CHAPTER IV

TROPICAL FOREST RESEARCH INSTITUTE JABALPUR

Tropical Forest Research Institute (TFRI), Jabalpur is the central regional Institute of ICFRE since 1988. The Institute caters to the forestry research needs of four states of central India, viz. Madhya Pradesh, Chhattisgarh, Maharashtra and Orissa. Thrust areas of research in the Institute relate to non-wood forest products, rehabilitation of mined areas and other stress sites, development of agroforestry models, planting stock improvement, developing tissue culture protocols for species of central Indian forests, and control of forest diseases and pests. During the recent years, TFRI has established excellent liaison with state forest departments, NGOs working in the field of forestry and allied areas, universities imparting education in forestry and forest based industries.

PROJECTS COMPLETED DURING THE YEAR 2004-2005

Project 1: Social and livelihood analysis of dependence of tribal people on forests [015/ TFRI-2000/Econ-23/2000-2005]

Findings: Vegetational survey in Korku dominated forest areas of M.P. showed that 38 plant species were used by the Korku tribes for food, fodder, oil and medicine.

Training on lac cultivation

Vegetation survey

Maror Phalli in Hoshangabad

Safed Musli in Teak forest

Project 2: Economic evaluation of NTFPs in tribal belt of Madhya Pradesh [044/TFRI-2002/Agro-2(9)/2002-2005]

Findings: Data from weekly markets in nine districts, viz. Mandla, Betul and Chhindwara, Damoh, Neemuch, Shivpuri, Sheopur, Umaria and Shahdol of M.P. regarding five important NTFPs was collected and analysed.

Project 3: Collection of ethnobotanical data from various tribes of Central India [006/ TFRI-97/Bot–7/2000-2005]

Findings: Ethnobotanical data was collected on Gond tribes from Madhya Pradesh and Chhattisgarh state. Herbal medicines used for cure of diseases such as Asthma, Jaundice, Arthritis, Malaria, Paralysis, Diabetes, Headache and Diarrhea along were recorded. Sixty ethnobotanical uses of various plants of forest origin were documented. Ten traditional herbal healers were contacted and interviewed for documentation of information on ethno-medicinal uses of vegetation in tribal culture. The social structure, customs and traditions of tribal were recorded from 10 localities.

Project 4: Impact of eco-restoration on degraded forests [TFRI-2000/Ecol-20/2000-2005]

Findings: Comparative studies were conducted in degraded forests protected by VFCs through JFM, adjacent in protected and natural forests in M.P., Chhattisgarh and Orissa and the impact of eco-restoration was observed by vegetation studies, soil characteristics and socio-economic parameters. The involvement of local people in the protection activities, particularly, in control of grazing, is reflected in increase of regeneration of the dominant tree species and the ground flora.

Project 5: Ecological and economic evaluation of Teak monoculture and mixed plantation [032/TFRI-(2000)2001/Ecol-2(5)/2000-2005]

Findings: The effect of Teak plantations, monocultures and mixed plantations of different ages at Behrai Range of Balaghat Division (Seoni) on the soil was studied. It was observed that soil characteristics such as nutrient status and physico-chemical characteristics have changed compared to control with aging plantations.

Project 6: Mass multiplication of *Trichogramma* spp. and their efficacy against key pests of Teak forests [TFRI-2000/Ento–24/2000-2005]

Findings: An experiment was conducted to optimise quantity of food (maize) for the development of an ideal host of *Trichogramma* spp. It was found that 300 gms of grinded maize is the optimum food quantity for the healthy development of 300 larvae of *Corcyra cephalonica*. The parasitisation caused by *Trichogramma brasiliensis*, *T. raoi* and *T. chilonis* at different temperatures and Relative Humidity (RH) showed that a temperature of 27 ± 1° C and RH of 80 ± 5 % was best for maximum (95 %) parasitisation. Studies conducted on parasitisation by *Trichogramma brasiliensis* on the eggs of *Corcyra cephalonica,* found that maximum parasitisation occurs within three days of oviposition. Chilling the freshly laid eggs of host insect *C. cephalonica* at –8° C is proved best for maximum parasitization. Field efficacy of five *Trichogramma* spp., viz. *T. brasiliensis*, *T. chilonis*, *T. japonicum*, *T. pretiosum* and *T. raoi,* has been carried out against Teak leaf skeletonizer, *Eutectona machaeralis*, by releasing the parasitoids @ 1.5 lakh ha^{-1} or lakh/ha. *T. chilonis* proved best among five species, showing about 52.63% protection of skeletonization in Teak followed by 48.25% in *T. raoi*. Field dispersal of *T. chilonis*, *T. japonicum*, *T. brasiliensis* and *T. pretriosum* showed that the wasps of *T. chilonis*, *T. japonicum, T. brasiliensis* and *T. pretiosum* move up to 50, 45, 40 and 40 metres horizontally respectively and 10 metres vertically within three days of introduction.

Project 7: Investigation into the nature of inheritance and breeding of *Tectona grandis* (Teak) [TFRI-2000/Gen-21/2000-2005]

Findings: Analysis of variance revealed highly significant differences among 30 families tested for height, girth, NRA, conductivity and stomatal conductance. Out of six characters NRA showed highest heritability values of 29 and 51 % at individual tree and family mean basis respectively.

Project 8: Studies on differential adventitious rooting response *vis-a-vis* clonal propagation of economically important forestry species [038/TFRI-2001/Gen-2(4)/2001-2005]

Findings: Physiological and biochemical changes at different stages of adventitious rhizogenesis in semi-hardwood and sprout cuttings of *Gmelina*

arborea were investigated in auxin-treated and non-treated condition. Profound changes in endogenous biochemicals occurred during the process of adventitious root formation in shoot cuttings. All biochemicals exhibited change in the first 24 hours, indicating consequential processes, which influenced subsequent rhizogenesis in treated cuttings. The results indicate two possible phases of adventitious rhizogenesis in these cuttings the initial phase requiring low endogenous moisture with elevation of endogenous phenols and peroxidase activity and later phase demanding higher endogenous moisture with minimal endogenous phenols and peroxidase activity.

Adventitious rooting in IBA –treated cuttings of *G. arborea*: Left- semi-hardwood cuttings; Right- sprout cuttings.

Project 9: Evaluation of various NWFP species for saponins potential and their value addition [TFRI/NWFP/2000-18/2000-2005]

Findings: Saponin glycosides from *Chlorophytum borivillianum* tubers were isolated and estimated. Physico-chemical properties of isolated saponins were determined. The biological activities of saponin glycosides against insects pest of stored seeds were also assessed.

Project 10: Establishment of Advance Centre of NWFP [TFRI/NWFP/2000-19/2000-2005]

Sub-project 1: Germplasm collection, conservation, domestication and commercial cultivation of threatened species of medicinal plants in India. Species: *Terminalis chebula, Celastrus paniculatus*, *Madhuca longifolia* and *Commiphora vitatae*

Findings : Germplasm of *Terminalis chebula, Celastrus paniculatus* and *Commiphora vitatae* from M.P. and Chhattisgarh and *Madhuca longifolia* from Maharashtra were surveyed and collected. Germination studies, chemical analysis and establishment of demonstration plots of selected species were carried out at TFRI campus, Jabalpur.

Sub-project 4: Qualitative and quantitative variations in Tree borne Oil Seeds. Species: *Schleichera oleosa* (Kusum), *Garcinia indica* (Kokam), *Mesua ferrea* (Nagkeshar) and *Actinodephane hookeri* (Pisa)

Findings: Seeds of *Schleichera oleosa* from different forest areas in M.P. and Chhattisgarh, *Garcinia indica* from Sindhudurg and Ratanagiri, *Mesua ferrea* and *Actinodephane hookeri* from Pune, Maharashtra were collected. Total carbohydrate, oil contents, protein contents and other physico-chemical properties of seeds of selected species were estimated. Established demonstration plots of selected TBO's in TFRI campus, Jabalpur.

Sub-project 5: Standardization of methodologies for extraction and value addition of NWFP providing sustenance to tribals [TFRI/NWFP/2000-19(5)/2000-2005]

Findings: Starch from the rootstock of *Curculigo orchioides* was extracted, purified and quantified. Total starch in the extracts of

Curcuma angustifolia and *C. orchioides* was estimated. Viscosity and X ray diffraction studies were done in starch of *C. angustifolia* and *C. orchioides*. Solubility and swelling power in the starch of *C. orchioides* were estimated. The volatile oil, resin and impurities were extracted and quantified in the resin sample of *Gardenia gummifera* (Dikamali). Heavy metals (lead and arsenic) in vegetable dye of *Butea monosperma* and *Woodfordia fruticosa* were estimated

Project 11: Investigation of methodologies for determination of elapsed period after felling of Teak and Bamboo [47/TFRI-2002/NWFP-1(7)/2002-2005]

Findings: Teak logs of varying girth classes from Kalpi Forest Depot, Mandla District and Bamboo samples of *Dendrocalams strictus* and *Bambusa arundinacea* from Balaghat and TFRI Jabalpur, M.P. were collected. Crude fibre, ash, moisture content, cellulose, hemicellulose, hollocellulose and lignin contents in Teak and Bamboo samples were estimated. Insect attack, fungal infestations, physical characteristics, silvicultural character and anatomical characteristics of selected Teak logs, stumps and Bamboo clumps were studied for determination of elapsed period.

Project 12: Development of germplasm bank of biofertilizers and field application of effective strains on important tree species [046/TFRI- 2002/Path-1(6)/2002–2005]

Findings: Cultures of VAM fungi were supplied for trial to Forest Development Corporation, Nagpur for application in Teak, *Gmelina arborea*, *D. sissoo* and Bamboo plantations. Cultures of VAM fungi and Azospirillum were supplied to the Institute of Forest Productivity, Ranchi. Root colonization by VAM fungi were studied in 25 different species of Bamboos planted at Amravati.

Project 13: Studies of population structure dynamics and efficacy of existing silviculture systems for management of Teak forests in the Central India with respect to carbon sequestration [023/TFRI-2000/Silvi-15/2000-2005]

Findings: This study was carried out in Mandla Range of Mandla Forest Division by selecting sites in Teak forests under clearfelling and selection-cum-improvement silvicultural systems. Data regarding population structure, regeneration, growth / yield, etc. were collected by laying out sample plots. Soil samples from different sample plots under the silviculture systems for Teak forests were collected and analyzed for pH value, % organic carbon and available NPK in Kg/ha. Information regarding extraction/ removal of timber, firewood, etc. has been obtained from Madhya Pradesh Forest Department. Data regarding growth, yield and carbon sequestration is being analyzed.

Project 14: Standardization of macro-propagation protocol for mass multiplication of Bamboo species [042/TFRI-2002/Silvi-3 (5)/2002-2005]

Findings: Seasonal variation in adventitious rooting in culm and culm-branch cuttings of different Bamboos, viz. *Bambusa tulda*, *B. vulgaris* var. green, *Dendrocalamus membranaceous* and *Bambusa nana* was studied. The most favourable period of year for adventitious rhizogenesis in culm and side-branch cuttings of *Bambusa tulda*, *B. vulgaris* var. green, *B. nana* and *Dendrocalamus membranaceous* has been identified. The efficacy of auxins and non-auxin growth regulators for induction and growth of adventitious roots was also studied. Most effective treatments for each species have been identified as IAA (*Bambusa tulda* and *B. vulgaris* var. green), IBA

(*Dendrocalamus membranaceous*), and Boric acid (*B. nana*). Evaluation of three types of culm-cuttings (full, half and strip) has been made for adventitious rooting under influence of the best growth regulator for each species. Graded doses of both growth regulators have also been tested in each species in the best season.

Project 15: Standardization of seed handling and storage techniques for important tree species of central India [041/TFRI-2002/Silvi-2(4)/2002-2005]

Findings: Seeds of *Acacia catechu* (Khair) and *Pterocarpus marsupium* (Bijasal) were collected from Jabalpur/ Bhandara and Bijadandi range respectively. Various parameters of seeds, viz. purity percentage, weight of 100 seeds, number of seeds per kg., initial moisture content, germination percentage, were determined. Pre-treatment studies revealed that cold water soaking for 24 h. improves the germination of seeds of both the species. Viability of *Acacia catechu* seeds declined after six months storage.

PROJECTS CONTINUED DURING THE YEAR 2004-2005

Project 1: Development and standardization of management practices for most promising existing agroforestry system in Central Narmada Valley and Satpura Plateau agroclimatic region [043/TFRI-2002/Agro-1(8)/2002-2006]

Status: An agroforestry model consisting of 21 month old plants of *Tectona grandis, Gmelina arborea* and *Emblica officinalis* as tree component was established. The inter-spaces between the trees were grown with soybean (Kharif season) and wheat (Rabi season). Among the tree species *E. officinalis* showed the best height performance (1.85 m) followed by *G. arborea* (1.5 m) and *T. grandis* (below 1m). Yield of soyabean was maximum under *E. officinalis* (470 gm/sq.m) followed by *G. arborea* (370 gm/sq.m) and *T. grandis* (320 gm/sq.m) as compared to sole crop (430 gm/sq.m). The wheat yield was not significantly different under the three tree species.

Project 2: Management of insect pests of forest nurseries in Central India [045/TFRI-2002/Ento-1(5)/2002-2006]

Status: *Holotrichia* sp. (White grubs) was found major insect pest of Teak seedlings in Maharashtra. Teak defoliator and skeletonizer were found major pests in Madhya Pradesh. Termites were major pests in Maharashtra and Orissa attacking seedlings of Teak and Khamer. Endocel @ 0.04% proved most effective against eggs of white grubs. Two commercial available biopesticides; Biopro super (*Bacillus thuringiesis*) and Bioseal super (*Metarhizium anisopliae*) were evaluated against the Teak defoliators. A new insect was recorded which damages Teak roots and was identified as *Myllocerus discolor*. Feeding behaviour of this borer is being studied in details.

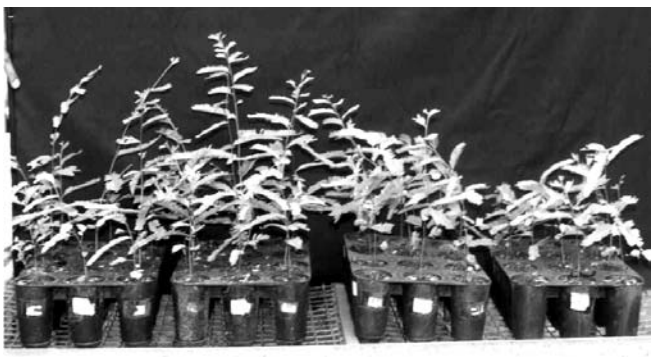
Project 3: Development of a decision support system for predicting suitability of important forestry species in various climatic conditions in central India [059/TFRI-2003/Misc-IT-1(1)/2003-2006]

Status: Field information on 15 identified tree species was collected.

Project 4: Integrated management of diseases of seeds, nurseries and plantations [035/TFRI - 2001/Path-4(5)/2001–2006]

Status: Fungi associated with Teak fruits were recorded and their role in abortiveness of its fruits was studied. A new fungus, *Cephaliophora irregularis,* was found to be a dangerous pathogen of Teak fruit. Effect of Trichoderma and PSB was studied for control of *Macrophomina phaseolina,*

which is known as charcoal root rot of Casuarina. Effects of soil solarization, VAM, Trichoderma application on germination and survival of *Acacia nilotica* seedlings were evaluated. Maximum germination and survival was found in solarized and Trichoderma applied nursery bed.



Effect of different Biofertilizers on Aonla 1. PSB 2. Azospirillum, 3. VAM and 4. Control

Project 5: Germplasm conservation and investigation on inheritance pattern of *Gmelina arborea* [040/TFRI–2002/Gen–1(5)/ 2002-2007]

Findings: Systematic surveys were undertaken in forest areas of Chhattisgarh and Maharashtra states to identify and mark candidate plus trees, which would form the base materials to start the breeding programme. Total 46 Candidate Plus Trees (CPTs) were selected and marked from 8 locations.

Open pollinated seeds and bud grafts of 88 phenotypically superior trees were collected for establishing breeding population and germplasm bank. Data collected from progeny trial was subjected to analysis of variance followed by estimation of General Combining Ability (GCA) and other genetic parameters. Analysis of variance revealed significant differences amongst the families for growth characters, viz. height and girth. Heritability values for height and girth were 5.59, 21.22, 19.02 and 44.01 % at individual tree and family mean level, respectively. Genetic gain estimates for these two characters were 9.14 % and 26 %. Twelve parents showed positive GCA for girth and 11 parents exhibited positive GCA for height. CPT No. 6 and CPT No. 63 showed maximum GCA for girth and height respectively.

NEW PROJECTS INITIATED DURING THE YEAR 2004-2005

Project 1: Ecological rehabilitation of limestone mined areas of Madhya Pradesh [065/TFRI-2004/Ecol-1(6)/2004-2007]

Status: Suitability of different tree species on limestone mined overburden spoils mixed with FYM (1:1) was studied in pot culture. Growth observations recorded after seven months of planting showed that *Leucaena leucocephala* recorded the highest score in respect of height, collar diameter and biomass followed by *Nyctanthes arbortristes*. *Albizia procera* recorded the minimum score. In control treatments using pure limestone mined overburden spoil, almost no seed germination or growth of seedling was observed.

Project 2: Screening populations of *Dalbergia sissoo* for tolerance to salt and water stress using physio-morphological and biochemical criteria [067/TFRI-2004/Gen-2 (8)/2004-2007]

Status: Open pollinated seeds (half-sib) of *Dalbergia sissoo* were collected from 30 healthy and vigorously growing trees. Seeds of 5 half-sib families (FRI/DS/006, FRI/DS/007, FRI/DS/011, FRI/DS/014 and FRI/DS/015C) were also obtained from Dehradun. Experiments have been designed for evaluation of germination potential and changes in endogenous level of biochemicals

in half-sib families as influenced by various regimes of NaCl induced salinity stress.

Project 3: Studies on inheritance pattern of selected wood traits in *Tectona grandis* L. (Teak) [068/TFRI-2004/Gen-3(9)/2004-2007]

Status: The project envisage to gather information on pattern of inheritance of wood traits in Teak, which would be used to formulate breeding strategy for improving its wood quality. Wood parameters such as wood specific gravity, earlywood and latewood per cent, fibre or vessel length/diameters, grain pattern and colour of wood in progenies of half-sib families will be studied using samples collected from progeny trials of Teak laid out in central Indian states.

Project 4: Chemical investigations on biologically active chemicals of forest species and their utility for pest control [069/TFRI-2004/NWFP-1(9)/2004-2007]

Status: *Jatropha curcas* seeds from Barha and TFRI Campus, Jabalpur were collected. Extraction was made from *J. curcas* seeds for isolation of toxic biochemicals.

Project 5: Evaluation of wild edible plants of central region for polysaccharides and other food value [070/ TFRI/2004/NWFP-2(10)/ 2004-2007]

Status: Tubers viz. *Alpinia galanga, A. calcarata, Kaempferia galanga, Costus speciosus* and *Crinum defixum*s were collected from NWFP Nursery. Phenols, carbohydrates, cyanogens, tannins, free amino acids, proline, P, K, Na in these species tubers were estimated.

Project 6: Studies on bacterial and viral diseases of Teak, Gmelina and Albizia and their management [066/TFRI/2004/Patho-1(8)/2004–2007]

Status: Samples of diseased seedlings of Teak and Gmelina from Mandla, Balaghat and Jabalpur forest nurseries were collected. Isolation of *Pseudomonas solanacearum* was confirmed and identified in most of the samples. Predisposing factors for disease development were also recorded.

Project 7: Evaluation of management systems and level of community participation under Joint Forest Management (JFM) [071/TFRI-2004/Silvi-1(6)/2004-2007]

Status: Compartment No. 560/563 of Maihar Range of Satna Forest Division is being managed under Joint Forest Management by Madhya Pradesh Forest Department and Udaipur Village Forest Committee under people protected area approach. The project work will evaluate the approach for better management of the forests.

Project 8: Studies on the role of Actinomycetes in controlling root diseases of *Tectona grandis* and *Albizia procera* [072/ TFRI-2004/Patho–2(9)/2004– 2007]

Status: Soil samples from different forest divisions were collected and screened for Actinomycetes population by dilution plate method. Some of the actinomycetes forms were isolated in PDA medium for detail studies.

Project 9: Seed physiology of the tropical forest species with special reference to their maturity and storage [076/TFRI-2004/Silvi-2(7)/2004-2009]

Status: Germination percentage was found to increase with simultaneous treatment with sulphuric acid and Gibberelic acid in *Rauvolfia tetraphylla*. Seeds of *R. tetraphylla* are desiccation tolerant up to 5% moisture content, hence likely

to be of orthodox category. Maturation study on *Mimusops elengi* is continued.

PROJECTS COMPLETED DURING THE YEAR 2004-2005

(Externally Aided)

Project 1: Improving infrastructure facilities for *ex-situ* conservation of rare/threatened plants in the Botanical Garden, TFRI, Jabalpur [037/TFRI-2001/BD-1(MoEF)(3)/ 2001-2005]

Cinnamomum tamala (Tej Patta)

Piper nigrum (Kali mirch)

Gnetum ula Brong.

Findings: The germplasm of 120 species belonging to 80 generas and 40 families of forest origin of central India have been collected and maintained in the botanical garden.

Project 2: Screening and identification of Teak of Madhya Pradesh for resistance against major insect pests [034/TFRI-2001/ Ento-1(MPCST)(4)/ 2001-2004]

Findings: Feeding potentiality of Teak defoliator and leaf skeltonizer on 5 Teak clones (3 trials) and progeny of 30 clones of Madhya Pradesh Teak was studied and leaf water contents of contributory leaves measured. Defoliation impact of major insect pests on 135 Teak clones of Madhya Pradesh in TSO, Behrai (Seoni) was measured.

Project 3: Productivity enhancement through people's participation – a follow-up action [054/TFRI-2003/Ext-1(FF)/2003-2005]

Findings: The long term and short term needs and expectations of the members of VFCs were documented through PRA exercises. Planting materials viz. Jatropha seeds (30 Kg) and seedlings 2000 Nos. at Barbati VFC and seed of Dinanath Grass (100 Kg) in Kukarikheda and

Richai VFC were distributed. Four and half hectare pasture for Barbati VFC was developed. Micro-plans for the VFCs of Moiyanala, Barbati, Richhai and Kukarikheda were prepared.

Project 4: Entomological survey of Kanha National Park [058/TFRI/2003/ Ento-I(MFD) (6)/2003-2004]

Findings: Periodical surveys of 5 different ranges of the Kanha National Park were conducted from July, 2003 to June, 2004. About 250 species were sampled from which nearly 200 species were identified, described and documented.

Project 5: Introduction of egg parasitoid, *Trichogramma* spp. to prevent growth loss in Teak plantations due to defoliator, *Hyblaea puera* Cramer and skeletonizer, *Eutectona machaeralis* (Wlk.) [062/TFRI-2003/Ento-2 (MPFD)(7)/ 2003-2004]

Findings: Wasps of indigenous egg parasitoid, *Trichogramma raoi* were multiplied in insectory and uniformly introduced @ 1.25 lakh wasps per hectare in 100 hectare Teak plantations in compartment Nos. 249 and 242 of Bijadandi and Kalpi ranges under West Mandla Forest Division from July, 2004 to November, 2004 in 4-5 instalments. Releasing of wasps proved effective in minimizing the skeletonized leaves of Teak as compared to non-introduced sites in the month of November.

Project 6: Introduction of egg parasitoid, *Trichogramma* spp. to prevent growth loss in Teak plantations of FDCM due to Teak defoliator, *Hyblaea puera* Cramer and skeletonizer, *Eutectona machaeralis* (Wlk.) [064/TFRI-2003/Ento-03 (FDCM) (8)/2003-2004]

Findings: A total of 100 hectare Teak plantations raised by Maharashtra Forest Development Corporation Ltd. were surveyed for identification of natural enemies of Teak defoliator and skeletonizer. To suppress the incidence of these pests, an egg parasitoid, *Trichogramma raoi*, which was missing in plantations was introduced uniformly @ 1.25 lakh wasps per hectare in 3-4 installments after pre monsoon showers. Releasing higher number of wasps in September resulted maximum protection of Teak leaves from the attack of skeletonizer.

Project 7: Analysis and valuation of common Bamboo under Sawran Jayanti Gram Swarojgar Yojana (SJGSY) [075/TFRI-2004/ Agro-1(MPFD) (11)/ (October 2004-December 2004)]

Findings: Five districts, viz. Satna, Shahdol, Sidhi, Panna and Chattarpur were selected for the study. Field work has been completed. Reports for Shahdol, Sidhi and Satna have been completed and are under preparation for the remaining two districts.

PROJECTS CONTINUED DURING THE YEAR 2004-2005

(Externally Aided)

Project 1: Studies on cataloguing the genetic variability in Teak species using molecular markers [052/TFRI-2003/Gen-1(DBT)(6)/ 2003-2006]

Status: DNA fingerprinting of 48 plus trees of *Tectona grandis* and one of *T. hamiltonii* were investigated using RAPD (Random Amplified Polymorphic DNA) markers. There was specific fingerprint of each plus tree commensurate with RAPD markers. RAPD markers were also used to study the genetic relatedness among the plus trees. Nei's gene diversity index for plus trees ranged between 0.141 and 0.499 with a mean of 0.345. *Tectona grandis* maintained genetic

distance from *T. hamiltonii*. A screening of Inter Simple Sequence Repeat (ISSR) primers, obtained from University of British Columbia, Canada with respect to Teak genomic DNA was conducted. Genomic DNA of Teak populations from four central Indian states has been extracted for RAPD/ISSR analysis. A reference library of RAPD fingerprints for the plus trees has been established. This information will serve as a reference source of RAPD profiles for each plus tree.

Project 2: Standardization of production technology of some important medicinal plants under tropical climate of Madhya Pradesh [55/CFRHRD/ 2003/2003-2006]

Status: Major active ingredients, viz. Ascorbic acid, Gallic acid and other phenolic acids were estimated in the Aonla fruits. Method for estimation of active ingredients, e.g. Reserpine and andrographolide in Sarpagandha roots and Kalmegh was standardized. Germplasm of Aonla, Sarpagandha, Kalihari, Gurmar, Giloe and Kalmegh were collected from different parts of Madhya Pradesh Seedlings/plantlets were raised and transplanted in the field. Cultivation techniques were standardized for Sarpagandha and Gurmar. Non-destructive harvesting technique of Kalmegh was standardized.

Project 3: Taxonomy and documentation of fungi occurring in forests of Madhya Pradesh and Chhattisgarh [061/TFRI–2003/Path–1(CSIR)(7)/2003– 2006]

Status: Surveys were conducted in forest areas of Pipariya, Tamia, Delakhari, Pachmarhi, Choorna, Bori, Mandla, Balaghat, Katni, Damoh, Sagar, Motinala and Supkhar, Madhya Pradesh. Total 231 fungi specimens were collected and 121 fungi identified, out of them 30 fungi confirmed upto species level. 259 isolates were recorded from 71 soil samples. Cultural characteristics of 56 soil fungi belonging to various families were conducted. Illustrations of 53 fungal generas have been drawn.

Project 4: Developing coalition approach to non-timber forest produce for better livelihoods of tribal communities of Madhya Pradesh [053/TFRI-2003/Agro (1) DFID (10)/ 2003-2005]

Findings: In this project there were 4 partners i.e, TFRI, State Institute of Rural Development, Tarun Sanskar, Jabalpur and Livelihood Solutions, New Delhi and coalition approach was introduced to four Self Help Groups (SHG). All these SHGs consisted of tribal women, who depend on Mahua for their livelihood. Main problem relating to Mahua was that of distress sale, repurchasing Mahua from traders at higher price during lean season and storage. Groups were imparted capacity building trainings. They were given seed money to procure Mahua from collectors, which they will be, using in lean season. Stored Mahua will be sold to others also. Mahua was stored in traditional bins in each member's house.These bins were lined with plastic sheets so that Mahua is protected from moisture.

Apart from Mahua, which is seasonal, Palas (*Butea monosperma*) trees are found in large number in this area, which is a good host for lac insect. To enhance tribal people incomes, SHG members were provided training in lac cultivation. 700 trees were inoculated with lac insects.

PROJECTS INITIATED DURING THE YEAR 2004-2005

(Externally Aided)

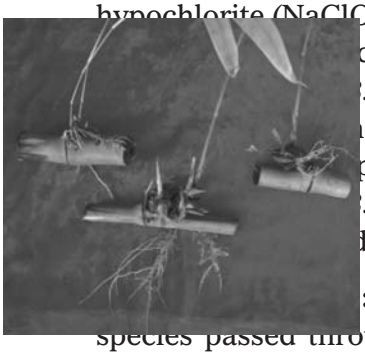
Project 1: Studies on refinement and scaling up of existing micropropagation and macropropagation technologies for *Bambusa nutans* and *B. tulda* [063/TFRI-2004/Gen-1/ DBT (7)/2004-2007]

Status: Survey for selection of superior clumps: Survey for selection of superior clumps of *B. nutans* and *B. tulda* was undertaken during November-December, 2005 at different places of Orissa for use in micropropagation experiments. *B. tulda* was collected from Ghatikia, Barbeta, Angul and *B. nutans* from Angul and Sambalpur.

Micropropagation

Collection of explants: The nodal segments (explants) of *Bambusa tulda* and *Bambusa nutans* were collected from the bambusetum and NWFP nursery of the institute. Collection of both the species was done from three clumps.

Explant sterilization of *B. nutans* and *B. tulda* was standardized for culture establishment in two seasons, i.e. rainy (July) and winter (November) employing three concentrations (0.05%, 0.1% and 0.2% for the duration of 10 min) each of mercuric chloride ($HgCl_2$) and sodium hypochlorite (NaClO). The 0.2% $HgCl_2$ was found



c culture establishment (*B.*
. tulda- 90%) and bud break
d *B. tulda*- 53%) in July and
otic culture establishment (*B.*
. tulda- 53%) and bud break
d *B. tulda*- 53%) in November.

: The cultures of both the species passed through 10 subculture cycles of 15 days for *Bambusa nutans* and 10 days for *Bambusa tulda* maintaining a maximum multiplication rate of 4.5 and 3.5 fold, respectively on MS liquid medium supplemented with 3 mg l^{-1} BA and 0.5 mg l^{-1} IAA. However, some of the cultures of *Bambusa tulda* started exhibiting yellowing and death after 5th subculture cycles and deteriorated by 7th subculture cycles. Inclusion of 50-100 mg l^{-1} glutamine and/or 50-100 mg l^{-1} ascorbic acid with NAA did not check yellowing. The proliferated cultures of both species will be used for setting experiments for optimization of shoot multiplication and induction of adventitious rhizogenesis. Presently, 831 clusters of *Bambusa nutans* and 96 clusters of *Bambusa tulda* are being regularly maintained. Each clusters contains 10 shoots in *B. nutans* and 3 shoots in *B. tulda*.

Macropropagation: The effect of seasonal variation on adventititous rhizogenesis in culm and culm-branch cuttings of *B. nutans* and *B. tulda* was investigated in rainy (July) and winter (November) season. The best adventitious rhizogenesis was recorded in auxin-treated *B. nutans* culm-cuttings of rainy season (55.6%). In the same season 25.6% root induction occurred in treated culm-branch cuttings. In spite of some sprout development, no rooting was noticed in *B. tulda*. Overall the pattern was: culm-cuttings > culm-branch cuttings and rhizogenesis in rainy season and winter season was same in case of *B. nutans*.

Adventitious rhizogenesis in *B. nutans*. a. Cuttings in mist chamber, b. Culm-cuttings and c. Culm-branch cuttings.

An experiment has been laid out to study the adventitious rhizogenesis in three types of culm cuttings (full, split and strip) of each species and to study the effort of 16 treatments comprising of four different concentrations of auxins (IBA and NAA) and non-auxins (boric acid, coumarin and thiamine).

Project 2: Screening of indigenous species of *Trichogramme westwood* and *Trichogrammetoidea girault* (Hymenoptera: Trichogrammatidae) from central India and their utilization against important forest insect pests [077/TFRI-2005/Ento-DST-1(9)/2005-2008]

Status: The project has been initiated recently.

Project 3: National network on integrated development of Jatropha and Karanj [73/TFRI-2004/NWFP-3 (NOVOD)(11)/2004-2007]

Status: *Jatropha curcas* seeds were collected from various agroclimatic regions of M.P. and were analyzed for fatty oils. Jatropha seeds from various provenances were sown in beds and poly bags to raise seedlings for multilocational trails.

Project 4: Study of Sal mortality in forest divisions of Chhattisgarh [074/TFRI-2004/Patho-3(CGFD)(10)/2004-2005]

Status: Project inception report has been submitted to Chhattisgarh Forest Department. Survey in east Raipur and Udanti Forest Division has been conducted and the samples from Sal mortality area have been collected.

EDUCATION AND TRAINING

Trainings organized

1. Two weeks training programme in biochemistry was organized for M.Sc. Students of R.D. University.
2. Two weeks training programme in biotechnology was organized for B.Sc. Students of Govt. Science College, Jabalpur.
3. Training programme was organized for SFD Officials at four locations, viz. Baihar, Motinala, Bajag and Amarkantak Range of Madhya Pradesh for effective catching of beetles of Sal heartwood borer.
4. Training progamme was organized for M.Sc. students in biotechnology and biochemistry.
5. Three days training programme on improving forest productivity through technological means was organized for field executives of Maharashtra Forest Department from 17th to 19th February, 2005.
6. One week compulsory training course was organized for IFS officers on New Approaches to biodiversity conservation from 31st January to 4th February, 2005.
7. One day training programme was organized for the members of VFC at Kukarikheda on 1st March, 2005 for Lac cultivation.
8. One day training programme was organized for the members of VFC at Richhai on 22nd March, 2005 for Mushroom cultivation.
9. Two days training programmes were organized on cultivation of Jatropha and Karanj for the farmers at Satna, Mandla, Lakhnadon, Balaghat and Narsinghpur.
10. Training was imparted to women and youth of Kanwar tribe on Cultivation of Lac and Medicinal Plants at Bilaspur, Korba and Katghora on 18th March, 2005.
11. Training was imparted to members of village society of Gotegaon (Narsinghpur) on Potential of Jatropha and Karanj in Agroforestry from 29th and 30th March, 2005.

12. Training was imparted to forest officials on Agroforestry Systems at Department of Rural Development, Chhindwara.

13. Training was imparted to members of village society of Satna, on Potential of Jatropha and Karanj in Agroforestry from 11th and 12th March, 2005.

LINKAGES AND COLLABORATION

1. A collaborative project entitled Developing coalition approach to non-Timber Forest Produces for better livelihoods of tribal communities of Madhya Pradesh funded by DFID was implemented.

2. Replied more than 10 public queries pertaining to various issues like availability of medicinal plants, diseases, pests and insect problems etc.

Pamphlets

1. Pamphlets containing information about divisions of TFRI - 250 Nos.

2. Booklet containing the cultivation of Jatropha and Karanj - 500 Nos.

CONSULTANCIES

1. Consultancy given to Regional Manager, Tribal co-operative Marketing Federation, Ministry of Tribal Affairs, Jagadalpur for cultivation of Safed musli at Jagadalpur from 20th and 21st November, 2004.

2. Evaluated coastal shelterbelt plantation in coastal districts of Orissa.

3. Analyzed soil samples from SAIL (Funding Agency: SAIL, Kolkata).

CONFERENCES/MEETINGS/ WORKSHOPS/SEMINARS/ SYMPOSIA/EXHIBITIONS

1. Director, TFRI and one scientist participated in IUFRO International Seminar on Multipurpose Tree Species from 22nd to 25th November, 2004 held at AFRI, Jodhpur, (Rajasthan).

2. Director, TFRI and two scientists attended International Symposium on Microbial diversity: Challenges, opportunities and relevance in new millennium organized by Society for Basic and Applied Mycology (SBAM), R.D. University, Jabalpur from 19th to 21st November, 2004.

3. Dr. R.K. Verma, Scientist-D participated in 26th Annual Conference of ISMPP and National Symposium on Advances in Fungal Diversity and Host Pathogen Interaction from 7th to 9th October, 2004 held at Department of Botany, Goa University, Taleigao, Goa.

4. Dr. Nidhi Sharma, SRF, CSIR Project attended International Symposium on Microbial diversity: Challenges, opportunities and relevance in new millennium organized by Society for Basic and Applied Mycology (SBAM), R.D. University, Jabalpur 19th to 21st November, 2004 presented a Poster Presentation on "Fungal diversity in the forests of Satpura" (by R.K. Verma, Nidhi Sharma, K.K. Soni and Jamaluddin).

5. Dr. Jamaluddin and Dr. V.S. Dadwal attended a National Symposium on Conservation and Management of Threatened Medicinal Plants, was held from 23rd to 25th February, 2005 at SFRI, Jabalpur and presented two research papers.

6. Shri Avinash Jain, Scientist-D, attended Advanced EMS Auditing Course for Quality and Environmental Professionals accredited by the Institute of Environmental Management and Assessment (IEMA) at ICFRE, Dehradun from 23rd to 27th November, 2004.

7. Shri S.P. Tripathi, IFS attended National workshop on refined criteria and indicators on sustainable forest management held from 10th and 11th March, 2004 at IIFM, Bhopal.

8. Dr. A.K. Pandey, Scientist-E presented a paper entitled Medicinal Plants in Madhya Pradesh: Potential and Constraints in National Interactive Meet on Scope and opportunities in research and business of medicinal and aromatic plants from 29th and 30th October, 2004, Central Institute of Medicinal and Aromatic Plants, Lucknow.

9. Dr. A.K. Pandey, Scientist E presented a paper Role of Tropical Forest Research Institute in Research and Development of NWFPs. Regional Workshop on Non Wood Forest Products at Raipur, from 3rd and 4th November, 2004.

10. Dr. A.K. Pandey, Scientist-E presented a paper Sustainable development of Aonla (*Phyllanthus emblica* L.) through non destructive harvesting practices in the International Conference on multipurpose trees in the tropics : Assessment, Growth and Management from 22nd to 25th November, 2004, Arid Forest Research Institute, Jodhpur.

11. Dr. A.K. Pandey, Scientist-E attended National symposium on emerging technologies and their application in assessment, conservation and management of endangered wild medicinal plants and their habitats from 23rd to 25th February at SFRI, Jabalpur and presented a paper.

12. Jamaluddin and Chawdhry, P.K. (2004). Management of nursery diseases of multipurpose tree species in central India. In: *IUFRO International Seminar on Multipurpose Tree Species* from 22nd to 25th November, 2004 held at AFRI, Jodhpur.

13. Dadwal, V.S. and Jamaluddin (2004). Diversity of diseases in agroforestry tree species in central India. Presented in Symposium on *Microbial Diversity: Challenges and Opportunities / Recent trends in Plant Sciences* held at R.D. University, Jabalpur from 19th to 22nd November, 2004.

14. Kulkarni, N. and Joshi, K.C. (2004). Role of ecofriendly insect control methods in plant conservation. Paper presented in National Workshop on *Regional Strategy for Conservation of Plants*, held at Tropical Forest Research Institute, Jabalpur from 26th and 27th February, 2004.

15. Rai, Rajiv and Nath, V. (2004). Glimpse on herbal medicinal plants conserved in Sacred Groves, Deogudi by Gond tribals of Central India. National Workshop on Strategy for Conservation of Sacred Grove. IFGTB, Coimbatore.

16. Rai, Rajiv and Nath, V. (2004). Tribal concepts of Conservation and Sustainable Utilization of Multipurpose tree species of medicinal value in Central India. International Conference on Multi purpose trees in the tropics from 22nd to 25th November, 2004, AFRI, Jodhpur.

17. Rai, Rajiv and Nath, V. (2005). Plants used by indigenous inhabitants in stress sites of Madhya Pradesh (India). International

Conference on Suitable Crop Production in tree Enviroments: Management and Genetic Option from 9th to 12th February, 2005. JNKVV, Jabalpur.

18. Rai, Rajiv and Nath, V. (2005). Medicinal and Aromatic plant product –oil used in ethnomedicine by Gond tribe in Central India. National Seminar on Medicinal and Aromatic Plants- Biodiversity, Conservation, Cultivation and Processing, IGKVV Raipur, CG from 26th and 27th February, 2005.

19. Rai, Rajiv (2005). Floristic diversity of herbal medicinal plants documented in tribal pockets of Madhya Pradesh. National Symposium on emerging Technologies, and their application, in Assessment, Conservation and Management of Threatened wild medicinal plants and their habitat from 23rd and 24th February, 2005, SFRI, Jabalpur, p. 14.

20. Sah, A.K.; Argal, A.; Singh, R.B., Dilraj, I.T.K. and Berry, N. (2004). Production of fodder crop under 5 MPTs. Paper accepted in IUFRO International Conference on Multipurpose Trees in tropics: Assessment, growth and management held at AFRI, Jodhpur held from 22nd to 25th November, 2004.

21. Participated in state level Krishi Vigyan Mela at JNKVV, Jabalpur from 3rd and 4th October, 2004.

22. Participated in Gramin Mela at Xavier Institute of Development Action and Studies (XIDAS), Jabalpur from 3rd to 5th December, 2004.

23. Participated in state level trade fair Van Mela at Bhopal from 8th to 10th December, 2004.

24. Participated in exhibition at JNKVV, Jabalpur on the occasion of an International Conference on Sustaible crop production in stress environment: management and genetic options from 9th to 12th February, 2005.

25. Participated in two days National Symposium on Emerging Technologies and their application in Assessment, Conservation and Management of Threatened wild medicinal plants and their habitat from 23rd and 24th February, 2005, organized by SFRI, Jabalpur and presented two research papers.

26. Participated in Herbal Mela 2004 from 10th to 13th December, 2004 organised by Madhya Pradesh, MFP Federation, Bhopal and delivered information on use of herbal medicines in cure of ailments.

27. Participated in Van Mela 2005 from 17th to 20th March, 2005 organised by DFO, Jabalpur to document information from vaidyas of Seoni, Mandla , Katni, Chhindwara, Jabalpur and Anuppur (Shahdol) for recording information on herbal medicines and their formulation.

AWARDS

1. Dr. Jamaluddin, Scientist-G, Head of Forest Pathology and Group Coordinator (Res.), Dr. K.K. Soni, Scientist-D and Dr. V.S. Dadwal, Scientist-B, Forest Pathology Division, TFRI were awarded Award of excellence in Forestry Research by ICFRE, Dehradun for 2003.

2. Dr. Jamaluddin, Scientist-G has been awarded Vishist Vaigyanik Puraskar from the Ministry of Environment and Forests, Govt. of India.

3. Dr. Jamaluddin, Scientist-G and Dr. V.S. Dadwal, Scientist-B awarded Brandis

Prize for the year 2004 by the Society of Indian Forester.

DISTINGUISHED VISITORS

Dr. D.N. Tiwari, Vice Chairman, Chhattisgarh State Planning Board visited this institute from 12th and 13th September, 2004 and held a discussion with officers and senior scientist of TFRI on various aspects of Jatropha.

MISCELLANEOUS

Museum development: Digital photograph (30" x 20") with lamination on various activities of extension have been prepared for museum - 5 Nos.

Meetings, RAG, CTA's etc.

1. Pre RAG – in-house meeting held at Tropical Forest Research Institute, Jabalpur in the last week of July, 2004.
2. 14th RAG Meeting held at Tropical Forest Research Institute, Jabalpur on 12th and 13th August, 2004. Members and a few special invitees participated from all 4 states under the jurisdiction of Tropical Forest Research Institute.

Important activities during the year

1. Celebrated World Environment Day on 5th June, 2004 with relevant programmes.
2. Celebrated Van Mahotsav on 27th July, 2004 in which about 200 seedlings of various species have been planted in TFRI, Jabalpur.
3. Celebrated Wildlife week from 1st to 7th Oct., 2004 along with relevant programmes.
4. About 2000 seedlings of Jatropha have been planted at Barbati village of Madhya Pradesh under Ford Foundation follow-up-action.
5. About 100 Kg seed of Dinanath Grass was distributed to the members of VFC at Richhai and Kukarikheda.