

# Tropical Forest Research Institute Jabalpur

Tropical Forest Research Institute (TFRI), an Institution of ICFRE caters to the forestry research needs of four central states of 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 and demonstration in agroforestry models, planting stock improvement, developing tissue culture protocols for difficult species of central Indian forests, and control of forest diseases and pests. TFRI has established constant liaison with state forest departments, NGOs working in the field of forestry and allied areas, universities imparting education in forestry, and forest based industries. A number of scientists, officers and staff of the institute participated in various scientific seminars and symposia both at state and national levels were also actively involved in extension activities. This has helped the institute in imbibing in its research programme ideas and concepts from various user groups.

## PROJECTS COMPLETED DURING THE YEAR 2005-2006

### 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]

**Findings:** An agroforestry model with three tree species (age 34 months) namely *Tectona grandis*, *Gmelina arborea* and *Emblica officinalis* and wheat developed. Wheat (rabi crop) was grown in the inter spaces between the trees. Among the tree species *E. officinalis* showed best performance in terms of height growth (1.24.m) followed by *Gmelina arborea* (0.93 m) and *T. grandis* (0.63m). Data on yield, wheat showed highest yield under *T. grandis* (311.18/sq m) followed by *G. arborea* (320.14 g/sq m) and *E. officinalis* (287.77/ sq m) against sole crop of wheat 231.99 g/sq m.



On Station Trail at TFRI



Agri crop-sole

Farmers of Jabalpur and Narsinghpur were also surveyed through questionnaire for identification of most suitable agroforestry system practiced by them. Farmers of Narsinghpur preferred planting teak, khamer and bamboo in their field bunds intercropped with wheat, arhar, gram and mustard. Farmers of Jabalpur preferred babul, bamboo, teak and eucalyptus in their field bunds with wheat, gram, arhar, masur, til and urad.



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

**Findings:** Surveys carried out at 7 major nurseries in M.P., Chhattisgarh, Maharashtra and Orissa, revealed white grubs to be the major species causing maximum economic losses in terms of seedling mortality in teak in forest nurseries of Maharashtra, M.P. and Chhattisgarh. Termites caused 23 to 60 % losses to teak and khamer (*Gmelina arborea*) seedlings in nurseries of Orissa. Considering the intensity of white grub attack detailed study was carried out at Ramdongari Nursery, FDCM Ltd., Nagpur (MS). Three species of white grubs, viz., *Holotrichia mucida* Gyll., *H. rustica* Burm. and *Schizonycha ruficollis* Fab were recorded for the first time, as a major pest on teak. Chafer beetle of these species fed on *Ziziphus jujuba*, *Z. mauritiana*, *Z. xylocarpa*, *Acacia catechu* and *A. leucophloea*. The beetle emergence initiated after the pre-monsoon showers and continued to be actively feeding and laying eggs till 18-19 days after emergence. Grubs of a predatory beetle species feeding on the white grubs in teak nurseries were recorded for the first time with predatory potential of matured grub in laboratory being 8-10 white grubs/day. Endosulfan @ 0.04% proved most effective against eggs of white grubs when treated through soil drenching. Field experiments proved that *Beauveria bassiana* and *Metarhizium anisopliae* in combination with phorate 10% G and methyl parathion 2% D, (in ratio of 100g microbial product + 250g phorate 10 % G/methyl parathion, proved effective in reducing infestation of grubs.

## **Project 3: Integrated management of diseases of seeds, nursery and plantation [035/TFRI-2001/Path-4(5)/2001-2006]**

**Findings:** One month after soil solarization population of *Aspergillus*, *Penicillium*, *Fusarium*, *Rhizopus* and *Nematodes* were completely eliminated from upper 10 cm soil depth, while population of AM fungi, *Trichoderma* and bacteria was significantly reduced. Population of weeds in the control beds were 229/m<sup>2</sup>, were completely eradicated after solarization. A new cotyledon rot of *Pongamia pinnata* caused by *Fusarium dimerum* was recorded from nursery. Disease was successfully controlled by application of Anucop 0.2%. An unrecorded foliar blight of *Ailanthus excelsa* due to *Colletotrichum dematium* was noticed in TFRI nursery. Disease was managed by keeping seedlings in well drained sites with full sunlight and fortnightly spray of Thirum 0.2%. Incidence of *Botryodiplodia* the obromae and *Funalia leonina* was first time recorded in 12 years old plantations of *Bursera paniculata*. Proper sanitation at the site of plantation and spray of bordeaux mixture (copper sulphate 1 kg + calcium carbonate 1kg in 100 lit. water) was recommended for disease management.

Seeds of 13 provenances of *Acacia nilotica* were evaluated for seed associated mycoflora. *Trichurus spiralis* was found in 6 provenances. Six fungi and one bacteria from *Albizia procera* seeds and ten fungi from neem seeds were isolated and identified.

Biocontrol experiments were conducted by using *Trichoderma* spp., PSB, VAM fungi against *Fusarium* wilt of *Gmelina arborea*. Combination of *Rhizobium*, *Trichoderma* AM fungi against *Fusarium* wilt of *Dalbergia sissoo* was tried in nursery. AM fungi *Rhizobium* and *T. polysporum* in combination was found best in controlling the disease. *Streptomyces* sp. controlled wilt of *A. procera*, *D. sissoo* and *A. lebbek* in nursery. Soil solarization completely eliminated population of pathogens. Nematode and weed population is also drastically reduced. Germination and survival of *D. sissoo* and *A. nilotica* seedlings in solarized plots increased as compared to non-solarized plots.



## PROJECTS CONTINUED DURING THE YEAR 2005-2006

### **Project 1: Eco-rehabilitation of limestone mined area in Madhya Pradesh [065/TFRI/2004/Ecol-1 (6)/2004-2007]**

**Status:** Vegetation survey was carried out in Kuteshwar limestone mined area by quadrat method in the overburden dump and adjoining sites (natural). In the overburden sites, *L. leucocephala*, *Casia siamea*, *A. procera*, *Eucalyptus* etc. were found as the dominating tree species; *Lantana camara*, *Zizyphus* spp., *Casia tora* and *Calotropis procera* as common shrub species and *Hyptis suaveolens*, *Binata*, *Parthenium* and *Atylosia* spp. as common herbs. In the adjoining (natural) sites *A. auriculiformis*, *A. nilotica*, *A. indica*, *A. procera*, *D. sissoo*, and *Gulmohar* etc. were commonly found. Soil samples were collected from both the sites and physiochemical and nutritional characteristics including pH, EC, organic carbon, N, P, K, Cation exchange capacity and exchangeable cations were quantified. Pot experiments on biofertilizer, chemical fertilizer and mulching were set up in nursery and in progress.

### **Project 2: 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:** Surveys were conducted in Sagar, Mandla, Badwani, Raipur and Jabalpur forest areas and collected different soil samples. Isolated one effective strain of actinomycetes. Its efficacy was tested against various soil borne plant pathogens. The culture filtrates of streptomycetes species were prepared and purified for identification of active antibiotic principles.

### **Project 3: Studies on bacterial and viral diseases of teak, *Gmelina* and *Albizia* and their management [066/TFRI/2004/Patho-1(8)/2004-2007]**

**Status:** Six isolates of bacteria were identified as a cause of collar rot and seedling wilt of *Tectona grandis* and *Gmelina arborea* from various forest nurseries of Madhya Pradesh and Chhattisgarh. Out of 6 isolates, 3 are gram positive and 3 are gram negative. Their morphological characteristic and field symptoms recorded. Further work on field management with application of broad-spectrum antibiotic and modification in cultural practices is in progress.

Incidence of bacterial collar rot was recorded from Katra teak nursery, Mandla and root trainers seedlings from social forestry nurseries, Jabalpur, Belkund and Kanchangaon. 15% seedlings were found to have leaf curl and stunting, caused by virus, in *Gmelina arborea* in TFRI nursery.

### **Project 4: Standardization of the cultivation technique and utilization of laccate, stipitate species Ganodermataceae (*G. lucidum*) [056/CFRHRD-2003/2(6)/2003-2006]**

**Status:** Surveys were conducted in different parts of Maharashtra state viz. Wardha, Arve, Yawatmal, Pushad, Ishapur, Gondia, Aamgaon, Salekasa, Darekasa, Jamkantri for collection of *Ganoderma* sp. Twenty two samples of fruit bodies of *Ganoderma* were collected. The culture prepared and isolates were purified. Further work on screening of *Ganoderma* isolates through CAI technique is continuing. The detail morphological and microscopic parameters were studied for taxonomic characterization of the strains.



### **Project 5: Germplasm conservation and investigation on inheritance pattern of *Gmelina arborea* [040/TFRI2002/Gen1(5)/2002-2007]**

**Status:** Germplasm bank with 49 diverse genotypes and clonal seed orchard with 36 clones of *Gmelina arborea* were established in the premises of the institute. Similarly to derive information on inheritance of growth traits during the project period data on growth from earlier established progeny trials was collected. In addition to this, a new SSO-cum-progeny trial comprising 9 families was established in randomized complete block design.

A study was undertaken to understand the pattern of variation and inheritance of seed morphology, germination and seed mycoflora using open pollinated seeds from 12 different phenotypically selected trees of different origin. Data on stone length, stone width, stone weight, germination (%), Germination Value (GV), Germination Velocity Index (GVI), Vigour Index (VI), number of fungi infested and fungal infection percent was generated. Data was subjected to analysis of variance followed by estimation of genetic parameters. Analysis of variance revealed significant differences for all the traits studied. Differences between phenotypic and genotypic coefficient of variation for stone traits, infection percent and GVI were found to be very small. Stone weight showed the highest heritability value of 84 %. Other traits also exhibited high heritability values ranging from 32 to 83 %. The study concluded that stone weight, stone width, GVI, fugal infection percent and germination percent are under the influence of additive gene action and amenable to selection of more productive parents for improvement in seed and germination traits through inclusion of these parents in breeding and production populations. It was also observed that trees, ORBLG-1, ORBLG-4 and Kasai-701 were less prone to seed infection. It is, therefore, suggested that phenotypically selected trees should also be screened for associated seed mycoflora.



Seedlings of different populations of *D. sissoo* raised in earthen pots to record changes in growth and endogenous biochemical under NaCl-induced salinity stress regimes

### **Project 6: Screening populations of *Dalbergia sissoo* for tolerance to salt and water stress using physiomorphological and biochemical criteria [067/TFRI-2004/Gen-2 (8)/2004-2007]**

**Status:** Seedlings of four populations (FRI, TFRI-I, TFRI-II and SFRI) of *Dalbergia sissoo* were raised to evaluate their tolerance to salinity stress. Seedlings of different populations were transferred to earthen pots containing



sterilized sand and provided nutrient solution supplemented with different concentrations of NaCl as  $T_1$  - 0 mM,  $T_2$  - 40 mM,  $T_3$  - 80 mM and  $T_4$  - 160 mM on alternate day. Changes in morphology and growth (height, collar diameter, leaf fresh and dry weight) and endogenous biochemicals (soluble sugars, starch, phenol, o-phenol, chlorophyll, proline, peroxidase, nitrate reductase) were recorded during different intervals of seedling growth, i.e. 0 h, week 1, week 3, week 5 and week 8. Analysis of the data is in progress.

**Project 7: Studies on inheritance pattern of selected wood traits in teak (*Tectona grandis* L.f.) [068/TFRI-2004/Gen-3(9)/2004-2007]**

**Status:** Wood core samples were collected from a 28 years old progeny trial consisting of nine families of teak at Chandrapur, Maharashtra. Data on height, girth and bark thickness were also collected from different teak progenies. Wood core samples were used to generate data on wood specific gravity and sapwood ratio among progenies of half-sib families. There was significant variation in height (range 5.00 - 18.5 m), girth (24 - 106 cm), heartwood percentage (20 - 77%) and wood specific gravity (0.53 - 0.73). Studies on inheritance pattern of wood traits revealed very high heritability values (77 %) for heartwood and sapwood. Specific gravity with 29 percent heritability, showed significant correlation with growth and other wood traits. Wood core samples collected from different progenies have been further processed for microscopic examination of length/diameter variations of vessels and fibres in progenies of half-sib families, which is in progress.

**Project 8: Chemical investigations on biologically active chemicals of forest species and their utility for pest control [069/TFRI/2004/NWFP-1(19)/2004-2007]**

**Status:** Isolated and estimated oil and anti-nutritional constituent, phytate in different provenances of Jatropha (*Jatropha curcas*). Separated toxic fraction of Jatropha oil assessed for anti fungal and anti-bacterial activities against *Fusarium oxysporum*, *Alternaria alternata* and *Pseudomonas tectoriae*. *J. curcas* seed oil was also derivatised and assessed for their physico-chemical properties.

**Project 9: Evaluation of wild edible plants of central region for polysaccharides and other food value [070/TFRI/2004/NWFP-2(10)/2004-2007]**

**Status:** Surveyed different parts of central region and collected wild edible fruits of Manhar (*Randia dumatorum*) and edible fungus Putpura (*Asterus hygrometricus*). Estimated different nutritional and anti-nutritional biochemicals.

**Project 10: Evaluation of Management systems and level of community participation under Joint Forest Management (JFM) [071/TFRI-2004/Silvi-1(6)/2004-2007]**

**Status:** Vegetation-cum-soil survey in Peoples Protected Area (PPA), (compartment No. 561) / Rehabilitation of Degraded Forests (RDF), (compartment No. 562)/Unprotected Forest (compartment No. 563) has been completed for study of ground flora, regeneration status etc. The data are being analysed for vegetation co-ordinates, Importance Value Index and Diversity Index and status of pH, organic matter, NPK in soils. Preliminary observations indicate that there is very good regeneration of ground flora, coppice growth and middle storey plants in PPAs followed by RDF areas. In unprotected areas heavy growth of *Lantana* sp., *Casia tora* and *Achyranthus* spp. was observed, which are not browseable by cattle. Only 10-12 old trees per ha of species of Salai, Dhawa and Gunja are found in unprotected area.



### **Project 11: Seed physiology of the tropical forest species with special reference to their maturity and storage [076/TFRI-2004/Silvi-2(7)/2004-2009]**

**Status:** Protocol for better germination had been developed for three medicinal plants- *Rauvolfia serpentina*, *Emblica officinalis* and *Abelmoschus moschatus*. Preliminary studies on desiccation sensitivity tests on *Bassia latifolia* suggests its recalcitrant nature. Desiccation tolerance tests and storage experiments on *Emblica officinalis* and *Rauvolfia serpentina* proved their orthodox nature. Seeds of these two species were stored at different conditions for further studies. Studies on seed development is continued on *Mimusops elengi*, *Buchanania lanza* and *Sapindus* spp.

### **Project 12: Development of decision support system for predicting suitability of tree species in various climatic conditions in central India [059/TFRI-2003/Misc-IT-1(1)/2003-2006]**

**Status:** Information for 15 identified tree species have been collected as per designed data structure. Different forms viz. main form, query shell form, data display forms have been designed and codes have been written to generate these forms. Designed algorithm for retrieval of information. Codes are being written to execute these algorithm for the retrieval of information and function of system as a whole.

## **NEW PROJECTS INITIATED DURING THE YEAR 2005-2006**

### **Project 1: Study on plant diversity in Sal -Teak ecotone zone as influenced by ecological and climatic changes [085/TFRI/2005/BD-2(5)]**

**Status:** Preliminary survey was conducted to observe the general features of the ecotone zones. Collected compartment history and maps of the area. Quadrates were laid down in the ecotone zone area and the total number and girth of individual species of herbs, shrubs and trees were recorded. Soil samples from appropriate areas were collected from 0-5 cm and 5-15 cm depth. Chemical analysis for pH, EC, organic matter and available nutrients and microbial analysis is in progress.

### **Project 2: Documentation of traditional knowledge on ethnomedicinal information from traditional herbal healers (vaidyas, ojhas, guniyas) in central Madhya Pradesh [084/TFRI/2005/BD1(4)]**

**Status:** Documentation of traditional knowledge on ethnomedicinal uses have been initiated from traditional herbal healers in districts of Bhopal, Sehore, Hoshangabad, Seoni and Jabalpur in central Madhya Pradesh. The traditional herbal healers have been enlisted from the tribal pockets. The medicinal plants used in cure of diseases such as fever, pain, diarrhea, dysentery, arthritic, paralysis, obesity, piles were recorded alongwith formulation prepared from medicinal plants.

### **Project 3: Studies on forest dwelling Braconids (Hymenoptera : Braconidae) from central India and their role in biological control of important forest insect pests [081/TFRI/2005/Ento-2(10)]**

**Status:** Surveyed Jabalpur, Seoni, Chhindwara, Parasia, Mandla, Tikamgarh and Chhattarpur districts of Madhya Pradesh and 150 samples of insect fauna were collected by sweeping method. 106 Braconids were isolated and



preserved. 112 samples of leaf miners of *Pongamia pinnata*, *Dalbergia sissoo* and *Lagerstroemia parviflora*; teak skeletonizer, and bamboo leaf roller were collected from different localities. *Apanteles machaeralis* Wilkinson and *Apanteles tachardiae* Cameron were emerged from the larvae of teak skeletonizer; *Parahormius deiphobus* Nixon and *Hormius* sp. were emerged out from the larvae of *Corcyra cephalonica* and *Meteorus dichomeridis* Wilkinson was emerged out from the larvae of *Crypsiptya coclesalis*.

#### **Project 4: Effect of microbial inoculants on Safed Musli (*Chlorophytum borivillianum*) [082/TFRI-2005/Path-1(11)]**

**Status:** Survey was conducted for germplasm collection of safed musli from Chhindwara and Saunser. Collected healthy propagules of Safed Musli and raised in nursery of forest pathology division. *Fusarium* and one fluorescent bacteria were isolated and purified from rhizosphere of safed musli plants. Further work on application of different biofertilizers and soil conditions is under progress.

#### **Project 5: Evaluation, modification and value addition of starches of forest origin [083/TFRI/2005/NWFP-2(13)]**

**Status:** Fruits of *Careya arborea* were collected from 4 localities namely Bargi, Barela, Kundam and Mandla, M.P in the month of July-August. The fruits were peeled and seeds extracted, which were used directly for extraction of starch. In another case seeds were used after removal of testa. Seeds of *C. arborea* were found to have 7.2% testa and 92.8% endosperm. Ammonium oxalate resulted in maximum yield of starch, 34.09% in seeds with testa and 47.38% in seeds without testa.



Fruits of *Careya arborea*



Seeds of *C. arborea* imbedded in the fruits  
(left) seeds of *C. arborea* (right)

#### **Project 6: Sustainable management of medicinal plants in JFM areas in different agroclimatic zones of Madhya Pradesh [079/TFRI/2005/Silvi-1(8)]**

**Status:** Study sites in JFM areas having richness of medicinal plants species namely, Kalmegh, Satawar, Surpgandha and Safed musli were selected for laying out sample plots for sustainable harvesting/management. JFM sites having



richness of Kalamegh at Satnur Forest under Sawni Forest Range was selected. The selected area measures about is 1.5 ha having 27 fruits bearing trees and 145 trees without fruits.

### **Project 7: Standardization of nursery techniques of *Strychnos nux-vomica* and *Strychnos potatorum* [080/TFRI/2005/Silvi-2(9)]**

**Status:** Two sites i.e. Sahnikhar, Saankara Forest Range, Dhamtari Forest Division were identified and selected for *S. nux-vomica* and Khutama Forest Range, South Forest Division, Chhindwara was identified and selected for *S. potatorum*. Seeds of *S. nux-vomica* were collected in the month of December 2005. Seeds of both the species were dried under room temperature and stored in airtight tin container. After viability test in laboratory seeds were sown in the nursery beds under different physical, chemical and hormonal treatment in the last week of March 2006. Proper watering and insecticidal spray are maintaining during experiment.

### **PROJECTS COMPLETED DURING THE YEAR 2005-2006 (Externally Aided)**

#### **Project 1: Screening and identification of teak of Madhya Pradesh for resistance against major insect pests [034/TFRI-2001/Ento-1 (MPCST) (4)/2001-2005]**

**Findings:** Out of 150 teak clones of MP origin, planted in teak seed orchards located at Behrai and Nanditola (Seoni), State Forest Research Institute and Tropical Forest Research Institute campus and Barha (Jabalpur) of Madhya Pradesh, 24 clones, viz, C 2, 3, 4, 8, 9, 11, 54, F-1, G-1, K-1, PT-1, 26, 41, 45, 46, 47, BLC-4, 11, CSC-9, SKC-2, 3, 4 and 11 were found to be highly resistant against teak defoliator, *Hyblaea puera* and skeletonizer, *Eutectona machaeralis*. The early, early-mid leaf flushing teak clones showed less damage intensity of teak defoliator and skeletonizer compared to mid, mid-late and late leaf flushing clones. Early leaf flushing clones with good growth and resistance to pests may be used for large-scale plantation.

### **PROJECTS CONTINUED DURING THE YEAR 2005-2006 (Externally Aided)**

#### **Project 1: Taxonomy and documentation of fungi occurring in forest of Madhya Pradesh and Chhattisgarh [061/TFRI-2003/Path-1(CSIR)(7)/2003-2006]**

**Status:** Surveys were conducted in the forests of Betul, Harda, Shadol, Dindori, Jagatpur, Umariya, Rewa, Raipur, Sidhi, Jahbua, Mandau, Sardarpur, Raisen, Katthiwara and 243 plants and 58 soil samples were collected. 50 genera belonging to different groups have been recorded from the collected plant samples. 7 genera and many unidentified forms were also recorded from soil samples. 10 different species of AM fungi were identified from soil samples. Description of 91 fungi was written and camera lucida drawings of 65 fungi were also prepared. Photographs of 216 specimens and microphotographs of 108 fungi were taken. Herbarium of 511 plant samples and culture of 149 fungal isolates are maintained. An ascomycete genus on *Dendrocalamus strictus* is found new. In addition to this, 11 species belonging to different genera were found new to science, 5 species were new fungal record for India and 19 species were new host record.



## **Project 2: 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: Micropropagation:**

***Bambusa nutans*:** Three liquid basal nutrient media, viz., Murashige and Skoog, Gamborg's B<sub>s</sub> and Llyod and McCown's Woody Plant Medium enriched with BA (7 mg l<sup>-1</sup>) and IAA (0.5 mg l<sup>-1</sup>) were tried over four consecutive subculture cycles each of 15 days. The subculture cycle had a significant effect on the rate of shoot multiplication whereas basal media and their interaction with subculture cycle was non-significant for shoot multiplication. The carbon sources (3% weroose) significantly affected shoot length.

In a two-way factorial experiment among four carbon sources (sucrose, lactose, fructose and glucose at 3 %), 5 levels of cytokinin BA (0, 1.0, 3.0, 5.0 and 7.0 mg l<sup>-1</sup>) and 4 levels of auxin IAA (0, 0.1, 0.5 and 1.0 mg l<sup>-1</sup>), MS medium supplemented with 7.0 mg l<sup>-1</sup> BA and 0.5 mg l<sup>-1</sup> IAA optimally produced 3.18 fold shoots. Another factorial experiment comprising 5 levels of BA (0, 5.0, 7.0, 9.0 and 11.0 mg l<sup>-1</sup>) and 4 levels of adenine sulphate (0, 5.0, 10.0 and 15.0 mg l<sup>-1</sup>) at uniform 0.5 mg l<sup>-1</sup> IAA, maximum shoot multiplication was obtained on medium supplemented with 9.0 mg l<sup>-1</sup> BA. Addition of adenine sulphate in the medium did not have any significant effect on shoot multiplication, but significantly enhanced the shoot length.

***Bambusa tulda*:** For *in vitro* shoot multiplication, a propagule (bunch of three axillary shoots) was inoculated on MS liquid medium supplemented with 100 µM glutamine, 1 µM IBA and different concentrations of BA (0.0, 9.0, 12.0 and 15.0 µM) alone or in combinations with adenine (0.0, 50.0 and 100.0 µM). A maximum of 2 fold shoot multiplication rate at 15 days sub-culture cycle was obtained on medium enriched with BA 12 µM and 15 µM alone or BA (9 µM) adenine (100 µM). The presence of cytokinins significantly inhibited the extension growth of shoots.

### ***In vitro* rooting**

***B. nutans*:** Two sets of experiments on *in vitro* rooting were carried out with propagules of 3-4 shoots. In the first experiment, MS liquid medium containing different auxin sources (IAA, IBA, NAA or IPA at 15 M) or a commercial formulation (VIB-333 at 3 ppm) were tested for their effect on rooting percentage, number of roots per propagule and root length. The rooting medium was changed after an interval of one month and observations were noted after two months. Various auxins did not show significant variation in rooting response but IBA and NAA maximally produced 60 % rooting and roots per propagule (2.22). However, the root initiation took 10-20 days in control, IBA, IPA and VIB 333 but 23- 29 days in IAA and NAA supplemented medium. In the second experiment, different doses of IBA (0, 5, 10, 15, 20 and 25 M) were tested for induction of rooting. MS liquid medium supplemented with 25 M IBA produced 78 % rooting and was on par with 20 M IBA.

***B. tulda*:** Two sets of experiments were conducted for *in vitro* adventitious rooting. MS medium was supplemented with 0.0, 10.0, 15.0 and 20.0 µM IBA in the first experiment and 0.0, 10.0, 20.0, 30.0 and 40.0 µM coumarin in the second experiment, taking 2-3 shoots (>2.0 cm length) from 10<sup>th</sup> subculture onwards. The higher rooting was obtained on 20 µM IBA (60 %) in the first experiment and 40 µM cumarin (98 %) in the second experiment.

**Hardening and acclimatization:** The plantlets of both bamboos (*B. nutans* and *B. tulda*) were transferred to root trainers containing sterile soilrite and compost mixture soaked with half strength MS nutrient medium (organic free) and kept in culture room for one week, followed by shifting to polybags containing soil, sand, and FYM in 1:1:1 proportion in shade house. This process of hardening resulted in around 90 % survival in *B. nutans* and 95 % survival in *B. tulda*.



**Macropropagation:** Material for propagation was collected from identified superior clumps of both species, i.e. *B. nutans* (Kalimati, Sambalpur, Orissa) and *B. tulda* (Ghatikia, Bhubaneshwar, Orissa).

Three types of single culm nodes i.e. full, split and strip cuttings were prepared and administered for 24 h with 0, 1, 2 and 3 mM of five growth regulators (IAA, IBA, coumarin, boric acid and thiamine). Root induction did not take place in *B. tulda*. However adventitious rhizogenesis and flowering was simultaneously recorded in *B. nutans*.



**Micropropagation of *Bambusa nutans* and *Bambusa tulda*.** (a) Shoot multiplication, (b) *In vitro* rooting,  
(c) Hardening of plantlets in root trainers and (d) Plantlets in polybags

Full and Strip cuttings exhibited better rooting than split cuttings. Full node cuttings also produced maximum number of roots. The influence of the growth regulators and their molar doses was not significant. Significant interaction of growth regulators and nature of cuttings was recorded for rooting. The best rooting occurred in full node cuttings treated with thiamine or coumarin. Strip cutting treated with coumarin, boric acid and IAA also induced rooting. Interaction of treatment doses and nature of cuttings was significant for rooting and root number. Strip and full cuttings in control exhibited the best root induction while treatment of full node cuttings with 0 or 1 mM growth regulators resulted in superior root numbers. Three-way interactions of growth regulators, molar doses and nature of cuttings were non significant for adventitious rhizogenesis. The maximum rooting (40.6%) was recorded in strip cuttings treated with 3 mM IAA followed by split cuttings treated with 1 mM thiamine (40.3%). Flowering was not significantly influenced by nature of cuttings, growth regulators, molar doses and 2 and 3 way interactions except full node control exhibiting the 17.5% flowering. Overall, 3 mM boric acid treatment of split cuttings provided maximum flowering. Flowering and rooting in culm cuttings appeared to be independent phenomenon as rooting did not correlate with flowering.



Adventitious rhizogenesis and flowering in *B. nutans*

- (a) Preparation of cuttings, (b) Treatment with growth regulators,
- (c) Planting in sand beds, (d) Sprout emergence in beds,
- (e) Flowering induction, (f) Closer view of flowering, (g) Rooted full node cuttings, (h) Rooted split cuttings and (i) Rooted Strip cuttings

### **Project 3: National network on integrated development of Jatropha and Karanj [073/TFRI-2004/NWFP-3(NOVOD)(11)/2004-2007]**

**Status:** Twenty five CPTs of *Jatropha curcas* were selected from 3 agroclimatic regions of Madhya Pradesh. Twelve Thousand seedlings/plantlets were raised from the collected superior material. National trial of Jatropha comprising of 19 accessions from 8 participating institutes and zonal trial of 14 accessions received from 6 participating institutes has been established at the institute campus. A progeny trial comprising of 20 families has been established at Chhindwara. Study has been initiated to standardize cultivation practices of Jatropha for central India at the institute campus to optimize spacing, fertilizer/manure doses, time of plantation, method of plantation sowing, age of seedlings, etc. Jatropha seedlings have been planted at 4x3 m spacing and lentil was grown as inter crop to establish agroforestry model. Fatty oil was extracted and its yield was estimated to identify the elite trees of Jatropha. The oil percentage varied from 18.20% to 42.50% from the seeds collected from various agroclimatic regions of the study area.

Forty three CPTs of *Pongamia pinnata* (Karanj) were selected from 5 agroclimatic regions of Madhya Pradesh. Four thousand Seedling were raised in nursery from the selected superior planting material. The collected



seeds were tested for its germination. Maximum germination percentage was recorded in Kusmeli, Chhindwara while minimum was in Satna town. A national trial comprising of 5 accessions received from two institutions and zonal trial comprising of 12 accessions from six participating institutions has been established at the institute campus. A progeny trial comprising of 20 progenies has been established at Bhandamuri, Balaghat. Karanj seedlings have been planted at 6 x 5 m spacing to develop a agroforestry model. Lentil was planted as agriculture crop. All the seed samples were analyzed for fatty oil content. 16 seed samples were sent to NBPGR, New Delhi for cryo-preservation.

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

**Status:** Mortality occurring in East Raipur and Udanti Van Mandal was studied. The status of mortality has been recorded in different ranges under these divisions. The sal in these areas is maintained on coppice system basis and most of the crop is in second and third rotation. There is 60% heart-rot in the affected trees. The swollen bole and punk knots are the indicators of heart rots, which have been observed in the affected trees.

The soil and leaf samples were collected from the affected and healthy trees for analysis of NPK and heavy metals. The analysis work is in progress. The ecto-mycorrhizal development was also recorded in the healthy trees as well as one year old seedlings. Mycorrhizae were characterised by monopodial light brown is smooth, to whitish corolloids roots attached with the main root of the seedlings.

#### **Project 5: Studies on cataloguing the genetic variability in teak species using molecular markers [052/TFRI-2003/Gen-1(DBT) (6)/2003-2006]**

**Status:** Inter Simple Sequence Repeat (ISSR) markers were used to study the DNA polymorphism for development of DNA fingerprint profiles in genotypes of *Tectona grandis* and *T. hamiltoniana*. Amplification of genomic DNA of 49 genotypes yielded 53 bands using five ISSR primers. Number of amplified fragments ranged from 8 to 13 and varied in fragment size from 70 bp to 8900 bp. All the five ISSR primers generated hundred percent polymorphic bands in 49 teak genotypes. Numerous plus tree specific bands/markers were generated in ISSR study, which could distinguish *T. grandis* and *T. hamiltoniana* genotypes. ISSR profiling generated specific marker for MHALP4 (6191bp) and WB (3255bp and 881bp). For *T. hamiltoniana* genotype, four specific markers were generated. With reference to AFLP assay, use of 4 primer combinations produced 276 clearly scorable bands which could clearly



ISSR fingerprints of plus tree of *T. hamiltoniana*



DNA fingerprint of teak (*Tectona grandis*) plus trees and *T. hamiltoniana* generated through AFLP technique.



distinguish all candidate plus trees. The results of ISSR and AFLP assays indicate high levels of genetic variation among selected genotypes of teak. Dendograms generated using UPGMA clustering method of ISSR and AFLP data clustered the teak genotypes into different groups. Studies have also been initiated on assessment of genetic variation within and among populations of teak collected from various natural forests and old plantations using RAPD, ISSR and AFLP markers.

#### **Project 6: Developing coalition approach to non-timber forest produce for better livelihoods of tribal communities of M.P. [053/TFRI-2003/Agro (1) DFID (10)/2003-2005]**

**Status:** Harvested baisakhi lac crop from its host trees i.e. *Butea monosperma*. Arranged disposal of lac produce through bye-back policy, which was initiated by TFRI for the members of SHGs of four pre-selected villages of Kundam block (Jabalpur). Besides, the above described lac host, another host (agri species- *Cajanus cajan*) also used for lac cultivation. On the basis of this study, an Agri-lac culture model was developed.

Further inoculation of lac on the host trees - Palash, Ber and Ficus species were carried out for obtaining II<sup>nd</sup> crop of lac. The work on lac production is on progress.

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. The quality of this stored Mahua was tested by Sadashiv and Manicam method, and it was found that sugar percentages was higher than the sugar percent stored in traditional bins. For value addition of Mahua, the dust free collection of Mahua was carried out to prepare Mahua kishmish.

#### **Project 7: Standardization of production technology of some important medicinal plants under**



Women busy with scraping of lac



Dust free collection of Mahua



Rangini lac on Palash



#### **tropical climate of Madhya Pradesh [055/CFRHRD/2003-2006]**

**Findings:** Germplasm of Sarpagandha (*Rauvolfia serpentina*), Giloe (*Tinospora cordifolia*), Gurmar (*Gymnema sylvestre*) and Kalmegh (*Andrographis paniculata*) were collected from different parts of Madhya Pradesh and conserved in NWFP nursery of the institute. Non-destructive harvesting technique of Sarpagandha was standardized. Harvesting time for Aonla fruits was standardized for tropical climate of central India. Major active ingredients viz. ascorbic acid, tannins and other phenolic acids in Aonla fruits; total alkaloids and reserpine in sarpagandha roots;



andrographolide in Kalmegh (*Andrographis paniculata*); gymnemic acid in Gurmar were estimated. Aonla fruits harvested during January are of superior quality in respect of ascorbic acid whereas gallic acid content was found to be highest in the fruits harvested in mid November. Green chip cutting (grating) and drying in shade was found to be the best method for the processing of Aonla. Roots harvested in the month of December were found to contain maximum amount of total alkaloids. For Kalmegh best harvesting period was found between 100-120 days after planting as it contains maximum andrographolide (1.67%). Standardized manural doses and irrigation schedule for the cultivation of Sarpagandha, Gurmar, Kalmegh and Giloe. Quality planting materials of Kalmegh, Sarpagandha, Aonla, Giloe and Gurmar were distributed to farmers and forest departments.

## **NEW PROJECTS INITIATED DURING THE YEAR 2005-2006 (Externally Aided)**

### **Project 1: Identification of species and ethnobotanical survey [088/TFRI/2005/BD3(CGMFD)6]**

**Status:** Survey in the People's Protect Area (PPA) earmarked in forests of Chhattisgarh at Bilaspur (Lamni), Dhamtari (Jabarra and Shankra), Pendra Road (Marwahi, Kevanchi), Kondagaon (Makdi), Jagdalpur (Karpavan, Machkot, Guriya) and Bhanupratappur (Antagarh) was conducted. The preliminary observations on vegetation status were recorded. Quadrate study has been initiated for documenting floral wealth and increasing or decreasing trend of important forestry species in the area. Vegetational records of PPA for tree species with girth class, regeneration status of major tree species and medicinal plants available in the area were recorded from previous survey records. Tabulation and calculation of these data for trees in different girth classes, number of species with total basal area, regeneration figures of major tree species in different years; identification of medicinal plants and other species were conducted.

### **Project 2: Identification of suitable tree species and other vegetation for biodrainage in Bargi command area (Jabalpur, M.P.) [087/TFRI/2005/Ecol-1 (MOWR)7]**

**Status:** Suitable sites having 10 ha area has been selected along the left bank canal of Bargi command area for experimentation and plantation of forest tree species. Existing vegetation of the selected sites was surveyed. Soil and water samples from the sites were collected and analysed for their quality. Meteorological data of the area including maximum and minimum temperature, relative humidity, rainfall, atmosphere pressure, solar radiation, wind speed and wind direction were collected for the last 10 years. Design and technical specifications of the instruments including lysimeters, piezometers, infiltrometer and pan evaporimeter were collected for the construction and installation at plantation sites and in the institute. Existing cropping pattern of the area was studied.

### **Project 3: Introduction of egg parasitoid *Trichogamma raoi* to protect teak seed orchards from the loss caused by teak leaf defoliator and skeletonizer [086/TFRI/2005/Ento-3(MPFD)11]**

**Status:** Teak seed orchards at Jabalpur, Behrai, Betul and Hassanpura near Nepanagar were selected. 1.25 lakh wasps of egg parasitoid, *Trichogamma raoi* per hectare were liberated in 4 installments between July to October to parasitize the eggs of teak defoliator and skeletonizer. The intensity of insect attacked in parasitoid liberated sites were compared with non-liberated nearby sites in the month of December.



#### **Project 4: Standardization of sustainable harvesting practices of arjuna (*Terminalia arjuna*) bark [078/TFRI/2005/NWFP-1(MPFED)12]**

**Status:** Surveys were conducted in Balaghat district of Madhya Pradesh to select Arjuna growing areas. Arjuna trees of different age group and girth size were selected for laying out the experiments. The experiments were laid out in the forest areas of Balaghat as well as in the farmer's field for the extraction of bark. The girth of selected trees at breast height ranged between 77-228 cm. Bark thickness at breast height ranged from 8.12 to 20.96 cm. Mean bark thickness at breast height in Arjuna trees was 15 mm. Mean bark yield per square centimeter ranged between 0.27 gm to 1.14 gm and found varying from tree to tree. The tannin content ranged from 6.76 to 14.29 gm per 100 gms. The amount of oxalic acid in the bark ranged between 11.54 gm to 20.05 gms per 100 gms. Regular field observations were taken on the recovery of bark. The stage of bark recovery (regrowth) varied from tree to tree. Extraction of bark can be done after two years from the opposite size of the blaze which will not damage the tree.

#### **Project 5: Standardization of non-destructive harvesting practices of Arjuna (*Terminalia arjuna*), Maida (*Litsea chinensis*) and Ashoka (*Saraca indica*) bark [096/TFRI/2005/NWFP-8(CGMFD)19]**

**Status:** Surveys conducted in Dhamtari, Kanker, Raipur districts of Chhattishgarh to select the Arjuna, Maida and Ashoka growing areas in the state. Experiments were laid out in the forest area of Dhamtari and Kanker for non-destructive harvest of Arjuna and Maida bark. Bark samples were analyzed for tannin and oxalic acid content.

#### **Project 6: Standardization of non-destructive harvesting practices of Aonla (*Emblica officinalis*), Baheda (*Terminalia belerica*) and Baividang (*Embelia ribes*) fruits [097/TFRI/2005/NWFP-8(CGMFD)20]**

**Status:** Baividang, Aonla and Baheda growing areas were selected in the Dhamtari and Kanker forest division of Chhattishgarh state. Experiments were laid out in field for the non-destructive harvest of Baividang, Aonla and Baheda fruits. Aonla and Baheda fruits were analysed for their major active ingredients.

#### **Project 7: Non-destructive harvesting practices for selective MFP- Nagarmotha [094/TFRI/2005/NWFP-6(CGMFP)17]**

**Status:** Surveyed and field experiment was laid out at Hagaria nala and Hafnadi Bisasara ghat, Pandaria Kawardha range, Kharragarh. From the experimental plot 60%, 70%, 80% and 90% Nagarmotha plants was uprooted and evaluated. Nagarmotha rhizomes were removed, cut into small pieces and essential oil was extracted by steam distillation using Clevenger apparatus.

#### **Project 8: Processing techniques of NWFP- *Aegle marmelos* (Bael) [095/TFRI/2005/ NWFP-7(CGMFP)18]**

**Status:** Surveyed and collected both unripe and matured fruits of *Aegle marmelos* from Baroda, Pandaria, Khairagarh forest division, Kawardha Chhattisgarh. The fruits were processed using 5 different methods. The pulp from the kernel were separated and dried. The powder of the pulp was prepared and chemically analysed.



**Project 9: Processing techniques of NWFPs of Chhattisgarh *Madhuca latifolia*, *Shorea robusta*, *Schleichera oleosa*, *Pongamia pinnata* and *Buchanania lanza* Spreng (Chironjee) [091/TFRI/2005/NWFP-3(CGMFP)14]**

**Status:** Surveyed different regions of Chhattisgarh for the collection of experimental materials of the selected species.

**Project 10: Non-destructive harvesting practices for selective MFP- *Buchanania lanza* Spreng (Chironjee) [092/TFRI/2005/NWFP-4(CGMFP)15]**

**Status:** Surveyed different areas of Chhattisgarh and selected sites to conduct experiments from April 2006 onwards when the fruits starts ripening.

**Project 11: Quality assessment of NWFPs from different regions of Chhattisgarh Species- *Asparagus racemosus*, *Buchanania lanza*, *Emblica officinalis*, *Embelia ribes* and *Andrographis paniculatus* [093/TFRI/2005/NWFP-5(CGMFP)16]**

**Status:** Surveyed different regions of Chhattisgarh. Collected Satawar and Kalmegh, and also soil samples where the above species are growing. Collected samples were processed and analysed physical parameters.

**Project 12: Training of societies in collection and grading of NWFPs in Chhattisgarh [090/TFRI/2005/Agro-2(CGMFD)13]**

**Status:** Training imparted to the forest officials and VFC members of following districts namely, Bilaspur, Kathghora, Korba, Pendra, Dharamjaigarh, Janjgir, Raigarh, Durg, Rajnandgaon, Khairagarh, Kawardha, Raipur, Mahasamund, Dhamtari, East Raipur (Gariyaband) and Udanti Van Mandal (Mainpur) of Chhattisgarh on “Cultivation and processing of Lac and Medicinal Plants”.



Training on collection and processing of medicinal plants for VFC members and forest officials of Korba, Raipur, Bilaspur divisions (Chhattisgarh)

**Project 13: Documentation of best practices in collection and processing of NWFPs in Chhattisgarh [089/TFRI/2005/Agro-2 (CGMFD)13]**

**Status:** Documented best practices in collection and processing of NWFPs in following districts namely, Bilaspur,



Kathghora, Korba, Pendra, Dharamjaigarh, Janjgir, Raigarh, Durg, Rajnandgaon, Khairagarh, Kawardha, Raipur, Mahasamund, Dhamtari, East Raipur (Gariyaband) and Udanti Van Mandal (Mainpur) of Chhattisgarh.

**Project 14: Sustainable yield assessment/harvesting of Non Wood Forest Produce (NWFP) in People's Protected Areas (PPAs) of Chhattisgarh [098/TFRI/2005/Silvi-3 (CGMFD)10]**

**Status:** Sample plots were laid out for Satawar and Kalmegh at Matchkot Forest Range, Jagadalpur Forest Division for Malkagani at Sankra Range Dhamtari Forest Division and Bael at Gandai Range, Khairagarh Forest Division. As per experimental design Satawar and Kalmegh were harvested and their fresh and dry weights were taken.

**Project 15: Nursery techniques for mass multiplication of superior seedlings of Baividang, Sarpgandha, Chironjee, Arjun, Aonla and Bael in Chhattisgarh [099/ TFRI/2005/Silvi-4 (CGMFD)11]**

**Status:** Literature has been collected from different sources i.e. universities, institutes, and internet. Seeds of Aonla and Sarpgandha have been collected from reliable sources for conducting experiments in order to establish standardized nursery techniques of test species

**Project 16: Screening of indigenous species of Trichogramma Westwood and Trichogrammatoidea Girault (Hymenoptera: Trichogrammatidae) from central India and their utilization against important forest insect pests [077/ TFRI/ 2005/ Ento-(1)(DST)9]**

**Status:** Surveyed Jabalpur, Chhindwara, Parasia, Mandla, Tikamgarh and Chhattarpur districts of Madhya Pradesh and 245 specimens belonging to the genera: Trichogramma and Trichogrammatoidea were collected.

Five species of Trichogramma viz., *T. plasseyensis* Nagaraja, *T. agriae* Nagaraja, *T. raoi* Nagaraja, *T. semblidis* (Aurivillius) and *T. pallidiventris* Nagaraja and one species of *Trichogrammatoidea* viz., *T. armigera* Nagaraja identified. *Trichogramma plasseyensis* Nagaraja and *T. raoi* Nagaraja were also collected from the fields by keeping the *Corcyra cephalonica* eggs as fictitious eggs. Culture of *Corcyra cephalonica* was maintained for the use of their eggs as laboratory host / fictitious eggs.

**Project 17: Monitoring of compensatory afforestation done under NVDA and monitoring of FDA work in north and south Betul of M.P.**

**Status:** To evaluate the work done under NVDA and FDA scheme in various districts of Madhya Pradesh, visited and collected data from Khandwa, Khargone Badwani and Burhanpur under NVDA scheme and also visited north and south Betul for monitoring of FDA work.



## Abstract: No. of Projects

	No. of projects completed in 2005-2006	No. of ongoing projects in 2005-2006	No. of projects initiated in 2005-2006
Plan Projects	3	12	7
External Projects	1	7	17
Total	4	19	24

## EDUCATION AND TRAINING

### Training organized

1. Training imparted to the forest officials and VFC members of following districts namely, Bilaspur, Kathghora, Korba, Pendra, Dharamjaigarh, Janjgir, Raigarh, Durg, Rajnandgaon, Khairagarh, Kawardha, Raipur, Mahasamund, Dhamtari, East Raipur (Gariyaband) and Udanti Van Mandal (Mainpur) of Chhattisgarh on Cultivation and processing of lac and medicinal plants.
2. Training imparted to the forest officials on Agroforestry systems and its benefits at Tala, Badhavgarh on 11<sup>th</sup> December 2005, 5<sup>th</sup> February 2006, 5<sup>th</sup> March 2006 and 25<sup>th</sup> March 2006.
3. Training imparted to forest officials and VFC members of Mandla districts on Lac Cultivation at Tropical Forest Research Institute, Jabalpur from 29<sup>th</sup> to 31<sup>st</sup> March 2006.
4. Training imparted to the farmers and forest officials of Jabalpur, Narsinghpur and Dindori districts of Madhya Pradesh on agroforestry models for central India at Tropical Forest Research Institute, Jabalpur from 15<sup>th</sup> to 17<sup>th</sup> February 2006.
5. Organized an exhibition on Promoting technology development, utilization and transfer in Mahakoshal region at this institute on 6<sup>th</sup> January 2006.
6. Training provided on Lac Cultivation to the forest officials and villagers of Singpur (Satna) on 16<sup>th</sup> June 2005.
7. Training organized for M.Sc students in the month of July to December 2005 on biotechnology, biochemistry and tissue culture.
8. Training organized for VFC members in Chhattisgarh State at Bilaspur, Dharamjaigarh, Raigarh, Khatgoda, Korba, Champa, Janjgir, Durg, Pendra, Rajnandgaon, Khairagarh, Raipur, Dhamtari and Gariyaband on MFP collection and processing.
9. Training programme organized on improvement, biofertilizer insect pest management, cultivation, processing and value addition of medicinal plants for field executives of Maharashtra Forest Department at CFRC, Chandrapur.
10. Three days training programme was organized on improving forest productivity through technological interventions from 15<sup>th</sup> to 17<sup>th</sup> February 2006 for the field executives of M.P. Forest Department.



## LINKAGES AND COLLABORATION

- Developed linkages and collaboration with state forest departments, forest development corporations and minor forest produce federations of central Indian states; local universities and institutes, TERI etc. for conducting field surveys, field experiments and utilization of specialized laboratory facilities.

### Pamphlet

- Pamphlets containing information about MFP collection, processing, value addition and marketing etc were published for the following species: (i) *Emblica officinalis*, (ii) *Termarindus indica*, (iii) *Buchmania lanzae* and (iv) *Madhuca indica* (Flowers and seeds).

## CONFERENCES/MEETINGS/WORKSHOPS/SEMINARS/SYMPOSIA/EXHIBITIONS

### Attended

1. A.K. Mandal attended the XII Silvicultural Conference held at FRI, Dehradun from 1<sup>st</sup> to 3<sup>rd</sup> February 2006 and presented the outcome of meeting of the group of researchers of central Indian states.
2. Jamaluddin attended the XII Silvicultural Conference held at FRI, Dehradun from 1<sup>st</sup> to 3<sup>rd</sup> February 2006 and presented a paper entitled Effect of fire on microbial status and physicochemical properties of soil in teak plantations.
3. R.K. Verma attended the National Conference on Tree Biotechnology : Indian Scenario held at TFRI, Jabalpur on 9<sup>th</sup> and 10<sup>th</sup> February 2006 and presented a paper entitled Interaction of AM fungi and Azospirillum enhances growth, survival and nutrient uptake in teak seedlings.
4. Jamaluddin attended the Global Conference of Society of Mycology and Plant Pathology at Udaipur from 25<sup>th</sup> to 29<sup>th</sup> November 2005 and presented a paper entitled Problem of diseases in multipurpose tree species and medicinal plants in central India.
5. Nanita Berry attended jKT; Lrjh; I akBh e/; insk eavsk/kh; QI ykach 0; ol kf; d df"kl id ladj.k , oafoi .ku dhi {kerk , oa l kouk; held at JNKVV, Jabalpur on 25<sup>th</sup> and 26<sup>th</sup> October 2005.
6. N. Kulkarni attended National Conference *Biopesticides: Emerging trends BET 2005* organized at Palampur (H.P.) from 11<sup>th</sup> to 13<sup>th</sup> November 2005 and presented a paper entitled Efficacy of *Beauveria bassiana* and *Metarrhizium anisopliae* against white grubs of *Holotrichia rustica* Brim (Coleoptera: Scarabaeidae).
7. N. Kulkarni attended International Conference on Biodiversity of Insects: Challenging issues in management and conservation (BIMC, 2006), at Bharathiar University, Coimbatore from 30<sup>th</sup> January to 3<sup>rd</sup> February 2006 and presented a paper entitled Incidence of white grubs, *Schizonycha ruficollis* (Fab.) (Coleoptera: Scarabaeidae) on teak seedlings at Nagpur, Maharashtra and its management.
8. Fatima Shirin attended National Conference on "Tree Biotechnology: Indian Scenario" held at TFRI, Jabalpur on 9<sup>th</sup> and 10<sup>th</sup> February 2006 and presented a paper entitled "Efficient *in vitro* plantlet production of *Bambusa nutans* Wall. and *Bambusa tulda* Roxb."
9. C. Narayanan attended National Conference on Tree Biotechnology: Indian Scenario" held on 9<sup>th</sup> and 10<sup>th</sup> February 2006 at Tropical Forest Research Institute, Jabalpur and presented a paper entitled "Molecular profiling of teak plus trees using RAPD marker system and its application for maintenance of germplasm collection and evaluation of genetic diversity".



10. S.A. Ansari attended National Conference on Tree Biotechnology: Indian Scenario" held on 9<sup>th</sup> and 10<sup>th</sup> February 2006 at Tropical Forest Research Institute, Jabalpur and presented a paper entitled "Molecular profiling and genetic relationship of teak (*Tectona grandis*) plus tree accessions and *T.hamiltoniana* using amplified fragment length polymorphism markers".
11. A.K. Mandal attended Regional workshop on Recent advances in teak research and management in central India held on 17<sup>th</sup> and 18<sup>th</sup> March 2006 at FDCM, Nagpur and chair a technical session on tree improvement.
12. Nanita Berry attended a workshop on Management and extension activities in the forestry sector on 14<sup>th</sup> and 15<sup>th</sup> September 2005 at TFRI, Jabalpur and presented a paper entitled Agri-lac culture: an innovative agri model.
13. Sharad Tiwari attended National Workshop on Forestry Extension held at TFRI, Jabalpur on 14<sup>th</sup> and 15<sup>th</sup> September 2005 and presented a paper entitled "Role and potential of decision support system in forestry extension services".
14. N. Kulkarni attended Regional workshop on Recent advances in teak research and management in central India organized by Forest Development Corporation of Maharashtra, Nagpur on 17<sup>th</sup> and 18<sup>th</sup> March 2006 and presented a paper entitled "New species of white grub, their menace on the seedlings of teak (*Tectona grandis* L. f.) and their management: an experimental study" at Ramdongari Forest Nursery, Nagpur.
15. Jamaluddin attended workshop on recent advances in teak research and management in central India held at FDCM, Nagpur on 17<sup>th</sup> and 18<sup>th</sup> March 2006 and presented a paper Diseases of teak in central part of India.
16. P. H. Chawhaan attended Regional workshop on management of extension activities in the forestry sector held on 14<sup>th</sup> and 15<sup>th</sup> September 2005 at TFRI, Jabalpur and presented a paper entitled "Do tree improvement activities pays? Evidence based research and implications for extension".
17. P.H. Chawhaan attended Regional workshop on Recent advances in teak research and management in central India held on 17<sup>th</sup> and 18<sup>th</sup> March 2006 at FDCM, Nagpur and presented a paper entitled "Half-sib genetic analysis of growth parameters in teak (*Tectona grandis* L.f.) of Maharashtra and Madhya Pradesh origin".
18. Sanjay Singh attended Regional workshop on Recent advances in teak research and management in central India held on 17<sup>th</sup> and 18<sup>th</sup> March 2006 at Nagpur and presented a paper entitled "Cloning of *Tectona grandis* : Procedures and economics".
19. N. Roychoudhury attended National Symposium on Environment and Development held on 16<sup>th</sup> and 17<sup>th</sup> January 2006 at EPCO, Bhopal and presented a paper entitled "Insect epidemic and its threat in deterioration of forest cover: A cause of environmental degradation".
20. N. Roychoudhury attended National Symposium on Biotechnology and insect pest management held on 2<sup>nd</sup> and 3<sup>rd</sup> February 2006 at Entomology Research Institute, Loyola College, Chennai and presented a paper entitled "Tree resistance to insects: A biotechnological method of forest insect management".
21. Jamaluddin attended National Symposium on Conservation and management of threatened medicinal plants held from 23<sup>rd</sup> to 25<sup>th</sup> February 2005 at SFRI, Jabalpur and presented a paper entitled "Effect of VAM and bacterial Biofertilizers on growth and development of *Chlorophytum borivillianum*".
22. V.S. Dadwal attended National Symposium on Conservation and Management of Threatened Medicinal Plants held at SFRI, Jabalpur from 23<sup>rd</sup> to 25<sup>th</sup> February 2005 and presented a paper entitled "An improved technique for germination of *Strychnos potatorum* seeds".
23. S.A. Wali attended National symposium on plant Biotechnology: New Frontiers held from 18<sup>th</sup> to 20<sup>th</sup> November 2005 at Central Institute for Medicinal and Aromatic Plants, Lucknow and presented a paper entitled "Influence of plant material and methods on yield, quality and suitability for ISSR-PCR analysis of extracted DNA in teak (*Tectona grandis* L.f.)".
24. Fatima Shirin attended National Symposium on Plant Biotechnology: New Frontiers at CIMAP, Lucknow



from 18<sup>th</sup> to 20<sup>th</sup> November 2005 and presented a paper entitled “*In vitro* propagation of *Bambusa nutans* Wall. using nodal explants from mature culms”.

25. C. Narayanan attended National symposium on plant Biotechnology: New Frontiers held from 18<sup>th</sup> to 20<sup>th</sup> November 2005 at Central Institute for Medicinal and Aromatic Plants, Lucknow and presented a paper entitled “ISSR profiles as molecular genetic markers for plus tree identification and diversity analysis and phylogenetic relationship in teak (*Tectona* spp.)”.

26. A.K. Pandey attended Seminar on Prospects and potential of commercial cultivation, processing and marketing of medicinal and aromatic plants on 25<sup>th</sup> and 26<sup>th</sup> October 2005 at JNKVV, Jabalpur and presented a paper entitled “Commercial cultivation of Sarpagandha (*Rauvolfia serpentina*)”.

27. Jamaluddin attended Seminar on Recent advances in forest sciences on 30<sup>th</sup> and 31<sup>st</sup> January 2006 held at G.G. University, Bilaspur and presented a paper entitled “Disease management in forest trees in central India”.

28. Rajiv Rai attended National Seminar on Environment and Development organized by EPCO Bhopal on 16<sup>th</sup> and 17<sup>th</sup> January 2006 and presented a paper entitled “Ethnomedicinal studies in Pachmarhi Biosphere”.

29. Sanjay Singh attended National Seminar on Plant physiology, crop productivity and quality improvement through physiological interventions held from 23<sup>rd</sup> to 25<sup>th</sup> November 2005 at Navsari, Gujarat and presented a paper entitled “Clonal multiplication of *Bambusa nutans* and *Bambusa tulda* by adventitious rhizogenesis : Influence of season, IBA and nature of cuttings”.

## Mela

The institute participated in National Swarozgar and Vyapar Mela at Jabalpur from 23<sup>rd</sup> to 26<sup>th</sup> December 2005 and demonstrated different technologies developed by the institute.

## AWARDS

1. Dr. Jamaluddin, Scientist-G, Group Coordinator (Research) and Head, Forest Pathology Division, has been awarded *Vishist Vaigyanik Puraskar* (2001-2002) by Govt. of India, Ministry of Environment and Forests in September 2005.
2. Dr. Jamaluddin and Dr. V.S. Dadwal, Scientist-B have been awarded *BRANDIS PRIZE* for the paper entitled Biocontrol of important pathogens of forestry species by Streptomyces formulation published in Indian Forester in 2003.

## DISTINGUISHED VISITORS

Dr. S.N. Paul Khurana, Vice Chancellor, R.D. University, Jabalpur visited this institute on 12<sup>th</sup> December 2005, inaugurated the 58<sup>th</sup> Zonal Meeting of Indian Phyto Pathological Society and addressed the officers and scientists of TFRI, Jabalpur.

## MISCELLANEOUS

### Meetings, RAG, CTA's etc.

1. 15<sup>th</sup> RAG meeting was held at Tropical Forest Research Institute on 23<sup>rd</sup> August 2005.



2. Two days regional workshop on Management of extension activities in the forestry sector was organized on 14<sup>th</sup> and 15<sup>th</sup> September 2005.
3. A workshop on Promoting technology development, utilization and transfer in Mahakoshal region was held on 6<sup>th</sup> January 2006.
4. Organized National conference on Tree biotechnology: Indian scenario on 9<sup>th</sup> and 10<sup>th</sup> February 2006.

### **Important activities during the year**

1. Celebrated World Environmental day on 5<sup>th</sup> June 2005.
2. Van Mahotsava was celebrated on 20<sup>th</sup> July 2005.
3. Wild Life Week was celebrated from 1<sup>st</sup> to 7<sup>th</sup> October 2005.