

ONGOING EXTERNALLY AIDED PROJECTS

Project 1: Establishment of Advanced Wood Working Training Centre at IWST (Funding agency: Italian Trade Commission/ACIMALL) [2003-2008]

Status: Advanced Woodworking Training Centre, an Indo-Italian joint project by IWST-ICE-ACIMALL entered into the seventh year of operation. The centre is equipped with 21 advanced wood working machines. A new CNC machine was installed during the year 2008-09 and CNC course has been introduced from January 2009. During the year 2008-09, the centre has imparted training to 387 trainees for conventional course and 35 trainees for CNC course. About 95% of the unemployed trainees have been benefited for employment with this training. The AWTC also participated in “DELHIWOOD 2009” which was held at Pragathi Maidan, New Delhi in February 2009.

Project 2: Investigation on Tree ring analysis of certain species in Western Ghats to monitor climate changes and its relevance to wood quality (Funding agency: Ministry of Environment and Forests) [2006-2009].

Status: Two JRFs joined at the end of May 2007. Basic training was provided to JRFs at IWST. Stereo-Zoom Microscope was installed and basic training was obtained. TA system was installed. Increment borer was purchased. Teak discs were collected from Madikeri, Mundugod of Karnataka and Thane, Chandrapur from Maharashtra. Meteorological data and information on sites from Karnataka and Maharashtra were collected. Teak samples were prepared by using special technique to expose growth rings. Field training for 2 JRFs in collaboration with IITM, Pune to Bandipur, BR Hills, Kallahalla and Shimoga completed. Training provided to JRFs at IITM, Pune for handling COFECHA and ARSTAN programmes in tree ring analysis and also for handling RESPO programme. Specific gravity, ring width and age of 36 discs completed from Madikeri & Mundagod (Karnataka) and Chandrapur & Thane (Maharashtra). Study on vessel morphology completed for 30 discs from Karnataka and Chandrapur of Maharashtra. Cross dating and standardization of 30 discs from Karnataka and Chandrapur (Maharashtra) carried out using COFECHA and ARSTAN programme, respectively. Collection and sanding to expose growth rings completed for 6 core samples of *Myristica spp*. Determination of age of 6 cores of *Myristica spp* completed.



Teak discs with wounds due to (i) insect attack (ii) Fire



Stereo-zoom microscope with TA system for tree ring analysis

Project 3: Studies on acoustical behaviour of plantation timbers for musical instruments and wall paneling. (Funding agency: CSIR) [2006-2009]

Status: Evaluated strength properties of 7 species. Determined sound absorption coefficient and effect of different wood parameters (grain orientation and thickness) 7 species. Generated data on commercially available 3 musical instruments (veena, violin and dholak). Determined anatomical properties like fibre and vessel dimensions of 7 species. Evaluated strength properties like modulus of elasticity, modulus of rupture, and hardness. Determined sound absorption coefficient and effect of different wood parameters. Generated data on commercially available musical instruments like veena, violin and dholak. Studied the effect of anatomical parameters and strength properties on frequency spectrum generated by the commercially available musical instruments. Fabrication of veena from plantation species (*Acacia auriculaeformis*, *Artocarpus heterophyllus*, *Azadirachta indica*, *Eucalyptus tereticornis*, *Grevillea robusta* and *Melia composite*) to find their suitability in musical industries.



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FFT analyzer to record sound waves from Dholak

Project 4: Development, Augmentation of efficacy and improvement of dissemination systems of *Metarhizium* based mycooinsticide for the management of major pests in forest plantations and nurseries. (Funding agency: DBT) [2006-2009]

Status: 25 *Metarhizium* isolates were maintained in the laboratory for studying the virulence and biocontrol potential against major pests on important forest tree species. The teak defoliators, *Hyblaea puera*, *Paliga machoeralis* and pests of *Ailanthus excelsa* were found susceptible to most of the isolates but pathogenecity varied among the isolates. Bioassay with Mahogany borer, *Hypsipyla robusta* reared using artificial diet revealed that 7 isolates were pathogenic to them. Pathogenecity of different isolates against arboreal termites, *Odontotermes* spp. was tested in the laboratory with different dosages/time and the LD50 and LT 50 were calculated. Field evaluation of selected isolates against *Ailanthus* pests showed mortality of 30-.34%. Mass multiplication of fungus in grains, solid media and agro wastes was tested.

Project 5: Investigations on Microsporidia affecting major Lepidopteran pests of important forest trees of South India and their prospects as bio-control agents. (Funding agency: DST) [2007-2010]

Status: A total of 94 lepidopterans were tested and microsporidian parasites were isolated from 29 species. Bio-assay study was carried out on *Hyblaea puera*, *Catopsilia*, *Papilio demoleus*, *Papilio polytes* larvae by inoculating different concentrations of spores isolated from their respective hosts. Morphometry of 29 species of microsporidia were studied. Studies on morphology, Pathogenicity, rate of multiplication and life cycle of microsporidian spores in

Hyblaea puera and 3 butterfly species was conducted. Cross-infectivity studies were carried out using *H. puera* spores to other forest pests to examine the infection potential.

Project 6: IWID: Indian Wood Insect Database – a Database on diversity of indigenous and exotic wood insects/pests in India. (Funding agency: DSIR) [2007-2009]

Status: IWID, a web based database for Indian wood insects was developed in collaboration with FRI, Dehradun. The insect museums in different research institutions, universities, national collections at ZSIs and BSI were visited and wood insects documented. The data pertaining to about 1000 wood species and 2500 wood insects have been entered into the database. The entries were checked and edited. The work is in final stages.

Project 7: Bioecology, damage potential and management of Gall formers of *Pongamia pinnata* (L.) Pierre. (Funding agency: DST) [2006–2009]

Status: The biology of gall inducers of Pongam viz., leaf gall inducer *Aceria pongamiae* and the ovary gall inducer *Asphondylia pongamiae* have been studied and their life cycles have been determined. The population dynamics of both gall inducers have been observed for two years and the analysis is underway. Experiment to evaluate the efficacy of miticides against leaf gall inducing mite has been completed. Yield loss assessment by ovary gall inducer was done in Mandya, Bangalore urban and Chickbellapur districts.

Project 8: Investigations on the fungi and insects associated with fruits and seeds of selected endemic trees of western ghats. (Funding agency: Ministry of Environment and Forests) [2006-2010]

Status: Pathogenicity of major pathogenic fungi and their control measures and biology of major insect pests were completed. 75-90% *Fusarium* infection was found in *D. malabaricum* fruits and seeds. In *C. sulpharatum* seeds though there was fungal infection (80%), viability of the seeds was not affected. In *S. malabaricum*, *M. longifolia* & *H. ofponga*, fungal infection was less (30%). Total 150 fungal species were isolated from the seeds of selected plants. Out of which, 40 species were pathogen and rest of the species were saprophytic fungi. The extent of damage and the host range of causative organisms were assessed. 7 insect species were obtained. % of incidence of Coleopteran was 37.78, Lepidoptera was 26.50 and Dipterans were 36.22. Diversity of insects in Subramanya was more ($H= 1.8099$ and in Makuta, it was less (0.808).

Project 9: Need for conserving forest canopies assessing the diversity of canopy insects in the Western Ghats. (Funding agency: Ministry of Environment and Forests) [2006-2009]

Status: Canopies of *Vateria indica* suitable for sampling were identified, three types of passive insect collection traps – canopy pitfall traps, canopy light traps and canopy yellow pan traps were tested. Sampling using the traps has been done and collections processed for identification and assessing the diversity of insects.

Project 10: Monitoring of biofouling at Visakhapatnam Port. (Funding agency: Ministry of Shipping, Road Transport and Highways, Government of India through National Institute of Oceanography, Goa) [2006-2009]

Status: Test panels exposed at three test sites, i.e., Slipway Complex, Ore Berth and Marine Foreman Jetty in Visakhapatnam Port were retrieved at monthly/long term intervals. Observations on the composition, growth, surface spread and biomass of fouling organisms and incidence of wood borers were recorded. Voucher specimens of different forms were prepared and maintained.

Project 11: Utilization of alternative timber species for catamarans to conserve traditional tree species of Eastern Ghats. (Funding agency: Ministry of Environment and Forests) [2007-2010]

Status: Durability, leaching tests for *Maesopsis eminii*, *Tetrameles nudiflora* and *Albizia lebbek* initiated and work is in progress. Untreated control timber panels of *Albizia lebbek* were completely destroyed by pholadid and terebinthid marine borers within 14 months of marine exposure trials in Visakhapatnam harbor whereas panels treated with copper-chromium-arsenic (CCA) incurred only 3% to 7% destruction and those treated with copper-chromium-boron (CCB) 8% to 13% damage within the same period depending upon the preservative loading. Untreated controls of *Tetrameles nudiflora* were totally damaged due to marine organisms attack in 12 months, while CCA treated panels showed 8% to 25% deterioration and CCB panels 18% to 28% deterioration at the end of 14 months. Fabrication of catamaran of *Bombax ceiba*, (5 Catamarans) *Albizia lebbek* (5 catamarans), *Tetrameles nudiflora* (10 catamarans) and *Maesopsis eminii* (5 Catamarans) (TOTAL 25 Catamarans) completed. Interactive meeting with fishermen of Kuppum village, Chennai was conducted and list of beneficiary from this village has been finalized for distribution of catamarans.

Project 12: Studies on assessing growth performance of *Guadua angustifolia* Kunth under different management schedules (Funding agency: NMBA) [2005-2008]

Status: Established field trials *viz;* spacing (5mx5m and 5mx9m) and fertilizer trials consisting seven treatments at two sites *viz;* Yelwala near Mysore and Gottipura (Hoskote) near Bangalore in 1.3 ha each site in 2005. Intercropping has been done in succeeding years with horse gram. Survival rate < 50% in Hoskote and < 10% in Mysore by the end of third year indicating the unsuitability of this species under semi-arid conditions.

Project 13: Conservation of Sandal (*Santalum album* L.) germplasm, production of quality planting stock and promotion of sandal cultivation practices (Funding agency: NMPB) [2006-2009]

Status: Produced 50,000 quality seedlings of sandalwood during 2007-08 and provided to the SFDs, farmers, sandal based industries and NGOs. Sandal stake holders meeting programmes have been conducted in Murdeswar, Kolar and in Shimoga districts in Karnataka. Two on- farm demonstration trials of sandal based agroforestry one ha each has been established in Mantralaya (A.P) and in Chikmagalur (Karnataka). Nearly 100 grafted sandal plants from various identified clones produced for restocking in germplasm bank at Gottipura

Project 14: Commercial cultivation of bamboo in Kodagu District: Raising of Quality Planting Material (QPM), Establishment of Demonstration plots and Bamboo based value addition facilities (Funding agency: NMBA) [2006-July 2009]

Status: This is a multi institutional collaborative project involving College of Forestry (CoF) Ponnampet (University of Agricultural Sciences, Bangalore), Kodagu Model Forest Trust (NGO) and IWST. This project is being coordinated by IWST. Farmers interaction meet organized in Coorg in Feb 2009 involving farmers and various stakeholders to discuss various prospects of bamboo cultivation. A vegetative propagation centre with capacity to produce 50,000 rooted cuttings of bamboo in one year was established in College of Forestry, Ponnampet. Nearly 25 ha of *D. asper* (edible bamboo) plantations involving 77 farmers established in Coorg with planting material supplied by the IWST.

Project 15. Cultivation of *Guadua angustifolia* Kunth and *Dendrocalamus asper* Backer in Kerala and Karnataka (Funding agency: NMBA) [2006-09]

Status: On-farm demonstration trials established in tropical humid conditions in 2 sites (Aluva and Palakkad) in Kerala and in Thithimathi, Coorg, Karnataka at two spacings to study growth performance. Intercropping carried out with nutmeg, sandal and *C. sappan* in these 3 sites. Growth performance data collected for the 3 sites in 2008 indicate best performance in Coorg, followed by Aluva and then by Palakkad.

Project 16: Bamboo Locational Trials - BLT (Funding agency: NMBA) [2005-2010]

Status: Eight bamboo species viz; *Bambusa bambos*, *B. balcooa*, *B. nutans*, *B. tulda*, *Dendrocalamus asper*, *D. hamiltonii*, *D. giganteus* and *D. stocksii* (in Bangalore) and *Guadua angustifolia* in place of *D. stocksii* (in FRC, Hyderabad) trials were established during July- Sept 2005 and maintained at Nallal, Bangalore and Dulapally, Hyderabad using 5m x 5m spacing. Maximum (100%) survival rate was in *B. balcooa* and minimum (50%) in *D. asper*. Among the eight species, *D. hamiltonii* proved the best in terms of height of culm (5.89m) and diameter (31.8 mm) in Bangalore as well as at Hyderabad, followed by the *D. stocksii*, *B. balcooa*, *B. nutans*. Minimum height (1.6 m) exhibited in *D. asper*, followed by *B. tulda* at both the locations.

Project 17: Vegetative Propagation Centre (VPC) for the production of quality plants of *D. stocksii*, *D. brandisii* and *Guadua angustifolia* (Funding agency:NMBA) [2006-2009]

Status: Plants were raised by rooting of culm cuttings in *D. stocksii*, from leafy branch cuttings in *Guadua angustifolia* and rhizomatous cuttings in *D. brandisii*. Total 18,000 plants have been raised. Plants raised have been used for plantation activities under NMBA and DBT funded projects and have also been supplied to Karnataka and Tamil Nadu Forest Departments and farmers for plantation. Training have been imparted to officials of KFD and farmers on vegetative propagation of bamboo.

Project 18: An integrated approach of bamboo improvement propagation, agroforestry models, protection, processing and utilization. (Funding agency: NBM) [2007-2010]

Status: Collected offset cuttings/plants of 15 economically important bamboo species from RFRI, Jorhat, Nagaland State Forest Department, State Forest Department, Rajamundry, KFRI, Peechi and FRL HT, Bangalore for widening germplasm bank of bamboo species at Gottipura, Nallal. Collected CPC material of *B. balcooa*, *D. brandisii* and *T. oliveri* from various sources for germplasm bank. Carried out studies on effect of auxin, period of collection and size of cutting in *D. brandisii*. Established agroforestry trials at two locations of industrially important bamboo species in Karnataka. Surveyed bamboo nurseries and plantations in Karnataka, Kerala, Tamil Nadu, AP and Goa to get information on insect pest attack and collected samples for laboratory studies. Samples of bamboo species treated with insecticide and preservatives were tested in field for durability. Fabrication of Boucherie and microwave dryer were completed. Studies on drying of *D. stocksii* carried out in microwave dryer. Drying behaviour of round *B. bambos* was studied in desiccant based dehumidification wood dryer. Specimens of *D. stocksii*

were treated with CCA and CCB by sap displacement and Boucherie methods. Elemental analysis of nitrogen, oxygen and sulphur contents were carried in *D. strictus*, *D. brandisii*, *D. stocksii* and *B. bambos*. Basic densities of these four species varied from 0.48 ± 0.03 to 0.61 ± 0.3 and value was highest in *B. bambos*. Conducted demonstration of bamboo based technologies viz; vegetative propagation, cultivation, ammonia fumigation and sap displacement in FRC of SFD, Hyderabad and VVK, Kadugodi, Bangalore for the SFD, VFCs at farmers in ten training programme during the past one year period.

Project 19: Development of bamboo fibre reinforced thermoplastic composites. (Funding Agency: National Mission for Bamboo Application) [2006-2009]

Status: Composites of bamboo and polypropylene were prepared to study the effect of fibre loading, coupling agent, process additives and particle size on mechanical properties of the composites. Results show that at 50% loading of bamboo flour the tensile strength increases by 45% and flexural strength by 83%. The modulus of elasticity exhibited an increase of 300%. Composites prepared with m-TMI grafted polypropylene as coupling agent exhibited superior mechanical properties over composites prepared with MAPP as coupling agent. The study on the effect of particle size showed that particles having -60 to -80 mesh size provides the best properties.