein from elite medicinal plants for control of plant pathogens (Funding Agency: Department of Biotechnology, Government of India) [IFGTB/EF-RP7/2003-2006]**

**Status:** In *Acorus calamus*, a Peroxidase belonging to the type III heme - dependent Peroxidase super family was identified using LC-MS MS. The tissue localization revealed the presence of the protein mainly in the epidermal tissues and lumen of xylem vessels of the leaf. The protein showed 37% sequence coverage with putative bacterial induced Peroxidase from *Oryza sativa*. The protein inhibited the hyphal extension of phytopathogens like *Trichosporium vesiculosum*, *Macrophomina phaseolina* and *Fusarium moniliforme*.

**Project 9: Refinement of *in vitro* multiplication protocol for *Bambusa nutans* and *Dendrocalamus giganteus* (Funding Agency: Department of Biotechnology, Government of India) [IFGTB/EF-RP17/2004-2007]**

**Status:** *In vitro* shoot proliferation methods for large-scale multiplication of mature clumps of *Bambusa nutans* and *Dendrocalamus giganteus* were developed. Nodal segments were inoculated and high frequency shoot multiplication cultures were established in the modified MS medium containing coconut milk. Anatomical studies showed the presence of preexisting root primordia in microshoots, hence based on the peroxidase activity and internal auxin concentration of microshoots, media composition was devised for the expression of roots. *In vitro* rooting was obtained in *D. giganteus* and excellent rooting was obtained in *B. nutans*. *In vitro* roots were produced after treating the shoots with Glucose and IBA followed by hormone free medium containing Sucrose.

**Project 10: Performance of micro and macropropagated planting stock of selected five commercially important bamboo species (Funding Agency: Department of Biotechnology, Government of India) [IFGTB/EF-RP18/2004-2007]**

**Status:** Field demonstration trials were established for micro and macropropagated planting stock of commercially important species of bamboos like *Bambusa bambos*, *Dendrocalamus strictus* and *Pseudooxytenanthera stocksii*. Growth data was recorded on the parameters like number of shoots, height of the tallest shoot, girth of the tallest shoot, number of internodes, internodal length of the tallest culm and number of newly produced culm per year. Survival percentage of the bamboo plants in the field after three months of planting was 85.5%. Initial observations showed that



the tissue culture raised plants of *O. stocksii* produce more number of shoots per culm followed by seed raised plants of *D. strictus*. Lowest number of shoots produced by the seedling raised plants of *B. bambos*. An average of 4 to 5 new culms were produced in one year time in all the species. Clonal collections of different bamboo species were assembled as germplasm garden.

**Project 11: Selection and clonal propagation of commercially important medicinal plants (Funding Agency: National Medicinal Plants Board, Government of India) [IFGTB/EF-RP19/2004-2007]**

**Status:** Work to standardize clonal propagation of medicinal plants initiated. Rooting of branch cuttings achieved for *Tinospora cordifolia*, *Terminalia bellerica* and *Aegle marmelos*. Collected cuttings of *Oroxylum indicum*, *Terminalia bellerica*, *Terminalia chebula*, *Saraca asoka* and *Phyllanthus emblica*. Experiments are in progress to standardize clonal propagation through rooting of branch cuttings obtained from Kerala forest areas.

**Project 12: Germplasm conservation and establishment of seed stands for production of quality seeds and seedlings (Funding Agency: National Medicinal Plants Board, Government of India) [IFGTB/EF-RP9/2003-2006]**

**Status:** Germplasm assemblage and seed handling - *Aegle marmelos* CPTs were identified in 14 new locations. Mature fruits were collected from the selected trees and seedlings raised and maintained in the nursery. Fruit parameters were recorded for 28 accessions. Seeds extracted from mature fruits collected from 28 CPTs were studied for variability. The seed physical traits like the 2D surface area, length, breadth, equivalent diameter, perimeter, roundness, aspect ratio and fullness ratio were measured using an image analyser (Leica Quantimet - QWin 500). The images of the seeds were captured using a CCD camera. The images were then calibrated to actual scale and measured using the software QWin.

Collected tubers of *Asparagus racemosus* from 9 new locations. Fruits collected from Punsai Puliamppatti were studied for seed parameters. Pretreatment study to improve seed germination in *Emblica officinalis* was conducted. Among 12 different pretreatments, soaking in a solution of 50 ppm Benzyl Amino Purine (BAP) and 1000 ppm Giberellic acid (GA<sub>3</sub>) for 24 hours improved the germination in Kurumalai source to 65%. Soaking in 1000 ppm GA<sub>3</sub> for 24 hours gave 47% germination in Kulipatti and 39% germination in Devikulam sources.

*Gymnema sylvestre* cuttings were collected from 8 different locations and rooted in the nursery without any growth regulators. The rooted seedlings were hardened and maintained in the nursery. Collected fruits of *Gymnema* from Dhimbhamb and studied for seed germination. Seedlings of *Rauwolfia serpentina* obtained are maintained in the nursery. The seedlings were often infected with scale insects which were controlled by regular chemical spraying. *Saraca asoca* seeds were collected in a selected tree at Kottakkal and raised about 500 seedlings. The plants were given nutrient drenching at regular intervals and hardened with proper care.

One tree of *Strychnos potatorum* was identified in Nellimalai near Mettupalayam, the root suckers were collected and maintained in the nursery. Pretreatment, moisture reduction and storage trials were also attempted. The seeds were found to possess physiological dormancy since they required growth regulator treatment for germination. Seeds did not tolerate desiccation and storage of fresh seeds in wet vermiculite prolonged seed viability. Cuttings of *Tinospora cordifolia* were collected from 8 different sources and propagated vegetatively. Effect of seed moisture and

storage temperature on germination of *Tinospora* was studied. Results showed that reducing seed moisture content to 5 % and storing at 10°C is the most ideal condition for storing *Tinospora cordifolia* seeds.

### **Establishment of Medicinal Plants Seed Production System**

Established seed production system for medicinal species in an area of about 1 ha at Anaikatti, Tamil Nadu. Hardened seedlings were transported from the institute nursery to the planting site, distributed according to the planned design and planted. In total, seedlings raised from 24 accessions of *Aegle marmelos*, 6 accessions of *Saraca asoca*, 18 accessions of *Asparagus racemosus*, 15 accessions of *Gymnema sylvestre*, 28 accessions of *Tinospora cordifolia* and 6 accessions of *Emblica officinalis* and 2 accessions of *Oroxylum indicum* were planted in randomized design.

### **Project 13: Characterization of tropical and temperate forest seeds with reference to seed storage behaviour (Funding Agency: SIDA, Sweden) [IFGTB/EF-RP10/2003-2006]**

**Status:** Seeds of *Persea macrantha*, *Hydnocarpus alpina* and *Azadirachta indica* were collected from different forests/ agro-climatic zones. Lowest safe moisture content and storage temperatures were assessed for each source. The viability status of each of these seedlots was assessed. Seeds of about 20 different species present in different forest types were collected and tested for their tolerance to liquid nitrogen temperature. The seeds were directly plunged into the liquid nitrogen for 1 hour and tested for viability. These seeds were also studied for moisture content and drying rate. Seed storage behaviour and germination methods for *Myristica dactyloides*, *M. fragrans*, *Strychnos nux-vomica*, *Embelia ribes* and *Symplocos cochinchinensis* were studied.

### **Project 14: Establishment of Agroforestry models with Medicinal Plants and Trees for Conservation, Propagation and Utilization (Funding agency: National Medicinal Plants Board) [IFGTB/EF-RP16/2004-2007]**

**Status:** Established about 4 ha of Amla based agroforestry models in 10 farmers' fields with medicinal plants (*Withania somnifera*), under farmland condition. Amla based agroforestry system registered maximum tuber yield of



Amla - Horse gram based agroforestry system in Coimbatore, District of Tamil Nadu



64 kg/acre. Effect of different spacing of Withania was assessed and the results showed that tuber yield varied from 31 to 76 kg/acre under various spacing. By considering market preference on tuber size, spacing of 15 x 15 cm and 20 x 20 cm recorded optimum tuber yield and produced marketable tuber size of Withania tuber. 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, 2.0 ha of Pungam and Neem based agroforestry plots with quality planting material of identified superior parent trees.

**Project 15: Evaluation of superior planting stock of *Acacia mangium* in agroforestry systems at different eco-climatic zones of Kerala and Tamil Nadu (Funding agency: NABARD) [IFGTB/EF-RP11/2003-2006]**

**Status:** About 1000 seedlings were raised at IFTGB and another 1000 clonal planting stocks of Mangium hybrid have been procured from Mysore Paper Mills, Karnataka for evaluation under agroforestry systems in Tamil Nadu and Kerala.

*A. mangium* plantations were raised in four farm fields in western zone of Tamil Nadu covering an area of 2.5 acres and in two farm fields in southern zone of Tamil Nadu in an area of 1.5 acres. Another 0.5 acre of land in Chullimadai in Central Zone of Kerala was planted with Mangium hybrids.

Initial soil samples collected from six farm fields have been processed and analyzed for various physical and chemical characteristics. Monitoring of the growth of Mangium in these farm fields is in progress. Best growth was observed in southern zone of Kerala (Omallur) with mean height of 6.0 m and mean gbh of 18.5 cm at the age of 18 months.

**Project 16: 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]**

**Status:** Incidence of insect pests like defoliators and sapsuckers in forest nursery seedlings were studied through regular surveys carried out at various nurseries maintained by the State Forest Departments of Tamil Nadu, Pondicherry and Kerela. Major pest problems were recorded. An unidentified leaf rolling curculionid on *Sizigium cumini* was recorded in Tamil Nadu and Pondicherry. Kerela, unidentified thrips in *Acacia mangium* and *Hyblaea puera* on *Tectona grandis* were recorded. Field survey also revealed the presence of few indigenous natural enemies of some of the insect pests. A Pest Calendar for nursery seedlings is prepared and updated. Influences of biotic and abiotic factors on pest build up were studied.



### **Project 17: Exploitation of mycorrhizal systems in the Nilgiris Biosphere Reserve Area (Funding agency: Ministry of Environment and Forests, Government of India) [IFGTB/EF-RP15/2004-2007]**

**Status:** Surveys were undertaken for collection of roots, soil and basidiomata samples for characterization of both ECM and AM fungi from different forest ecosystems such as Sholas, Grasslands, man-made plantations at regular intervals in the Nilgiri Biosphere Reserve areas of Nilgiri Hills, Tamil Nadu.

Distribution of 20 different ECM were recorded from different study sites under various host trees like *Acacia* spp., *Cupressus* spp., *Eucalyptus* spp. *Hopea* spp. and *Pinus* spp.

Some of the species of ECM fungi such as *Alnicola*, *Astroporina*, *Hebeloma*, *Leucophleps*, *Lycoperdon* and *Russula* were reported for the first time in association with the said host trees.

Estimation of percent colonization and spore population of AM fungi in the roots and soil samples collected from various study areas revealed the occurrence of 3 genera viz., *Acaulospora*, *Gigaspora* and *Glomus*.

Pure cultures of different isolates of the ECM fungi viz., *Laccaria fraterna*, *Lycoperdon* sp., *Russula* sp., *Scleroderma citrinum*, *Suillus* sp. and *Suillus subluteus* were raised and maintained for further studies.

An experiment was conducted to screen the efficacy of both ECM and AM fungi on growth improvement of *Acacia auriculiformis* in glass house conditions.

### **Project 18: Ecorestoration for Tsunami devastated coastline of Andaman Group of Islands (Funding agency: Department of Biotechnology, Government of India) [IFGTB/EF-RP20/2004-2007]**

**Status:** Seeds and seedlings of *Casuarina equisetifolia* were collected Casuarina Bay, the place where the Casuarina is distributed naturally for planting the coast line. For the purpose multiplying the Casuarina nurseries have been established at Casuarina Bay (North Andaman) Kadamtala (Middle Andaman) and Kalatang (South Andaman). The Kalatang nursery is being improved into a Model Nursery. Frankia nodules have been collected from the population in Andaman Islands which are being used for inoculation of all the seedlings. Soil samples have been collected for identification and isolation of VAM fungi. This work is in progress to improve the planting stock. The project envisages the planting of 60 ha. Area over a period of 3 years. So far 6.5 hec. Area has been planted at Casuarina. 40 persons from the Tsunami affected areas have been engaged in the planting related activities and 3137 mandays of employment have been generated. Training on nursery techniques of *Casuarina equisetifolia*, use of biofertilizers was conducted for about 250 staff and labour at 12 different places.

### **Project 19: Establishment of Bamboo Model Plantations In Different Agro-Climatic Zones of Tamil Nadu Using Quality Planting Stock (Funding Agency: Department of Biotechnology, Government of India) [IFGTB/EF-RP21/2005-2008]**

**Status:** The project objective is to raise 100 ha demonstration trials of quality planting stock of seven bamboo species viz *Bambusa bambos*, *B. tulda*, *B. nutans*, *B. balcooa*, *B. vulgaris*, *Dendrocalamus strictus*, and *Pseudoxylonenthera stocksii* in six agroclimatic zones of Tamil Nadu. Production of planting stock for raising demonstration trials for the



first year initiated. Tissue culture activities for mass propagation and nursery activities related to infrastructure development, vegetative propagation through rhizome splitting and rooting of culm cuttings are in progress.

**Project 20: Development of yield assessment methods for *Eucalyptus* spp. and *Anacardium occidentale* using Image analyzer (Funding agency: Tamil Nadu Forest Plantation Corporation) [IFGTB/EF-RP 22/2005-2007]**

**Status:** Methods for image grabbing, frame and image standards were developed. Field studies were conducted for 3D calibration of images. Methodology for the technique was standardized. Relationship between height and diameter was studied.

**Project 21: 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:** The project envisages carrying out multilocational species trial - involving 8 species of Bamboos viz., *Bambusa bambos*, *Bambusa balcooa*, *Bambusa nutans*, *Bambusa tulda*, *Bambusa vulgaris*, *Dendrocalamus asper*, *Dendrocalamus giganteus* and *Dendrocalamus hamiltonii* as well as field trials to study the performance of micro and macro- propagated plants and nutrient and water management studies using *Bambusa bambos*, *Bambusa balcooa* and *Bambusa nutans*. Planting stock received from various Institutes are being maintained and hardened for field planting. Efforts to increase their numbers through rhizome splitting are also underway to augment the quantity of seedlings for the trials proposed to be laid out during the forthcoming rainy season.

**Project 22: Development of post harvest techniques for seed production in *Jatropha* (Funding agency: Department of Biotechnology, Government of India) [IFGTB/EF-RP 24/2005-2008]**

**Status:** Survey was conducted at Attapadi, Periathadagam, Sathyamangalam, Annur and Punsai Puliampatti for identifying high fruit yielding trees of *Jatropha curcas*. Fruits were collected and parameters such as fruit yield, fruit weight, seed weight, No. of seeds per fruit, total seed weight per fruit, total shell weight per fruit, seed moisture, oil content etc. were recorded. Standardized the extraction of *Jatropha* oil by Soxhlet Method. Oil was extracted from the seeds of different sources and characterized the oil properties such as Acid number, Saponification number and Iodine value. The oil content in shell, kernel and seed as a whole were determined so as to understand the variation in oil recovery.

**Abstract: No. of Projects**

	<b>No. of projects completed in 2005-2006</b>	<b>No. of ongoing projects in 2005-2006</b>	<b>No. of projects initiated in 2005-2006</b>
Plan Projects	4	9	8
External Projects	-	22	-
Total	4	31	8

## EDUCATION AND TRAINING

### Training organized/provided

1. Training organized on Biodiversity of Rain Forests with special reference to Silent Valley National Park on 19<sup>th</sup> May and 18<sup>th</sup> July 2005 for SFS Officers, SFS College, Coimbatore
2. Training on Seed Handling of selected tree species and Seed Handling techniques of commercially important medicinal plants on 15<sup>th</sup> and 16<sup>th</sup> July 2005, respectively for Farmers and Foresters of Pondicherry Forest Department.
3. Training on Tree crop interactions agroforestry models for higher returns and cultivation of medicinal plants and farm land on 16<sup>th</sup> July 2005 for farmers of Pondicherry.
4. Training on Molecular defense in plants on 2<sup>nd</sup> September 2005 for students of Karpagam Arts and Science College, Coimbatore.
5. Training on Ecological census techniques on 10<sup>th</sup> October 2005 for Deputy Rangers, Foresters and Guards of Kerala Forest School, Walayar.
6. Training on Mycorrhizal Biofertilizer Techniques Isolation, Identification, Multiplication and Application on December 2005 to March 2006 for students of Tamil Nadu.
7. Training on Nursery technique for raising Casuarina and vegetative propagation of *Casuarina equisetifolia* and Bamboos from 16<sup>th</sup> January to 7<sup>th</sup> February 2006 for officials of Forest Department, Andaman Nicobar Islands.
8. Training on Nursery techniques for quality seedling production on January 2006 for officials of Forest Department, Andaman Nicobar Islands.
9. Training on diversity of insects associated with *Casuarina equisetifolia* in Tamil Nadu on 24<sup>th</sup> February 2006 for students of Dept. of Zoology, Bharathiar University, Coimbatore.
10. Training on Nursery techniques for quality seedling production on March, 2006 for officials of Forest Department, Andaman Nicobar Islands.
11. Training on Genetic improvement and domonstration of Andaman Padauk (*Pterocarpus dalbergioides* Roxb.) on March 2006, Andaman Forest Department.

### Training received

#### National

Shri T. Gunasekaran attended training on Advanced Forest Management at IGNFA, Dehradun from 17<sup>th</sup> to 28<sup>th</sup> October 2005.



## LINKAGES AND COLLABORATION

Collaborative work is being implemented for identification and benchmark studies in Gene Pool Conservation Area (GPCA) in Kerala with people's participation. Under this programme Dr. C. Kunhikannan, visited Periya VSS area, Periya range, Manandavady, Wayanad District, Kerala for identification of Gene Pool Conservation Area (GPCA) during May, 2005.

Taxonomic identification of *Morus* species was initiated with Central Sericultural Germplasm Resource Centre (Central Silk Board Ministry of Textiles Government of India) Hosur, Tamil Nadu. In this direction Dr. N. Venkatasubramanian visited the centre and thirteen *Morus* species (*Morus australis*, *M. multicaulis*, *M. alba*, *M. laevigata*, *M. rotundifolia*, *M. cathya*, *M. sinensis*, *M. thomsirenge*, *M. indica*, *M. serrata*, *M. taeliafolia* and *M. nigra*) were collected and herbarium specimens prepared for further taxonomical studies.

## PUBLICATIONS

### Books published

Kunhikannan, C. and Gurudev Singh, B. (Eds.) (2005). Strategy for Conservation of Sacred groves, Institute of Forest Genetics and Tree Breeding, Coimbatore.

## CONSULTANCY

Dr. B. Nagarajan, Scientist-D offered consultancy to the Andhra Pradesh Forest Department on Strategies for Tamarind Improvement between from 31<sup>st</sup> March 2005 to 5<sup>th</sup> April 2005.

## CONFERENCES/MEETINGS/WORKSHOPS/SYMPOSIA/EXHIBITIONS

### Workshops / Seminars attended

#### National

1. Customs Policies and Procedures on 23<sup>rd</sup> May 2005 at Coimbatore.
2. A National Program of Red-Listed Species using Biotechnological Approaches on 18<sup>th</sup> and 19<sup>th</sup> July 2005 at Bannerghatta Biological Park, Bangalore.
3. Diversity of Ectomycorrhizal Fungi in the Nilgiri Biosphere Reserve Area of South India and their future potential from 15<sup>th</sup> to 17<sup>th</sup> September 2005 at Bharathiar University, Coimbatore.
4. Intellectual Property Rights in Bioinformatics and Biotechnology on 15<sup>th</sup> and 16<sup>th</sup> September 2005 at Bioinformatics Centre, Pondicherry University.



5. Innovative HPLC and analytical solutions on 12<sup>th</sup> September 2005 at Coimbatore.
6. Study on the Salt Tolerance of Different Ectomycorrhizal Fungi on 7<sup>th</sup> and 8<sup>th</sup> October 2005 at Tamil Nadu Agricultural University, Coimbatore.
7. Database and its Applications in Agriculture on 26<sup>th</sup> and 27<sup>th</sup> October 2005 at Tamil Nadu Agricultural University, Coimbatore.
8. Global Conference-II, Indian Society of Mycology and Plant Pathology from 25<sup>th</sup> to 29<sup>th</sup> November 2005 at Rajasthan College of Agriculture, Udaipur, Rajasthan.
9. Site management of exotic forest plantations in southern India from 8<sup>th</sup> to 10<sup>th</sup> November 2005 at KFRI, Peechi.
10. Biosafety Considerations for Evaluation of Transgenic Crops from 7<sup>th</sup> to 14<sup>th</sup> November 2005 at NBPGR, New Delhi.
11. II<sup>nd</sup> National Conference of the Western Ghats Forum on 1<sup>st</sup> and 2<sup>nd</sup> December 2005 at Southern Forest Service College, Coimbatore.
12. Emerging Technologies and Resistance Dynamics in Insects and Crop Plants from 2<sup>nd</sup> to 4<sup>th</sup> December 2005 at Chennai.
13. Biodiversity of insects: Challenging issues in Management and Conservation from 30<sup>th</sup> January to 3<sup>rd</sup> February 2006 at Bharathiar University, Coimbatore.
14. National Seminar on Biodiversity and Conservation on 5<sup>th</sup> and 6<sup>th</sup> January 2006 at Government Victoria College Palakkad, Kerala.
15. Intellectual Property Rights on January 2006 at Institute of Wood Science & Technology, Bangalore.
16. Integrated Coastal Zone Management Plan for Andaman & Nicobar Islands on January 2006 at Port Blair.
17. The second dialog meeting between the Protection of Plant Varieties and Farmers Rights Authority and the Agricultural System in Tamil Nadu, Pondicherry and Karnataka state on 1<sup>st</sup> February 2006 at Tamil Nadu Agricultural University, Coimbatore.
18. National Seminar on Fungal Biodiversity, Biotechnology and Bioinformatics and 32<sup>nd</sup> Mycological Society Meeting on 2<sup>nd</sup> and 3<sup>rd</sup> February 2006 at Sri Bhagawan Mahaveer Jain College, Jayanagar, Bangalore.
19. Bamboo Location Trials, Bambusetum and Propagation from 14<sup>th</sup> to 16<sup>th</sup> February 2006 at GB Pant University of Agriculture and Technology, Uttaranchal.
20. Tree Biotechnology: Indian Scenario on 9<sup>th</sup> and 10<sup>th</sup> February 2006 at TFRI, Jabalpur.
21. Geographical Information Systems at Forest Survey of India on February 2006 at Forest Survey of India, Port Blair.
22. Mangrove Conservation in Andaman Islands and around the World organized by Coastal Poor Development Action Network India on 2<sup>nd</sup> March 2006 at Port Blair.
23. Down stream process and Bioprocess on 10<sup>th</sup> March 2006 at Department of Biotechnology, Kumaraguru College of Technology, Coimbatore.



24. Techniques in Biological Sciences on 10<sup>th</sup> March 2006 at Kerala University.
25. Recent Advances in Teak Research and Management in Central India on 17<sup>th</sup> and 18<sup>th</sup> March 2006 at Forest Development Corporation of Maharashtra Ltd, Nagpur.
26. Secondary Timber Species and Bamboo Management for sustainable yield and Development on 27<sup>th</sup> March 2006 at Forest College and Research Institute, Mettupalayam, Tamil Nadu Agricultural University.

## **International**

1. Globalization of traditional, complementary and alternative systems of medicine from 16<sup>th</sup> to 18<sup>th</sup> March 2006 at Tamil Nadu Agricultural University, Coimbatore.

## **DISTINGUISHED VISITORS**

1. Shri Suresh Chandra, Special Secretary, Ministry of Environment and Forests, Government of India visited the Institute on 30<sup>th</sup> August 2005.
2. Dr. P.S. Rao, Chairman, Expert committee Bamboo Network Programme and task force member of DBT, Ministry of Science and Technology, visited the Institute on 26<sup>th</sup> September 2005.
3. Prof. Jae-In Park, Director, School of Forest Resource, Chnugbuk National University, South Korea visited the Institute on 20<sup>th</sup> and 21<sup>st</sup> February 2006 and made presentation on Tree Breeding in South Korea.

## **MISCELLANEOUS**

### **Service rendered**

1. Plants and plant products slated for export were examined and subjected to the appropriate quarantine measures. 881 Phyto-sanitary Certificates were issued to various organizations and individuals
2. Queries relating to the pests and diseases problems of Rosemary Pongamia and Eucalyptus clone referred by the State Forest departments and Forest Development Corporation of Tamil Nadu and Andhra Pradesh were attended and provided appropriate solution.

### **Grass Forest Museum**

Collection management, upkeep and maintenance, visitor's service and educational service were undertaken. The museum received a total of 7004 visitors during the year.

## Maintenance of Seed Bank

1. Seeds of various important species viz. *Tectona grandis*, *Acacia auriculiformis*, *A. mangium*, *Azadirachta indica*, *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, Pudukkottai, Pondicherry, Sadivayal, Tholpetty etc. Seeds of the many of above species were supplied to other divisions of the Institute, SFDs, Paper mills and NGOs on request and on payment.
2. Seed testing for viability, seed count and purity were conducted and test results were provided to various clients and researchers.

## Computer Support

1. Local Area Network established and maintained with Compaq /Cerebra Net Server with Windows 2000 server and Linux as Operating system and Windows 2000 Professional, Windows XP, as nodes. More than 83 desktop systems are connected to the LAN. Structured cabling with manageable switches in each floor and fibre optics connectivity to extension building is provided.
2. Intranet Server maintained to provide in-house information to researchers such as ongoing and completed Project details of ICFRE and externally aided projects, different reports submitted such as Annual Reports, Annual Action Plan etc., research assets of the Institutes such as CSO's, SSO's, SPA's of different species, instruments available in different Lab, formats of different reports, Action plan of scientists/officers, tour plan of officers, purchase procedures, email ID's of IFGTB and ICFRE officers.
3. Web server, mail server maintained using 512 KBPS leased line for hosting Institute's web site and Internet access to researchers.

## Library and Documentation

- The Library has a collection of 8170 books, 30 Indian journals, nearly 285 back volumes, other research reports, seminar proceedings, tour reports and non-subscribed periodicals.
- The Library provides services to the researchers, foresters and University students. The library facilitates access to wide range of information and documentation to the state forest departments and other research oriented institutes.
  - a) Reference and bibliographic service



- b) Circulation service
- c) Current awareness service like i) new addition to library, ii) new arrival of periodicals and iii) new arrivals of library literature
- d) Literature search through Internet
- e) CD ROM service facilities, and
- f) Document delivery services through reprographic services.