# PROJECTS COMPLETED DURING THE YEAR 2008-2009

## PLAN PROJECTS

### Project 1: Genetic Improvement of *Eucalyptus tereticornis* through controlled pollination and molecular characterization (IFGTB/RP 3/ 2002 – 2008).

**Findings:** Twenty clonal selections were made in *E.tereticornis x E.grandis* and *E.tereticornis x E.alba* from a 60 months inter-specific full sib family trial developed in Panampally. Both selections could be clonally multiplied. A trial was established using twenty clones (3 tree plots in five replications) at Panampally field station, Kerala.

### Project 2: Genetic transformation of Eucalyptus and Casuarina to enhance salinity tolerance [IFGTB/RP 6/ 2000 – 2005; 2008]

**Findings:** Protocol for regenerating seedling explants and clonal genotypes was standardised. Sporadic shoot morphogenesis and rhizogenesis were obtained from *Casuarina equisetifolia*. Hairy root cultures were established in *Eucalyptus tereticornis*. *Agrobacterium tumefaciens* strains GV2260, EHA105, LBA4404, pCAMBIA series of plasmid vectors, and gene constructs *Osmotin* and *AtNHX* were obtained and used for transformation studies in *Eucalyptus tereticornis.* Critical parameters for transformation like media supplements (Acetosyringone, buffers, sugars), strains and their concentrations, co-cultivation durations, sonication duration, antibiotic concentrations were evaluated using the gene constructs/ vectors. Optimum distances for bombardment were found. Transient GUS expression was obtained in *Eucalyptus tereticornis* using *Agrobacterium* and particle bombardment methods.

### Project 3: 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]

**Findings:** Genes conferring salt tolerance were classified and tables in excel sheets were created for input of gene information. DNA and protein sequence information for Sodium antiporters, Calcium Transporters, High Affinity Potassium Transporters, Low Affinity Potassium transporters, Proton transporters, Water transporters, Transcription factors, Cellular signaling components, Transcription factors and protein and membrane protection were downloaded into Excel sheets. A prototype database for sodium transporters was created using MySQL and PHP. The sequences were analyzed using Clustal W and PRIFI for identification of conserved regions and deducing PCR primers that could be tested for isolation of genes from salt tolerant tree species.

### Project 4: Origin, distribution and genetic diversity of *Jatropha curcas* in India. [IFGTB/RP43/2006-2008]

**Findings:** Fifteen enzyme systems provided a total of 18 locii for the 56 accessions of *Jatropha curcas.* Twenty eight percent of the resolved isozyme locii were polymorphic on an average,

26.67% were found to be polymorphic and mean observed number of alleles per locus was 1.533. Average observed heterozygosity was 0.15 and expected value was 0.14 with a gene flow value of 0.24. DNA extraction procedures were standardized to avoid latex contamination. PCR protocols were optimized by carrying out variations in $MgCl_2$ concentration, primer concentration, DNA and buffer volume. A total of 120 bands whose size ranged between 300 and 2000 bp were produced using 25 primers. Genetic identities at the RAPD level varied from 0.951 to 0.998, not significantly different from the values obtained at the isozyme level. Comparison of genetic variation showed that RAPDs consistently revealed higher levels of variability than isozymes in terms of percentage of polymorphic locii, gene flow and gene diversity. Yet, the numerical congruence between the isozyme and RAPD data suggests an indication that in *J. curcas* the isozyme data provides a fairly good picture of the genetic structure.

## Project 5: Evaluation of teak CSO at Walayar using DNA profiling (IFGTB/RP 54/2007-2008)

**Findings:** Twenty teak clones from three different geographical locations namely Topslip, Tamil Nadu (TNT), Nilambur, Kerala (KLN and KLK), Sungam, Kerala (KLS) and South Bhadrachalam (SBL-1) of Andhra Pradesh were screened using seven RAPD primers. Of the 113 fragments, 36 were monomorphic (32%) and 77 were polymorphic (68.0%). Nei's genetic distance separated the 20 clones into 4 major clusters. DNA profiles of clone SBL 1 was unique from the rest. The clone KLN 2 was close to the TNT clones (genetic distance 0.1). TNT 1, TNT 3, TNT 4 and TNT 15 were identified as duplicates in the dendrogram corresponding to 100% similarity in RAPD bands shared between them

## Project 6: Studies on the diversity of bee fauna of the Nilgiris [IFGTB/ RP 36/ 2005-2008]

**Findings**: Survey was carried out in 32 sampling locations in the Nilgiris, covering 9 forest types and 4 plantations. Altogether 60 species of bees, coming under 14 genera were collected. They include, *Apis* spp. (*Apis cerana indica*, *A. florae* and *A. dorsata)*, *Amegilla* spp., *Braunsapis* spp., *Ceratina* spp., *Chelostoma* sp., *Halictus* spp., *Heriades* sp., *Lasioglossum* spp., *Megachile* spp., *Nomia* spp., *Sphecodes* spp., *Thyreus* sp., *Trigona* sp. and *Xylocopa* spp.

Since the occurrence of bees is closely linked to the availability of flowering plants, data on the vegetation of all these locations was collected and phenological observations of the plants made. Among the natural forests, the Dry Deciduous Forests, Thorn Forests, Moist Deciduous Forests and the Semi-evergreen Forests were found to have the maximum diversity of bees, while the Montane Wet Temperate Forests, wherein cool conditions persist almost throughout the year, had the least diversity. The monoculture plantations of *Acacia mearnsii, Eucalyptus globulus*, Teak and Tea were also found to be poor in bee diversity, mainly due to lack of floristic diversity.

Data on the seasonality of various bee species, the frequency of occurrence and floral associations were also collected. The frequency of occurrence of bee species, in general, was high, during the months of March, April and May, when most of the plant species in the deciduous forests were in bloom. The occurrence was low during the winter and rainy seasons. About 100 species of plants were recorded as nectar/ pollen sources for the bee species in the

study area. They include not only tree species, but also herbs and shrubs that flower in different seasons and this diversity enables the bees to sustain their populations throughout the year. The degradation of forests, due to fire and anthropogenic factors, resulting in habitat destruction and loss of floristic diversity were found to be the major threat factors on the bee fauna in this region. Although many species of exotic plants like *Ageratina adenophora, Cestrum* sp., *Cytisus scoparius*, *Lantana camara, Passiflora mollissima*, *Ulex europaeus* and *Wedelia trilobata* were also found to act as nectar/ pollen sources for some of the common bee species, the colonization of such exotic species in the forest areas is likely to adversely affect the floristic diversity and, in turn, the bee faunal diversity

## Project 7: Natural regeneration studies on important trees in Silent Valley National Park, Kerala [IFGTB/RP-32/2004-2009]

**Findings**: Regeneration status of different trees in different ecosystems in Silent Valley National Park, Kerala has been studied. A total of about 150 tree species have been enumerated from the park and prepared their population structure. More than 100 species including herbs, shrubs and trees are recorded as addition to the flora of Silent valley National Park, Kerala.

In forest areas, the regeneration of dominant species like *Palaquium ellipticum, Myristica dactyloides, Reinwardtiodendron anamallayanum, Syzygium laetum, Litsea oleoides, Dimocarpus longan, Mesua ferea, Aglaia lawii, Cullenia exarillata* and *Drypetes elata etc. w*as found to be frequent, whereas, species like *Actinodaphne lawsonii, Aphanamixis polystachya, Appollonias arnottii, Diospyros nilagirica, Epiprinus mallotiformis, Holigarna nigra, Hydnocarpus alpina* and *Sysygium densiflorum* showed very poor regeneration.

Tree species recorded in the grasslands in their order of dominance are *Wendlandia thyrsoidea, Glochidion ellipticum, Elaeocarpus serratus* var. *serratus, Ligustrum perrottetii, Symplocos racemosa, Apodytes dimidiata, Phyllanthus emblica, Symplocos cochinchinensis, Syzygium cumini, Maesa indica, Ziziphus rugosa* and *Olea dioica*.

Species generally observed only in wet evergreen forests like *Palaquium ellipticum, Elaeocarpus tuberculatus, Litsea floribunda* and *Litsea oleoides* could also be recorded in various stages of growth viz. seedlings and saplings under the shade of above species.