# PROJECTS ONGOING DURING THE YEAR 2008-2009

## PLAN PROJECTS

### Project 1: Genetic improvement of *Acacia auriculiformis* through half-sib progeny selection (IFGTB/RP 39/2005-2010).

**Status:** Maintenance activities like weeding and fire tracing were undertaken in all the four progeny trials established at Pondicherry, Vadakkancherry, Panampally and Palode. The trials at Panampally and Pondicherry have been evaluated for growth parameters and stem form. Profound variations were observed for these characters among families and seed sources. Among the four seed sources (Panamapally, Karunya, Behalli and Mumbaru) the families originating from Behalli and Panampally seed orchards were performing better than others.

### Project 2: Phenotypic selection, reproduction and propagation in *Ailanthus excelsa*: Perspectives for safety matches industry and farmers in Tamil Nadu (IFGTB/RP 40/2005-2009)

**Status:** Two germplasm banks have been established in BIOTRIM, Tirupati (Andhra Pradesh) and in Kuruvampatti (Tamil Nadu). The survival percentage is 83 and 90 % in Tiurpati and Kuruvampatti respectively. Periodical biometric data from both the germplasm banks have been collected. The analysis of growth of different seed lots collected from different agroclimatic zones in the States of Andhra Pradesh, Madhya Pradesh, Rajasthan, Tamil Nadu and Uttarakhand was undertaken. Results from the analysis showed that the growth performance of Cauvery delta zone (Tamil Nadu) was found to be performing better than other seed sources. Seed parameters also been studied for the seeds collected from different sources.

### Project 3: Evaluation and characterization of clones of *Casuarina* with reference to yield, tree form, biomass, pulping characteristics and key nursery pests [IFGTB/RP 44/2007-2012]

**Status:** Established two clonal trials of *Casuarina equisetifolia* (1) at Pugalur, Karur district (sodic site) and (2) at Sirugramam, Cuddalore district (casuarina growing belt), Tamil Nadu (one hectare area each) in addition to the one at Mayiladumparai, Karur district (Farmer's land) established in the previous year. Eighty-seven clones have been planted in an Incomplete Randomized Block Design with 6 replications at a spacing of 3 x 1.5 m. Quantitative and qualitative data are being collected from these trials at six monthly intervals. The preliminary results from the one year old trial at Mayiladumparai revealed significant clonal variation with respect to the biometric and qualitative traits like stem straightness and branching habits.

A total of 220 clones are maintained in the nursery to study the key nursery pests. Observations (at 15 days interval ) on incidence of the targeted insect pests viz., *Icerya purchasi* and *Eumeta crameri* revealed that totally 131 clones have so far been infested by *I. purchasi* and 47 clones by *E. crameri*. Intensity of attack of these pests was observed to range between low to severe. Severe infestation of *I. purcahasi* has been observed on 35 clones while moderate

to high infestation observed on 59 clones. Whereas, in the case of *E. crameri,* high intensity of the attack has been observed on clones TNPP-3 and TNKP-1. Observations of feeding damage caused by the pest, population build up, abundance were also collected from individual clones. In addition to the targeted pest mentioned above information on incidence of the other pests like Myllocerus beetle, two species of Coccids sap suckers and a species of leaf hopper have also been recorded. Stock cultures of the targeted pests are maintained and their biology being studied.

## Project 4: Improvement of teak through selection, quality seed production, hybridization and clonal evaluation- [IFGTB/RP 45 /2007-2012]

**Status:** Selected around 400 outstanding teak trees from Parmbikulam, Topslip, Konni, Tholpatty and Nilambur in Kerala and Tamil Nadu States based on growth, stem form and branching characteristics. Seeds were collected from 230 trees and characterized for morphological characters using image analyzer. X-radiography of fruits was conducted to determine seed filling for 70 trees. Fruits of 82 trees were sown in nursery for raising seedlings. Flowering and fruiting (number of inflorescences per tree and number of flowers / fruits per inflorescence) was assessed in 475 trees in Walayar CSO and 170 trees in Panampalli CSO. Pollinator visitation per unit time per tree was assessed in both the CSOs. Based on flowering behaviour, trees were selected at Walayar for carrying out the control crosses between clones. A partial diallele crossing design has been developed. The 40 selected clones in the VMG were coppiced and being multiplied and about 1100 clonal propagules were produced for establishing a clone trial. The rooting performance of the clones was studied. Thirteen new superior teak trees were selected in the plantations at Pattikadu and Machad Range in Thrissur Division (Kerala State). The teak clonal trial established at Tirunelveli has been evaluated for growth and form traits.

A vegetative multiplication garden (VMG) of teak has been established with 56 clones. The clones were multiplied from VMG for establishing clonal trials. The rooting performance of different clones was studied. Twenty three superior teak trees were selected in the teak plantations in different parts of Kerala.

## Project 5: Selection and conservation of red and sweet tamarind in southern India [IFGTB/RP 49 /2007-2010]

**Status:** Extensive surveys were made in different parts of Tamil Nadu, Karnataka and Andhra Pradesh States to identify and select the red and sweet tamarind trees. Fifty two individuals of red tamarind and 38 sweet tamarind trees were selected from different sites of the three States mentioned above. Biochemical characterization of red and sweet tamarind was done by quantifying anthocyanin, total sugars, titrable acidity, and ascorbic acid and anti oxidant properties. To test the compatibility levels between red and sweet tamarind trees, control pollination experiment was conducted in Chidambaram, Karaikal and Mayavaram and fruit set for seven full sib families were obtained. Vegetative multiplication of different red tamarind trees was carried out through cleft grafting method. The data were recorded on biometric characters, phenological and reproductive variation.

**Project 6: Association analysis of adventitious rooting traits using STS markers in *Eucalyptus tereticornis* and DNA profiling of eucalypts clones [IFGTB/RP 53/ 2007-2010]**

**Status:** Phenotyping to identify individuals with contrasting rooting parameters for the generation of association population was conducted by rooting the cuttings collected from coppice shoots over different seasons. Identified association population was analyzed using ten polymorphic SSRs having genome wide distribution for population structure and the STRUCTURE software showed the unstructured nature of the population and its suitability for association analysis. Thirty three sequence tagged site (STS) primers for vegetative propagation traits were PCR amplified with poor and best rooters. One hundred and ten *Eucalyptus* clones were profiled with 6 RAPD primers and ninety three clones were screened with 7 ISSR primers.

**Project 7: Assessment of Population structure using SSR and molecular characterization using RAPD (IFGTB /RP-52/ 2007-2010)**

**Status:** 60 clones of *Casuarina equisetifolia* planted in IFGTB clone bank were screened with 15 ISSR primers. PCR reactions were set up in a 11 ul reaction volume containing 60 ng of template DNA, 1.0mM of ISSR primer, 100mM dNTPs, 2.5mM MgCl2, 10mM Tris-HCl, pH 8.8 and 0.3 U of Taq DNApolymerase. PCR was performed on a JH bio thermal cycler with an initial denaturation at 94 °C for 3 min, followed by 30 cycles at 94 °C for 0.30min, 58 °C for 0.30 min, 72 °C for 1 min, and the last step of final extension at 72 °C for 10 min. 30 cloned samples of Casuarina possessing the inserts of SSR fragments were successfully sequenced. The sequence data were assessed using WEBTROLL software for the identification of SSR locii. Simple sequence repeats were identified as (C)10, (CACCT)2, (TGTGC)2, (TG)8, (AG), (GA)n, (CA)n (GAT)n and (AT)n rich repeats. Among the assessed locii of SSR, the CA and GA repeats were found in most of the clones. The (CACCT) 2, (TGTGC) 2 and (TG) n repeats are not common in all the clones. 10 SSR primer pairs were identified (PRIMER-3 database) and it is found to be the most suitable for assessing Casuarina clones.

**Project 8: Assessment on carbon pool potential of important tree species at different ages, sites and management regimes [IFGTB/RP-41/2006-2011]**

**Status:** 200 trees were felled from 69 casuarina plantations in Cuddalore, Nagapattinam Villupuram, Kanchipuram, Tiruvallur, Ramanathapuram, Pudukottai and Thanjavur districts of Tamil Nadu. Carbon pool of the standing crop under different soil types and under irrigated and rainfed conditions was estimated. 60 Eucalyptus trees were sampled from 20 plantations in Pudukottai and Aranthangi in Tamil Nadu. Dry matter production of eucalyptus on per tree basis in 20 plantations was estimated. Soil samples collected from these plantations were analyzed for organic carbon and various other properties.

**Project 9: Demonstration of Agroforestry technologies for enhancement of livelihood opportunities in different agro-climatic zones of Tamil Nadu [IFGTB/RP-46/2007-2010]**

- **Status:** This project is being implemented in collaboration with the National Research Centre for Agroforestry, Jhansi and Forest College & Research Institute, Mettupalayam. The agroforestry systems being prasticed by the farming, communities in five agro-climatic zones were documented along with major tree species and annual crops. Agroforestry demonstration plots were established in 15 ha area in five agro-climatic zones (3 ha per zone) with tree components like *Casuarina equisetifolia, Casuarina junghuhniana, Melia dubia, Tectona grandis, Eucalyptus spp. and Ailanthus excelsa* and horticultural species like Mango, Guava, Sapota and lemon along with the annual crops. In the established agroforestry demonstration plots, intercropping activities have been carried out under above mentioned agroforestry systems and the yield assessed. *Casuarina* with cotton registered highest net income of Rs. 31,250/ha in Cauvery delta zone followed by Lemon with sunflower (Rs. 18,750/ha) in Southern zone, Teak with black gram and cowpea (Rs. 14,650/ha and 12,500/ha respectively) in western zone and *Ailanthus* with black gram and cowpea (Rs. 12,840/ha and 10,230/ha respectively) in North eastern zone.

**Project 10: Studies on the population structure and reproduction of *Pterocarpus marsupium* in Tamil Nadu and Kerala [IFGTB / RP 37 / 2005 – 2008]**

**Status:** Based on the Forest map of South India prepared by the French Institute of Puducherry, *Anogeissus latifolia – Pterocarpus marsupium - Terminalia spp* forest type (>600 msl) under the category of Dry Deciduous Forests in Tamil Nadu and under the category of Deciduous Climax Forests and degradation stages in Kerala was located. Based on physical barriers separating distribution of *Pterocarpus marsupium,* 17 distinct populations on the eastern aspect of Western Ghats in Tamil Nadu and 14 distinct populations on the Western aspect of Western Ghats in Kerala was short listed for field studies. All the 17 populations of Tamil Nadu and 6 populations of Kerala have been surveyed, tagging 579 trees in Tamil Nadu and 133 trees in Kerala for observation. Herbarium specimens have been made for 214 specimens. Morphometric readings of seeds from 72 trees using image analyser have been collected. Morphological parameters and phonological variations have been observed.

**Project 11: Evolving silvicultural practices for *Casuarina junghuhniana* ssp. *timorensis* [IFGTB / RP 33 / 2005 – 2009]**

**Status:** A total of eight field trials have been established at Kattukuppam, Veeravanallur, Vedaranyam, Erakudy, Sriharikota, Tirupathi, Edapady and Uppar dam. Effect of spacing and irrigation is being studied in all the trials spread over five agroclimatic zones of Tamil Nadu. The nursery trials to study the effect of different concentrations and rooting media on root of *Casuarina junghuhniana* and the effect of biofertilizers on seedling growth has been initiated.

**Project 12: Assessment of insect pest problems of selected fast growing indigenous tree species in Tamil Nadu and Kerala [IFGTB/RP 42/2005-2008].**

**Status:** Pest surveys at nurseries, plantations and in natural forest eco-system of the selected tree species of *Ailanthus excelsa*, *Melia dubia*, *Gmelina arborea*, *Thespesia populnea*, *Morus alba*, *Bombax* sp., and *Dalbergia sissoo* were carried out at 12 selected locations in Tamil Nadu and 9 selected locations in Kerala. Totally 28 tours were undertaken. Out of 35 insect species recorded,

6 insect species on *A. excelsa*, 5 insects species on *M. alba*, 4 insect species on *B. ceiba*, 6 insect species on *D. sissoo*, 6 insect species on *G. arborea*, 4 insect species on *T. populnea* and 4 insect species on *M.dubia* were recorded.

The cercopid, *Clovia* sp. on *G. arborea*; the lepidopteran leaf roller, *Sylepta derogata* and the sap sucker *Paracoccus marginatus* on *T. populnea*; the mealy bug, *Rastrococcus iceryoides* on *B. ceiba*; the sap sucker, *P. marginatus* on *A. excelsa*; the defoliator, *Abirus sp*. on *D.sissoo* were recorded for the first time on these host plants. 3 different *Coccinellid* beetles on the mealy bug, P. marginatus of *A. excelsa* and *M. alba and* 2 different species of spiders on *Atteva fabricilla* were recorded as predators. A strain of entomopathogenic fungus was isolated from the naturally infected pupae of *Eligma,* the *Ailanthus* defoliator. Influence of biotic and abiotic factors such as temperature, humidity and soil factors on the pests incidences were also recorded.

## Project 13: Performance of selected clones of *Casuarina equisetifolia* for insect pests and disease tolerance and their response to biofarming practices [IFGTB/RP 48/ 2007-2010].

### Host plant resistance for insect pest

**Status:** A clonal trial at Sirkali (Nagapattinam district, Tamil Nadu) was established to assess the incidence of bark feeder, *Inderbela quadrinotata* and, thereby, to select the resistant candidates. Field screening of trees in the clonal and provenance trials of Casuarina at Coimbatore and Puducherry for incidence of the bark feeder carried out. Feeding preference and growth of the bark feeder, *I. quadrinotata* on different casuarina clones studied in the lab and field condition. Wood samples of selected provenances of casuarina were analysed for phenols, lipids and tannin contents to correlate the feeding preference or deterrence of the bark feeder.

Pathogenicity test was carried out by inoculating *C. equiesetifolia* seedlings with trichosporium spores under controlled condition and symptoms of infection identified and assessed. Analysis of physical properties of the soil samples showed that the alkaline pH and poor drained clay soil tends to enhance infection by *T. vesiculosum* at Panampally Field Research Station in Kerala. Blister bark disease symptoms was not observed in the trees grown in fertile sandy soil with low moisture holding capacity at Karunya Nagar, Coimbatore.

Chemical properties of macro, micro nutrients and growth regulators of Panchagaya and Dasagavya were analysed. Seedlings of Casuarina, eucalyptus and teak in a nursery trial were sprayed with 12 concentrations of Panchagavya & Dasagavya. Spraying of 3-10% solution of panchagavya and dasagavya in nursery showed reduction of 25% gall infection in Eucalyptus, 15% reduction of scale insect in Casuarina and 15% reduction of Mealy bug in Teak as compared to control.

## Project 14: Screening and identification of potential isolates of Ectomycorrhizal fungi for increased productivity of *Acacia*, *Casuarina* and *Eucalyptus* tree species in nursery (IFGTB/RP 51/2007-2010)

**Status:** Pure cultures of different isolates of Ectomycorrhizal (ECM) fungi such as *Laccaria fraterna* and *Pisolithus albus* were made and maintained in the culture bank.Standardized suitable culture medium for mass production of different isolates of selected ECM fungi under *in vitro* condition.

Data on growth parameters such as shoot & root lengths, leaf numbers, collar diameter, fresh and dry weights of shoot and roots of both ECM inoculated and uninoculated (control) seedlings of Acacias viz,, *Acacia auriculiformis* and *A. mangium* were recorded at different intervals of time. The results revealed that the seedlings inoculated with basidiospore and vegetative mycelial inocula of ECM fungi showed better growth performance, followed by alginate bead and basidiospore inoculum of ECM fungi over uninoculated control.

Studies on morphological and anatomical features of roots of both ECM fungi inoculated and uninoculated (control) seedlings of *Acacia* species for assessing the persistence of the inoculant ECM fungi revealed that more mycorrhizal tips in the roots of *Acacia auriculiformis* and *A. mangium* grown in sterilized (autoclaved) potting medium as compared to unsterilized potting medium.

## Project 15: Evaluation of improved germplasm of *Eucalyptus camaldulensis* and *E. tereticornis* for productivity, wood traits, tolerance to insect pests and diseases and management for higher seed production. (IFGTB/RP 47/ 2007-2010)

**Status:** Wood samples of 37 prioritized clones collected from Karunya and Sathyavedu were submitted to IWST, Bangalore, Kerala Agricultural University (KAU) and Tamil Nadu Paper Mills Ltd., for various wood traits (the fibre length, fibre width, lumen width, wall thickness, fibre length/fibre width ratio, and specific gravity) and pulping quality (Kappa number, Pulp yield, Strength properties such as Tear Factor, Breaking length and Burst factor, soft wood, hard wood and bark ratio). Analysis of pulping characters for 37 clones and wood traits for 14 clones have been completed. Among 37 clones, 7 were found to be the best for pulp yield and pulp quality.

Continued Insect pests' and diseases' surveys carried out on 80 clones of Eucalyptus in 5 replications at Sathyavedu, 50 clones in 5 replications at Kulathupuzha, 100 clones in 5 replications at Karunya and 27 clones at Forest campus, Coimbatore at a regular intervals revealed the incidence of different species of insects ( stem borer, termite, aphid, grass hopper) and diseases (leaf spot caused by *Cercospora eucalypti* , leaf blight caused by **Alternaria** and Pink disease caused by **Cylindrocladium**), including the major problem of gall insect during different seasons. The per cent incidence and intensity of attack and identity of these pests and diseases and influence of biotic and abiotic factors on occurrence and spread of the pest and diseases were assessed. Based on the field observations so far collected, the clones were categorized (less susceptible, Moderately susceptible and Highly Suceptible) for the key pests and diseases problems.

Pretreatment observations on seed yield viz., number of fruiting branches, number of bunches in each branch and number of fruitlets in each bunch at two SPAs of -*Eucalyptus camaldulensis* and *E. tereticornis* completed and the trees were selected and marked for imposing treatments to increase seed yield. The data on height and gbh of selected Eucalyptus

trees were recorded. Initiated action for imposing different treatments to increase seed yield in Karunya (Tamil Nadu) and Panampally (Kerala).

**Project 16: Studies on efficacy of secondary plant derivatives of *Aegle marmelos* on important insect pests of teak (IFGTB/RP-50/2007-2009)**

**Status:** Variation of different groups of bioactive compounds of secondary plant metabolites were analysed from the extracts of three different tissues of *A. marmelos & A. sapota* (fruit, unripen fruit and seeds). The identified elutants of phenols, phenolics and polyphenols were further fractionated and analysed through TLC-UV method of characterization, and about 11 fractions of each tissue (total 30 fractions) were purified by HPLC and GC-MS-MS methods in comparison with 11 standards (sigma standards). About 13 individual compounds (identified from 3 tissues of *A. marmelos* & *A. sapota* viz. fruit, unripen and seeds) were tested for their bioactivity on the target pest, *H. puera* larvae. Only three compounds were showing biopesticidal effect at the concentrations ranging from 250 to 1000 ppm. Project got extended for two years (2009-2011) for conducting further experiments in order to conclude the results for making preformulation.