

Tropical Forest Research Institute Jabalpur

Tropical Forest Research Institute (TFRI), Jabalpur an institution under the ICFRE, 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 and demonstration of agroforestry models, planting stock improvement, developing tissue culture protocols for difficult species of central Indian forests and control of forest diseases and insect 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 and were also actively involved in extension activities. This has helped the Institute in imbibing its research programme, ideas and concepts from various user groups.

PROJECTS COMPLETED DURING THE YEAR 2006-2007

Project 1: 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]

Findings: A user-friendly package "PLANTPAK" has been developed and tested successfully to evaluate the climatic suitability of forestry species in central Indian region. The package can be used to store, retrieve and display information based on simple key strokes. The package provides query on textural as well as map basis. The package is tested with 15 data records and all the features including data entry, information retrieval based on species name, location, climatic as well as edaphic fields are working properly. The package is successfully tested for providing map based retrieval of information of suitable species.

Project 2: Germplasm conservation and investigation on inheritance pattern of *Gmelina arborea* [040/TFRI-2002/Gen-1(6)/ 2002-2007]

Findings: As availability of germplasm is a building block for effecting genetic improvement of any species, a germplasm bank with 49 diverse clones was established. 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 CSO-cum-progeny trial comprising of 11 families was established in complete randomized block design.

Germplasm bank of 49 clones, production population with 36 clones and progeny trial comprising of 11 half-sib families were maintained. Growth data from progeny trial was collected and statistically analysed according to Zobel and Talbert (1962). Analysis of variance revealed significant differences among the families for both height (ranging from 47.77 to 76.11 cm) and collar girth (ranging from 3.77 to 6.01cm). Height showed 63 and 70 percent whereas collar girth exhibited 73 and 62 percent heritability at individual and family levels, respectively. Both the traits were also found to be associated with each other as revealed by their significant correlations. Families Zagadpur-5 ORBLG-



1, ATIA-39, ATIA-45 and ORBLG-5 outperformed other families as indicated by their positive general combining ability (gca) values.

Project 3: Screening populations of *Dalbergia sissoo* for tolerance to salt and water stress using physio-morphological and bio-chemical criteria [067/TFRI-2004/Gen-2(9)/2004-2007]

Findings: Experiment was conducted to test 4 regimes of salt stress in sand culture pots. Growth and biomass accumulation and various biochemical parameters were investigated for 8 weeks at weekly intervals. The 4 populations of *Dalbergia sissoo* exhibited variable response with respect to these parameters. In conclusion, *D. sissoo* populations had considerable salt tolerance. Beside half-sib seeds were collected from various populations from Maharashtra and Madhya Pradesh and seed germination was tested against high salt concentrations.

Project 4: Evaluation of non-wood forest waste material for use in bio-composites [106/TFRI/2006/NWFP-1(21)/ 2006-2007]

Findings: Different forest areas viz. Kajol Nadi, Jabbara, Dugli, Achankmarg in Chattisgarh and Amarkantak in M.P. were surveyed and NWFP waste materials (leaves of Nagarmotha; Kans waste not used for rope making; lemon grass left over after extraction of essential oil) were collected. All the samples were processed for the estimation of ligno-cellulosic contents in the leaves.

PROJECTS CONTINUED DURING THE YEAR 2006 -2007

Project 1: Study on plant diversity in Sal Teak ecotone zone as influenced by ecological and climatic changes [085/TFRI/2005/Biod-2 (5)/ 2005 2009]

Status: Two sites viz. Umariya (M.P.) and Jagadalpur (C.G.) have been selected for the study where sal and teak are growing together naturally. Maps and other details of the study area along with weather records from 1995-2005 have been collected. Microclimatic data for May, June 2006 inside and outside the forest was also recorded. Quadrats have been laid out at both the ecotone area for floristic study. Number of species occurring in a quadrate and girth of tree species along with phenological observations of major tree species from both the sites have been recorded. The Important Value Index (IVI) and Diversity Index of tree species observed in both the sites are being calculated. Surface soil samples are collected from 0-5 and 5-15 cm depth in the ecotone area of Jagadalpur for analysis of soil microflora and soil chemical properties. The pattern of exploitation of major forest produces have also been recorded.

Project 2: Documentation of traditional knowledge on ethno-medicinal information from traditional herbal healers (vaidyas, ojhas, guniyas) in central Madhya Pradesh [084/TFRI/2005/Biod-1 (4)/ 2005- 2008]

Status: Literature survey was conducted for recording of existing information on traditional knowledge. Different tribal pockets have been identified for survey work in Sehor, Hoshangabad and Seoni districts of Madhya Pradesh. Five tribal pockets in Sehor district viz. Irchawar, Budni, Astha, Rehti and Nasrullaganj; four tribal pockets in Hoshangabad district viz. Sohagpur, Bagra Tawa, Kesala and three tribal pockets in Seoni district viz. Banjari, Dhuma and Chhapara have been identified. Preparation of list of herbal healers is in progress for Hoshangabad, Sehore and Seoni districts. Field survey was



conducted to record information available with traditional healers in tribal pockets identified in Sehore, Hoshangabad and Seoni districts. The plant part used along with different formulations and dosages used in cure of ailments were recorded. The response of tribal community towards use of herbal medicines has been recorded. Awareness among tribal communities was created by organizing village meetings in tribal pockets and among end users during Van Mela organized at Bhopal and Jabalpur.

Project 3: Eco-rehabilitation of limestone mined areas in Madhya Pradesh [065/TFRI/2004/Ecol-1(6)/ 2004-2007]

Status: Vegetation survey was carried out in Jamori limestone mined area by *quadrate* method in the overburden dump. Significant improvement in soil quality and fertility status was observed in already existing plantations of Kuteshwar and Jamori limestone mined areas. *Jatropha curcas* (232.3) showed superiority over other 21 selected species regarding growth and biomass parameters followed by *Acacia nilotica* (185.2), *Gmelina arborea* (130.5), *Dalbergia sissoo* (129.6), and *Eucalyptus hybrid* (125.2). VAM+PSB+Rhizobium was found as the best biofertilizer treatment for the growth of *Albizia procera* followed by VAM+PSB and Rhizobium+PSB. Twenty five ppm single super phosphate and 100 ppm urea was observed as the best combination for higher biomass production of *Albizia procera* followed by 100 ppm urea and 50 ppm single super phosphate. Ammonium nitrate was found as the best treatment for higher biomass production among 3 different nitrogenous fertilizers followed by ammonium sulphate and ammonium chloride. Leaf litter prevented moisture loss followed by husk and grass.

Project 4: 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)/ 2005-2008]

Status: Surveys were conducted in different localities of Jabalpur, Behrai, Kanjai, Bamandehi, Dindori, Shahdol, Sagar, Damoh, Guna, Shivpuri, Indore, Jhabua, Satna, Panna, Katni, Maihar, Rewa, Sirmore, Mandsaur, Neemuch, Itarsi, Hoshangabad and Harda of Madhya Pradesh for the collection of Braconids. Over all 328 samples of insect fauna were collected by sweeping method; out of which 303 Braconids were isolated and preserved. A total 197 samples of leaf miners and defoliators of forest tree species (*Ailanthus excelsa*, *Butea monosperma*, *Pongamia pinnata*, *Dalbergia sissoo*, *Syzygium cumini*, *Lagerstroemia parviflora* and *Ziziphus jujuba*), teak leaf defoliator / skeletonizer: *Hyblaea puera* and *Eutectona machaeralis* and bamboo leaf roller: *Crypsipta coclesalis* were collected from above localities of Madhya Pradesh. *Apanteles machaeralis* was emerged from the larvae of *Eutectona machaeralis*; *Apanteles* sp. near *malacosomae* was reared from the larvae of *Atteva fabriciella*. Twelve Braconids (*Apanteles machaeralis*, *Apanteles* sp. near *malacosomae*, *Adialytus salicaphis*, *Cassidobracon indicus*, *Chelonus deogiri*, *Chelonus narayani*, *Microchelonus nigripes*, *Eutropobracon granulatus*, *Cassidobracon sumodani*, *Opius* species, *Parahormius stoma* and *Mirax* sp. were identified up to species level. Other available Braconids are belonging to subfamilies: Microgasterinae, Miricinae; Opiinae, Cheloninae, Aphidiinae, Euphorinae, Dirrhopinae, Alysinae, Cardiochilinae and Adeliinae.

Project 5: Effect of microbial inoculants on Safed Musli (*Chlorophytum borivillianum*) [082/TFRI-2005/Path-1(11)/2005-2007]

Status: Survey was conducted for germplasm collection of safed musli from Chhindwara, Saunser and Seoni. Safed Musli was raised in nursery beds by collected propagating material. *Fusarium* and one



fluorescent bacterium were isolated and purified from rhizosphere of safed musli seedlings. A nursery experiment was conducted in RBD design to enhance the production of safed musli. VAM, PSB, *Azospirillum*, *Azotobacter* individually and in combination were used for experimentation. It was observed that application of VAM + *Azospirillum* + PSB has given maximum yield of safed musli. Saponin contents in different treatments were also analyzed.

Project 6: Studies on bacterial and viral diseases of teak, *Gmelina* and *Albizia* and their management [066/TFRI/2004/Patho-1(8)/ 2004-2008]

Status: Six isolates of bacteria were identified as a cause of collar rot and seedling wilt of *Tectona grandis* and *Gmelina arborea* in forest nurseries of Madhya Pradesh and Chhattisgarh. Out of 6 bacterial isolates 3 each were gram-positive and gram-negative. Further work on field management with application of broad spectrum antibiotics and modification in cultural practices is in progress. Assessment of damage caused by *Pseudomonas* in three FDCM teak nurseries (Ram Dongari, MS; Kanchangaon, MP and Chulband nursery, Gondia, MS) was done. Incidence of bacterial collar rot and wilt in six months' old seedlings of teak was assessed to be <5%. Leaf curl and stunting in one year old hi-tech teak plantation in Panna Forest Division was recorded. *Xanthomonas* was isolated from the affected leaf region.

Project 7: Studies on the role of Actinomycetes in controlling root diseases of *Tectona grandis*, *Albizia procera*, *Albizia lebbek* and *Acacia nilotica* in nurseries [072/TFRI-2004/Patho-2(9)/ 2004-2007]

Status: Soil samples were collected from different parts of M.P. and C.G. (Katni, Mandla, Sagar, Badwani, Balaghat, Raipur, Bilaspur, Kundam) for isolation of actinomycetes and antagonistic bacteria. Three actinomycetes and 4 bacteria were isolated from the collected samples. Interaction of antagonistic actinomycetes and bacteria was tested against *Trichoderma viride*, *Bacillus subtilis*, *Fusarium oxysporum*, *Macrophomina phaseolina*, *Alternaria alternata* and *Ganoderma lucidum*. Crude extract of *Streptomyces* sp. was analyzed for mass spectra and NMR from CDRI Lucknow. The efficacy was also tested in nursery beds against wilt and root rot of *Albizia procera*, *Dalbergia sissoo*, *Albizia lebbek* and *Acacia nilotica* caused by *Fusarium solani*. Culture filtrate of antagonistic organism inhibited the growth of fungal flora on seeds of *Albizia lebbek*, *Dalbergia sissoo* and *Acacia nilotica* in Petri plates. FYM and Chicken Manure were found best for the growth of *Streptomyces* sp. for bulk culturing. Antagonistic bacteria were bulk cultured on PDA medium.

Project 8: Standardization of the cultivation technique and utilization of laccate stipitate species in *Ganodermataceae* (*G. lucidum*) [056/CFRHRD-2003/2(6)/ 2003-2007]

Status: Seventy eight specimens of the collected samples of *Ganoderma* species were identified up to species level. Purified cultures have been maintained in the laboratory for further estimation of their medicinal content. Screening of all the *Ganoderma lucidum* was carried out through cellulose degrading capability test. Estimation of glucanase production in four selected strains of *Ganoderma lucidum* was confirmed and categorized as stains of medicinal value. Selected strains cultivated in different nutrient substrate for mass multiplication and production of mycelium.

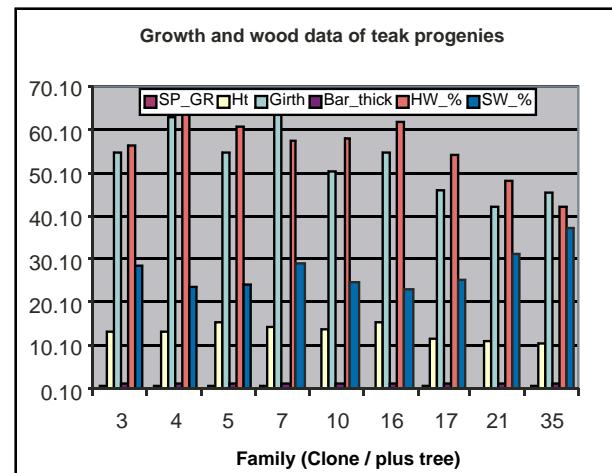
Project 9: Studies on inheritance pattern of selected wood traits in teak (*Tectona grandis* L.) [068/TFRI/2004/Gen 3(9)/ 2004-2007]



Status: The progeny trial of teak, raised at Mohogata (Maharashtra) during 1988, was investigated for growth and wood traits. Data on growth parameters viz., height, girth and bark thickness and wood traits viz., heart wood and sap wood, were collected from different teak progenies of the half-sib trial. There was significant variation with reference to the above growth and wood traits among the teak progenies. Wood core samples were also collected and processed for microscopic examination of length/diameter variations of vessels and fibers in progenies of half-sib families, to assess their inheritance pattern. Wood samples of teak progenies, collected from 28 years old progeny trial (Chandrapur, Maharashtra) were analyzed for fibre length, fibre thickness and fibre lumen width using micro-technique methodology. Preliminary results showed variation in the above wood parameters among the various progenies of families of teak.

Project 10: 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* seed oil was modified by sulphation reaction followed by neutralization. Physico-chemical properties of modified oil were assessed. Solubility of the product was assessed in different organic and inorganic solvents. Specific gravity, wetting power of 1-5% concentration, emulsifying power 1%, foaming power, surface tension, viscosity of different concentration of sulphated products were assessed. Properties were also compared with sulphated castor and karanj oil. Oil%, saponin and phytate contents in *J. curcas* seeds collected from Chhattisgarh were estimated. Herbicidal activities of *J. curcas* seed components and sulphated product was assessed against weed, *Parthenium hysterophorus*. Insecticidal /feeding deterrent activities of *J. curcas* seeds were assessed against insect *Hyblea puera* and termite *Odontotermes obesus* by soil graveyard method on wooden blocks of *Mangifera indica*. Nitrifiability of *J. curcas* seed cake was assessed up to 75 days. Antifungal activities of *J. curcas* seed products was assessed by seed dressing of *Dalbergia sissoo* and *Pongamia pinnata* seeds and appearance of fungal flora was recorded.



Project 11: Evaluation of wild edible plants of central region for polysaccharides and other food value [070/TFRI-2004/NWFP-2(10)/ 2004-2007]

Status: Surveys were conducted and samples were collected of *Curcuma angustifolia*, *C. pseudomontanum*, *Costus speciosus*, *Eulophia nuda*, *Puraria tuberosa*, *Randia dumatorum* and *Asterus hygromatricus* from Kalpi, Bichiya (Mandla), Kundam (Jabalpur) and Dindori (M.P.), Dhamtari, Dondi, Kanker (Chhattisgarh) and processed for further laboratory analysis. Different nutritional and anti-nutritional bio-chemicals viz., carbohydrates, starch, protein, tannin, phenols, oil per cent, cyanogens, fibre, minerals in collected fruits and tubers of different species were estimated. Diosgenin content in *Costus speciosus* tubers collected from different localities was isolated and estimated. Phenolic acids in tubers were extracted for estimation with HPLC.

Project 12: Evaluation, modification and value addition of starches of forest origin [083/TFRI/2005/NWFP-2(13)/ 2005-2008]



Status: Surveys were conducted and fruits of *Careya arborea* were collected from 5 localities namely Bargi, Kundam, Mandla, Niwas and Sangrampur (M.P.) and starch was extracted. Maximum starch was obtained in 1% ammonium oxalate and distilled water. Rhizomes of *Curcuma aromatica* were collected and starch was extracted. The physico chemical properties of *C. aromatica* rhizomes were also determined.

Project 13: Evaluation of management systems and level of community participation under Joint Forest Management (JFM) [071/TFRI-2004/Silvi-1(6)/ 2004-2008]

Status: Sample plots have been laid out for assessment of JFM activities at Mendha (Lekha) Forest, Dhanora Range at Garchiroli Forest Division, Compartment No. RF-18 (Narwar Beat), MF-19 (Nipania Beat), RF-12 (Aintathar Beat), RF-11 (Jodhpur Beat). Soil samples have been collected for analysis of pH, per cent C and NPK. A copy of Micro plan and MoU signed between Maharashtra Forest Department and Villagers of Mendha Lekha Village has been obtained. Data have been collected for phyto-sociological studies. A micro-plan got prepared for Udaipur village in Maihar Range, Satna Forest Division and socio-economic and phytosociological studies were completed.

Project 14: Sustainable management of medicinal plants in JFM areas in different agro-climatic zones of Madhya Pradesh [079/TFRI/2005/Silvi-1(8)/ 2005-2010]

Status: Regeneration study of Kalmegh in a selected site has been completed. A new site has been selected near Delakhadi Forest Rest House, West Chhindwara Forest Division for study of sustainability of Kalmegh. Sample plots have been laid out and data have been collected. Site has been selected near Budhni village under Shiyarkheda Beat of East Harrai Range under East Chhindwara Forest Division for study of sustainable harvesting of Chironjee.

Project 15: Standardization of nursery techniques of *Strychnos nux-vomica* and *Strychnos potatorum* [080/TFRI/2005/Silvi-2(9)/ 2005-2008]

Status: In order to repeat the experiment for confirmation of earlier results the seeds, roots and branches of *S. nux-vomica* and *S. potatorum* were collected from Sahanikhar, Dhamtari Forest Division and Khutama South Forest Division, Chhindwara, respectively. The physical, chemical and hormonal treatments were given to seeds, roots and branches of *S. nux-vomica* and *S. potatorum* to study the regeneration of the species in silviculture nursery. Different physical, chemical and hormonal treatments were found to be effective in enhancing the germination and rooting performance of *S. nux-vomica* and *S. potatorum* of seeds and vegetative propagules over control.

Project 16: Seed physiology of the tropical forest species with special reference to their maturity and storage [076/TFRI-2004/Silvi-2(7)/ 2004-2009]

Status: Pre-treatment studies for enhancement of germination of seeds have been completed on *Mimusops elengi*, *Sapindus laurifolia* and *Terminalia chebula*. Studies on desiccation tolerance and seed storage behaviour have been done on *Bassia latifolia*, *Mimusops elengi*, *Moringa oleifera*, *Terminalia chebula* and *Holoptelea integrifolia*.

Seeds of *Moringa oleifera*, *Holoptelea integrifolia*, *Mimusops elengi*, and *Terminalia chebula* were adjusted to three to five moisture contents and stored at four different temperatures for evaluation of storage potential. Seed maturation studies for determination of seed collection time have been completed on *Mimusops elengi* and *Bassia latifolia* seeds.

NEW PROJECTS INITIATED DURING THE YEAR 2006-2007

Project 1: Evaluation of Medicinal plant based agroforestry system (Silvi-medicinal) under existing teak plantations [105/TFRI/2006/Agro-1(14)/ 2006-2009]

Status: Existing teak plantations site was identified and selected for the study. The field experiments with Randomized Block Design were laid out for establishing Silvi-medicinal system by raising three medicinal plants viz. *Glossiosa superba*, *Costus speciosus* and *Curcuma longa* as intercrops under existing teak plantation in OSR (On Station Research), Agroforestry nursery and OFR (On Farm Research), Ranga plantation (private farmer) at Deori, Jabalpur. Observations on growth and yield data of trees and medicinal crops were recorded. Results indicated that *C. longa* performed significantly better as compared to *G. superba* and *C. speciosus*. Soil samples collected from the experimental plots were analysed for macronutrients (Nitrogen, Phosphorus and Potassium) in soil and no significant changes have been observed during the first year of the experiment. Rhizomes of all three medicinal crops were collected for the estimation of their active ingredients (dieosgenin, curcumin and colchicines).



A view of On Farm Research, Deori Village, Jabalpur



A view of On Station Research, TFRI

Project 2: Studies on the efficacy of toxins of soil actinomycetes against major forest insect pests [103/TFRI/2006/Ento-2 (13)/ 2006-2009]

Status: One hundred soil samples were collected from forests of Bargi, Kundam, Sihora, Belkund, Seoni, Rukhad, Mandla, Amarkantak of Madhya Pradesh and Achanakmar, Chhatarpur, Lamni, Atariya of Chhattisgarh. Soil culture of isolated actinomycetes was prepared by dilution plate method and culture filtrate was collected. Nurseries, plantations and natural forests were surveyed for collection of insects damaging teak and siris. Five new insect species (1 lepidopteran defoliator, 2 beetle defoliators and 2 sap-suckers) were reported feeding on *Albizia* species. Teak defoliator and skeletonizer and *Albizia* shoot feeder were collected and their breeding and rearing in the laboratory was carried out. Seed pests of *A. lebbek* were collected and a major bruchid pest, *Bruchus* species was reared in laboratory. Observations were recorded on the pattern of infestation and concomitant loss in seed yield due to bruchids. The culture filtrate of soil actinomycete against teak defoliator was standardized in the laboratory. Culture filtrate of soil actinomycete was tested against skeletonizer and *Albizia* shoot feeder through larval and food treatment. Tests of culture filtrate of soil actinomycete against *Bruchidius bilineatopygus*, a major seed pest of *Albizia* species were initiated.



Project 3: Evaluation of biopesticidal products for the management of teak defoliator and skeletonizer in forest nursery [104/TFRI/2006/Ento-3(14)/ 2006-2009]

Status: The experimental nursery stock was periodically monitored for incidence of the teak defoliator and skeletonizer. Collection of teak defoliator and skeletonizer was made from plantation areas of Udaipur, Kalpi, Tikariya under Mandla Forest Division, Mandla (M.P.) and culture was maintained in laboratory. Eight concentrations of three commercially available botanical biopesticides (Neemgold, Neemsuraksha and Neem oil) were evaluated. Sampling, isolation and identification of entomopathogenic fungi from insects collected from Nagpur (M.S.), Belkund, Kundam, Seoni and Mandla (M.P.) were carried out and cultures were maintained.

Project 4: Development of nursery techniques for *Terminalia chebula* Retx. (Harad) [107/TFRI/2006/Silvi-1(12)/ 2006-2009]

Status: Seeds and vegetative propagules of *Terminalia chebula* were collected from two sources. Different physical, chemical and hormonal treatments were found to enhance the germination of *Terminalia chebula* seeds over control.

PROJECTS COMPLETED DURING THE YEAR 2006-2007

(Externally Aided)

Project 1: Documentation of best practices in collection and processing of NWFPs in Chhattisgarh [089/TFRI-2005/Agro-CGMFP(13)/ 2005-2007]

Findings: Field visits have been made to document the collection and processing methods of NTFPs in all 16 divisions of Chhattisgarh. The Collected data were compiled, tabulated and analysed for preparation of the final report.

Project 2: Training of societies in collection and grading of NWFPs [090/TFRI-2005/Agro-2 CGMFP(12)/ 2005-2006]

Findings: Training was 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".

Project 3: Developing coalition approach to non-timber forest product for better livelihood of tribal communities of Madhya Pradesh [053/TFRI-2003/Agro-1(DFID)(10)/ 2003-2007]

Findings: Technique of lac cultivation established, maintained and standardized in the study sites viz. villages of Bhajia, Bisenpura, Mehdar and Majhegaon (Kundam block of Jabalpur). Broodlac was raised on about 600 lac host trees and data recorded on yield of lac and growth of trees. Compiled and tabulated data was statistically analysed.

Project 4: Introduction of egg parasitoid, *Trichogramma raoi* to protect teak seed orchards from the loss caused by teak defoliator and skeletonizer [086/TFRI-2005/Ento-3 (MPFD)(11)/ 2005-2007]

Findings: Utilization of indigenous egg parasitoid, *Trichogramma raoi* to protect Teak Seed Orchards (TSOs) from the loss caused by teak defoliator and skeletonizer, proved that application of egg



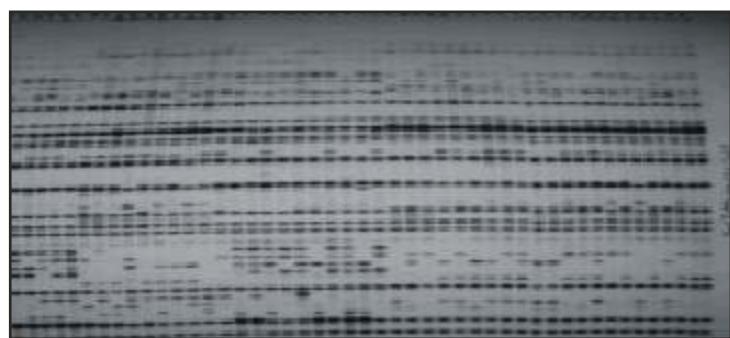
parasitoid between July to September at 1.25 lakhs/ha was highly effective to minimize the intensity of pest attack and annual growth loss in TSOs as compared to the unreleased sites.

Project 5: Taxonomy and documentation of fungi occurring in forests of Madhya Pradesh and Chhattisgarh [061/TFRI-2003/Path-1(CSIR)(7)/ 2003-2007]

Findings: Fungi were collected from forests of Madhya Pradesh and Chhattisgarh. A total of 813 collections were made from plant parts and soil fungi were isolated from 144 soil samples. Total 249 fungi were identified, described in detail with photographs and camera lucida drawings. Documentation and genus wise record of fungi was prepared. The study revealed 2 new genera, 24 new species, 28 new records of fungi from India and 73 new host records for the fungi. The new genera proposed are: *Acrodictiella* and *Kamalomyces*, while the species reported new to science are: *Acrodictiella indica*, *Acrostroma madhucae*, *A. sterculiae*, *Corynespora pogostemonis*, *C. supkharii*, *C. woodfordiae*, *Denticularia terminaliae*, *Hypoxyylon dendrocalami*, *H. spiralis*, *Hysterium jabalpurensis*, *Kamalomyces indicus*, *Kameshwaromyces butiicolous*, *Meliola ougeinia*, *Mysterosporiella terminaliae*, *Phaeoseptoria shoreae*, *Phomopsis ougeinia*, *Pseudocercospora isorae*, *P. schleicheriae-oleosae*, *Rehmiodothis bambusae*, *Sirosporium aeglicola*, *S. xylopyrae*, *Stenella flacourticola*, *S. liliacearum*, and *S. satpurensis*. The record of identified fungi from forests of M.P. and C.G. was prepared tree wise. In this regard total 803 fungi were listed including 656 fungi on 138 trees, 32 on bamboos and grasses, 8 on palms, 41 on shrubs, 15 on climbers, 13 on herbs, 2 on ferns, 13 on dead wood and dead twigs, 2 on dead unidentified bark, 3 on leaf litter and 18 in rhizosphere soil of tree species. The fungi were also classified on the basis of forest types of M.P. and C.G., into 17 groups. A mycology herbarium of forest fungi was established at the institute and 813 specimens were systematically arranged and kept in herbarium cabinets. An identification service for forest fungi has been started at the institute.

Project 6: Studies on cataloguing the genetic variation in teak species (*Tectona grandis* and *Tectona hamiltonii*) using molecular markers [052/TFRI-2003/Gen-1(DBT)(7)/ 2003-2006]

Findings: Teak populations collected from different forest types of the country were assessed for molecular genetic variation using ISSR and AFLP markers. Analysis of DNA polymorphism detected very high levels of genetic diversity in the teak populations. ISSR analysis of 29 teak populations detected high Nei's genetic diversity (0.36) than AFLP analysis of ten populations (0.26). Most of the teak populations grouped according to their distribution range. In ISSR assay using 29 teak populations, intra-population variation was high (91%) than inter-population variation (3%). AFLP assay using 10 teak populations detected similar trend for albeit comparatively less values (67% intra-population variation and 27% inter-populations variation).



AFLP profile of populations of *T. grandis*

Project 7: Standardization of production technology of some important medicinal plants under tropical climate of Madhya Pradesh [055/CFRHRD- 2003/1(MHFW)(5)/ 2003-2007]



Findings: *Emblica officinalis* (Aonla): Non-destructive harvesting method to harvest aonla fruits was standardized. Major active ingredients viz. ascorbic acid, gallic acid and tannins were estimated in Aonla fruits collected at different time of maturity. January was found the best time to harvest Aonla fruits as it contained higher amount of ascorbic acid. Influence of storage on ascorbic acid content was studied. Green chip grating and drying in sun was found the best method of processing of Aonla fruits.

Rauvolfia serpentina (Sarpagandha): Manure requirement for the cultivation of Sarpagandha was standardized. Vermicompost 2.5 kg plus 5 kg FYM per bed was found superior among all the treatments. April-May was found the best time to sow Sarpagandha seeds to raise seedlings. March-April was found the best time for vegetative propagation through root and stem cuttings. December was found the best time to harvest Sarpagandha roots as at this time it contained higher amount of alkaloids. Non-destructive harvesting practices were standardized for the tropical climate of Madhya Pradesh. Total alkaloid and reserpine content were estimated in Sarpagandha roots. Seeds (7 Kg) were collected for distribution among farmers.

Andrographis paniculata (Kalmegh): Cut method was found superior over uproot method. March-April was found the best time to raise nursery for Kalmegh. Kalmegh samples were analyzed for andrographolide content using HPLC. The variations in andrographolide content were found among samples collected during different time of maturity and locations. Seeds (2 kg) were collected for distribution among farmers/SFDs.

Gymnema sylvestre (Gurmar): Vermicompost 2.5 kg plus 5 kg FYM per bed was found superior to raise Gurmar. The vegetative propagation techniques were standardized. Woody cuttings planted in the month of July performed well in terms of rooting (60%). The Gurmar seedlings were also raised from seeds. However, the germination percentage was only 40%. October-November was found the best time to harvest the leaves. As Gurmar is a climber, it requires support for its development. Gymnemic acid was estimated from the leaves of Gurmar.

Tinospora cordifolia (Gurbel or Giloe): Vegetative propagation techniques were standardized. April-June was found the best time to raise plantlets. Cuttings treated with 500 ppm IBA got 100% rooting. Ninety five per cent germination was recorded in the seeds sown in the month of October. Manure doses were standardized for the cultivation of Giloe. Giloe is a climber, the support system plays vital role in the development and growth of Giloe. Non-destructive harvesting practices were also standardized. The drying and processing technique were developed for Giloe.

Gloriosa superba (Kalihari): Kalihari seedlings were raised from seeds. However, germination percentage was very poor being only 15 %. One-year old rhizomes raised from seeds were planted in nursery. For cultivation of Kalihari good support system is required as Kalihari plant is very tender. Colchicine was estimated from Kalihari rhizomes and seeds.

Project 8: Study of Sal mortality in Forest Divisions of Chhattisgarh [074/TFRI-2004/Patho-3(CGFD)(10)/2004-2007]

Findings: Dying of Sal is observed from top to downwards where fire and grazing are common. Soil analysis showed less organic matter and compactness which reduced its moisture holding capacity. The affected Sal trees showed 40-60% rot in the heartwood. In some observations, a root rot fungus *Polyporus shorae* was recorded. Ectomycorrhizal development and regeneration of Sal were very poor. There is needed to improve the organic matter in Sal mortality area by adopting measures for protection from fire and grazing.

Project 9: Non-destructive harvesting practices for selective MFP-Nagarmotha [094/TFRI/2005/NWFP-6(CGFP)(17)/ 2005-2007]



Findings: Different forest areas viz. Hagaria Nala and Haff Nadi, Bissaraghata, Pandaria, Khawardha; Amadoh Nala, Kewchi range, Marwahi Forest Division; Khandajhari Nala, Komakhan, Abhunpur; Chargao, Bhabbar Ganj River, and Kajool Nadi, Dhugli and Dhumtari were surveyed for the occurrence of Nagarmotha. An experiment in Randomized block design with plot size 1x1 meter with 4 treatments and 3 replications were set up in Kajol Nadi in the month of May June 2006. Total plants were counted in each experimental plot and 60%, 70%, 80% and 90% Nagarmotha plants were uprooted, rhizomes were removed and essential oil was estimated to be 0.06%. The experiment was evaluated in the month of December to ascertain efficacy of the above harvesting intensity for regeneration and sustainability. From the experiment it was inferred that for non destructive sustainable harvesting plants should only be harvested up to 80-90% to ensure proper regeneration.

Project 10: Processing techniques of NWFP *Aegle marmelos* (Bael) [095/TFRI/ 2005/NWFP-7(CGFP)(18)/2005-2007]

Findings: Different forest areas viz. Badora and Rhamankappa in Pandaria, Kawardha and Mohgao in Kharagarh, Chattisgarh were surveyed. Unripe and matured fruits of *Aegle marmelos* in the month of January-February 2006 and ripe and matured fruits in the month of May-June 2006 were collected. Fruits from all the 3 localities were slightly cracked and processed by 3 different methods for the development of best processing techniques of bael fruits. Results indicated that Rhamankappa fruits were best in terms of size, amount of pulp, colour and texture of the pulp as well as taste. Fruits from this locality also yielded best quality pulp with less amount of mucilage. Among different processing methods tested, sun drying method was found to be the best.

PROJECTS CONTINUED DURING THE YEAR 2006-2007 (Externally Aided)

Project 1: Identification of species and ethnobotanical survey [088/TFRI/ 2005/Biod.3(CGMFD)(6)/ 2005-2008]

Status: Survey in eight People Protect Areas (PPAs) of Chhattisgarh at Karpavan, Machkot, Guriya, Jabarra, Shankra, Lamni, Marwahi and Makadi located in Jagadalpur, Dhamtari, Bilaspur, Pendra Road and Kondagaon was conducted for observations on vegetation status. Quadrat study has been conducted in eight PPA sites for documenting floral wealth and increasing or decreasing trend of important forestry species in the area. Vegetational data of PPA for tree species with girth class, regeneration status of major tree species and medicinal plants available in the area were recorded during the study and from previous survey records. Data collected from Jabarra PPA sites of Chhattisgarh forest area for species richness, Diversity Index and IVI have been calculated. Tabulation of regeneration data from Machkot, Sankara, Lamni, Marwahi and Guriya PPA sites for the year 2004-05 and 2005-06 have been made. A total of 140 herbarium specimens have been collected. The ethnobotanical uses of medicinal plants observed from above PPA sites have been documented. Common and medicinal uses of 73 plants species including 56 dicots and 17 monocots found in the PPA sites are recorded along with proper identification, botanical name and family.

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)/ 2005-2010]

Status: The suitable sites having 10 ha area were selected at Bargi command area for experiment.



Water samples from the Left Bank Canal (LBC) were collected and analysed for their physical, chemical and biological parameters. The native vegetation of the selected sites was surveyed. Existing cropping pattern in the villages surrounding the selected sites along the LBC of Bargi command area was studied. The soil samples were collected from different horizons and analysed for pH, CEC, organic carbon, available N, P, K, exchangeable Na, K, Ca and Mg. Mechanical analyses for texture of the soil samples were also done. Seeds from phenotypically superior trees of *Albizia lebbeck*, *Albizia procera*, *Acacia nilotica*, *Dalbergia sissoo*, *Terminalia arjuna*, *Terminalia tomentosa*, *Pongamia pinnata*, *Boswellia serrata*, *Ailanthus excelsa*, *Eucalyptus* species (FRI-4 and FRI-5) and *Jatropha curcas* and bulbils from *Agave americana* were collected. About 29000 seedlings were raised in nursery. About 3000 seedlings of *Jatropha curcas* and 1500 seedlings of *Agave americana* were planted at Bargi command area for bio-fencing of the plantation sites. Profile studies were conducted for selected sites. Transpiration rate (E) of the selected species under nursery condition was measured using Photosynthesis system.

Project 3: 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(9)/ 2005-2008]

Status: Survey of important localities of Jabalpur, Mandla, Seoni, Behrai, Kanjai, Bamandehi, Sagar, Damoh, Guna, Shivpuri, Kawardha, Durg, Rajnand gaon, Raipur, Bhilai, Kanker, Jagdalpur, Bastar, Narayanpur, Bilaspur, Korba, Janjeer Chanpa, Jashpur Nagar, Ambikapur, Koria, Dantewara, Mahasamund, Nagpur and Amravati were carried out for the collection of *Trichogramma* and *Trichogrammatoidea* species. Over all 938 specimens belonging to the genera: *Trichogramma* and *Trichogrammatoidea* were collected. Nine species of *Trichogramma* and two species of *Trichogrammatoidea* (*Trichogramma achaeae*, *T. chilotraeae*, *T. hesperidis*, *T. plasseyensi*, *T. raoi*, *T. sembeli*, *T. vargasi*, *T. sericini*, *T. julianoi*; *Trichogrammatoidea bactrae* and *T. ruficorpa* have been recorded as indigenous species, existing in Madhya Pradesh and Chhattisgarh. One culture of local indigenous species, *Trichogramma raoi* is being maintained. Six new cultures of *Trichogramma* species were collected from Madhya Pradesh and Chhattisgarh. All six new cultures of *Trichogramma* species are being maintained. Culture of *Corcyra cephalonica* is being maintained for the use of their eggs as laboratory host / fictitious eggs for *Trichogramma* and *Trichogrammatoidea* species.

Project 4: Studies on refinement and scaling up of existing micro-propagation and macro-propagation technologies for *Bambusa nutans* and *B. tulda* [063/TFRI2004/Gen-1(DBT)(7)/ 2004-2007]

Status: Micropropagation/shoot multiplication: In *B. nutans* shoot multiplication experiment was conducted to compare stationary cultures and cultures on rotary shaker. Multiplication rate was better in stationary cultures. *Bambusa tulda* shoot multiplication experiment was conducted under different light regimes, which exhibited non-significant effect on shoot multiplication rate. Presently 750 and 605 propagules of *B. nutans* and *B. tulda* are being maintained for multiplication, respectively.

Hardening and acclimatization of plantlets: In the first set of experiment, *in vitro* raised plantlets of *B. nutans* and *B. tulda* were hardened in four types of sterilized substrates, viz., soilrite, perlite, vermiculite and compost in root trainers. Perlite was found to be most suitable hardening mixture with 91% survival of plantlets of *B. tulda* whereas in *B. nutans* maximum survival (90%) was observed on vermiculite,

which was statistically at par with that on soilrite and perlite. In the second set of experiment six mixtures were tried for hardening, which did not have any significant effect on the survival and height of plants.



Micropropagation of *Bambusa nutans* and *B.tulda*

(a)shoot multiplication of *B. nutans*,(b) shoot multiplication of *B.tulda*,
 (c),(d) Hardening in four substrates in root-trainers,(e)plantlets of *B. nutans* (f) plantlets of *B.tulda*

Macropropagation: Cuttings of *B. nutans* from Sambalpur (Orissa) were collected for production of plantlets through adventitious rhizogenesis.



Macroproliferation: Macroproliferation of the plantlets produced through both micropropagation and macropropagation were carried out. For *B. nutans* 1308 number of micropropagated and 521 number of macropropagated plants were produced and for *B. tulda* 708 number of micropropagated plants were produced.

Project 5: Processing techniques of NWFPs of Chhattisgarh *Madhuca latifolia*, *Shorea robusta*, *Schleichera oleosa*, *Pongamia pinnata*, *Buchanania lanza*s Spreng (Chironjee) [091/TFRI/2005/NWFP-3(CGMFD)(14)/2005-2007]

Status: Seeds of *Pongamia pinnata* (karanj), *Madhuca latifolia* (mahua), *Schleichera oleosa* (kusum) from Kundam (Jabalpur) and Kalpi (Mandla); *Shorea robusta* (sal) and *Buchanania lanza*s from Bilaspur (Chhattisgarh) were collected. Collected seeds were processed (decorticated, dried and stored). Oil percentage, physico-chemical properties of oil, carbohydrates, and protein content were estimated. Seeds were dried and stored in different containers for the assessment of effects of processing methods on quality of seeds. Fungal flora of seeds was assessed from collected species.

Project 6: Quality assessment of NWFPs from different regions of Chhattisgarh (Species - *Asparagus racemosus*, *Buchanania lanza*, *Emblica officinalis*, *Embelia ribes* and *Andrographis paniculata*) [092/TFRI/2005/NWFP-4 (CGMFD)(15)/2005-2007]

Status: Aonla, Satawar, Chironjee, Vaibidang and Kalmegh were collected from Bilaspur, Dhamtari and Bastar regions of Chhattisgarh. Physico-chemical properties of chironjee seeds were assessed. Ascorbic acid in aonla samples were estimated. Kalmegh samples were prepared for the estimation of *Andrographolide* with the help of HPLC. Minerals, carbohydrates and saponins in Satawar samples were estimated.

Project 7: Non destructive harvesting practices for selective MFPs - *Buchanania lanza* Spreng (Chironjee) [093/TFRI/2005/NWFP-5 (CGMFD)(16)/2005-2007]

Status: Physico-chemical properties, viz. moisture percentage, kernel: shell ratio, fruit and seeds weight, oil percentage, specific gravity, refractive index, saponification value, free fatty acid composition and iodine value of oil of Chironjee collected at different intervals were assessed. Minerals and protein were assessed in chironjee seed cake. Two sites (Bilaspur and Sirpur, Chhattisgarh) were selected to conduct experiment for sustainable harvesting.

Project 8: Standardization of sustainable harvesting practices of *Terminalia arjuna* bark [78/TFRI/2005/NWFP-1(MPFED)(12)/2005-2008]

Status: Surveys were conducted at Balaghat and Jabalpur districts of Madhya Pradesh for laying out of experiments to harvest Arjuna bark. Arjuna trees of different age groups and girth sizes were selected for laying out the experiments to harvest the bark. The experiments were laid out in the forest area of Balaghat as well as in the farmer's field for the extraction of bark. The girth of selected trees ranged between 67-218 cm, bark thickness ranged from 7.12 to 18.65 mm were recorded at breast height. Mean bark thickness at breast height in Arjuna trees was recorded 13.50 mm. Mean thickness of bark varied from trees to trees irrespective of the age and girth of the tree. Mean bark yield per square centimeter ranged between 0.29 gm to 1.25 gm and found varying from tree to tree. Collected bark samples were analysed for tannin and oxalic acid contents. The tannin content ranged from 7.70 to 15.35 gm per 100 gm. The amount of oxalic acid in the bark ranged between 10.50 gm to 20.25 gm per



100 gm. Regular field observations were taken on the recovery of bark. The stage of bark recovery (regrowth) varied from tree to tree. In some trees the bark regeneration is complete. In the areas where water is available throughout the year (near nallas) the recovery of bark was faster. In younger trees the bark regeneration was faster in comparison to older trees. Extraction of bark can be done after two years from the opposite quarter of the blaze without destroying the tree. September October was found the best time to harvest the bark.

Project 9: Standardization of non-destructive harvesting practices of Arjuna (*Terminalia arjuna*), Maida (*Litsea chinensis*) and Ashoka (*Saraca indica*) bark [96/TFRI/2005/NWFP-8(CGMFD)(19)/ 2005-2007]

Status: The experiments were laid out to harvest Arjuna and Maida bark in the forest area of Dhamtari, Kanker, Sarguja, Raigarh and Marvahi forest divisions of Chattisgarh. Bark. Samples were collected and processed for chemical analyses. The availability of Maida trees in the forest area is very less. Arjuna bark samples were analysed for tannin and oxalic acid contents. Mucilage and tannin were analysed from Maida bark samples. No Ashoka tree could be found in the forest areas of Chattisgarh. Therefore, experiments were laid out to harvest Ashoka bark in Balaghat and Sagar in Madhya Pradesh. Data on bark regeneration/regrowth were collected from the experiments laid out earlier. The regeneration of bark has started and no tree was found with complete regeneration.

Project 10: Standardization of non-destructive harvesting practices of Baividang (*Embelia ribes*), Baheda (*Terminalia belerica*) and Aonla (*Embllica officinalis*) fruits [97/TFRI/2005/NWFP-8(CGMFD)(20)/ 2005-2007]

Status: Aonla, Baividang and Baheda growing areas were selected in Dhamtari, Kanker, Sarguja, Raigarh and Marvahi forest divisions of Chhattisgarh. Experiments were laid out to harvest Aonla and Baheda fruits. Fresh and dry weight of collected fruit samples was determined. Collected Aonla and Baheda fruits were analysed for tannin, ascorbic acid and gallic acid. Processing of Aonla fruits (boiling, chipping, grating, sun drying, solar cooker drying) was done. Grating was found the best processing method. The different processed samples were analysed for tannin, ascorbic acid and gallic acid contents. The Baividang fruits were analysed for Ca and Mg. Variations were found in fruit size, fruit weight, tannin and ascorbic acid contents in the fruit samples of Aonla and Baheda collected from various locations. The data on regeneration status of Aonla, Baheda and Baividang were collected. New Aonla, Baheda and Baividang seedlings were found in the experimental areas.

Project 11: National Network on Integrated Development of Jatropha and Karanj [73/TFRI-2004/NWFP-3(NOVOD)(11)/ 2004-2007]

Status: *Jatropha curcas*: 8000 seedlings/plantlets have been raised from the collected superior material. National trial of Jatropha comprising of 3 accessions from 2 participating Institutes has been established at the institute campus. A progeny trial comprising of 20 progenies has been established at Barah experimental area of the Institute. All experiments e.g. national trial, zonal trial, progeny trials and package of practices trials are being maintained at the Institute campus and its Centre at Chhindwara. The observations on growth attributes like height, collar diameter, number of branches, etc. were recorded at regular intervals. The trials are performing well and the survival is more than 95%. Pruning operations were conducted to study the effect of pruning on growth and productivity of *Jatropha*. Fatty oils were extracted and yield was estimated to identify the elite trees of *Jatropha*. The oil percentage



varied from 24.07 - 40.06 % from the seeds collected from various agroclimatic regions of the study area. Out of 25 samples, seeds from seven CPTs have been found to contain more than 35% oil. Ten seed samples were sent to NBPGR, New Delhi for cryopreservation and allotting accession numbers. Initial findings of the study show that the seedlings planted on ridges in the last week of July 2005 performed better than the seedlings planted in pits. Bare-rooted seedlings performed at par with poly-potted seedlings if planted within 24 hours after taking out from the nursery beds. The planting of bare-rooted seedlings reduced the cost of plantation considerably. Pruning had positive impact on seed production of *Jatropha* as it yielded more fruits.

Pongamia pinnata (Karanj): Twenty five Candidate Plus Trees (CPTs) of Karanj have been selected for collection of fruits from Sagar, Gwalior, Shivpuri, Muraina, Shivpur Kala and Damoh districts of M.P. The data pertaining to individual candidate plus tree on height, dbh, crown area, fruit size (pod) and fruit yield, etc. were collected. A total of 3,000 seedlings have been raised from the seeds collected from various sources. The collected seeds were tested for germination. A zonal trial comprising of 5 accessions received from one institution has been established at the Institute campus. However, a progeny trial comprising of 20 progenies has been established at Barah experimental area of the Institute. Twenty five seed samples collected from various parts of Madhya Pradesh were sent to TERI, New Delhi for oil estimation. Out of 25 samples, 18 samples contain more than 35 % of oil. The oil percentage varied from 31.52 to 39.65 percent. Sixteen Karanj seed samples were sent to NBPGR for cryopreservation and allotting accession numbers. National, zonal and progeny trials raised at the Institute campus and Bhandamuri, Balaghat are being maintained. The dead plants were replaced by the seedlings of same age from same accessions. The survival percentage is more than 90 per cent. Regular field observations were recorded on growth attributes of plants e.g. height, collar diameter, etc.

Project 12: 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) 2005-2007]

Status: Sample plots of Kalmegh were laid out at Jhalpani, Sonakhan Range under Raipur Forest Division and at Lalunga Range of Dharmjaigarh Forest Division. Sample plots of Kalmegh, Malkangni and Satawar were laid out at Mohali Forest Circle in Karpawond Range of Jagadalpur Forest Division. Two sample plots were laid out of Malkangni at Sankara Forest Range under Dhamtari Forest Division. One more sample plot was laid out for Bael at Mohgoan Gandai Range under Khairagarh Forest Division. As per experimental design and regeneration studies, sampling of Satawar, Malkangni and Kalmegh were done and their fresh and dry weights were taken.

Project 13: Nursery technologies of mass multiplication of superior seedlings Balbaring, Sarpgandha, Chironjee Arjun, Aonla, Bael in Chhattisgarh [099/TFRI/2005/Silvi-4 (CGMFD -11) 2005-2007]

Status: Seeds of Baividang and cuttings of Maida have been collected from Biligarh Range, Raipur Division in Chhattisgarh. Vegetative propagation experiments under different hormonal treatments were conducted to study the sprouting and rooting performance.

PROJECTS INITIATED DURING THE YEAR 2006-2007 (Extremally Aided)

Project 1: Study on utilization pattern of plants in ethno - medicinal uses prevalent in tribal pockets of Satpura plateau in Madhya Pradesh [101/TFRI/JBP/2006/Biod-1 (MPSBDB) (07) 2006-2010]



Status: Field surveys were conducted in Mandla district of Madhya Pradesh and Bijadandi, Kalpi, Motinala, Mohiyanala, Pondi, Sarhi, Chhindgaon, Jamuniya, Tikariya, Kundamali, Bhaiswahi, Rasulganj, Bammari, Babaliya and Amgaon villages have been identified tribal pockets. Fifteen traditional healers have been identified from above villages for documentation of traditional knowledge. Seventy eight plants have been identified from Kalpi, Niwas and Gughari range of Mandla district. The existing utilization pattern of 36 plants was recorded with formulations for cure of various diseases prevalent in tribal pockets. List of 10 traders and middle men involved in collection of raw materials of medicinal plants has been documented from Mandla Forest Divison.

Project 2: Lead institution for Achanakmar-Amarkantak Biosphere Reserve Chhattisgarh [102/TFRI/2006/Ento-1(MoEF)(12)/ 2006-2009]

Status: Data on vegetation available in Achanakmar-Amarkantak Biosphere Reserve (AABR) viz., 7 species of algae, 111 species of fungi, 3 species of lichens, 15 species of bryophytes, 23 species of pteridophytes, 14 species of gymnosperms and 656 species of angiosperms were documented. Seven sample plots were laid out in different ranges of A.A.B.R. and population density of trees, shrubs, herbs and their regeneration were studied. NTFPs existing were also documented. Inventory list of 47 species of butterflies, 22 species of beetles, 1 species of rare cricket, 22 species of fishes, 9 species of amphibians, 45 species of reptiles, 145 species of birds and 29 species of mammals were also prepared. Soil types and nutrient status of 7 sample plots were studied. Tribes inhabiting in 238 villages of AABR were documented and economic status of 6 villages sampled.

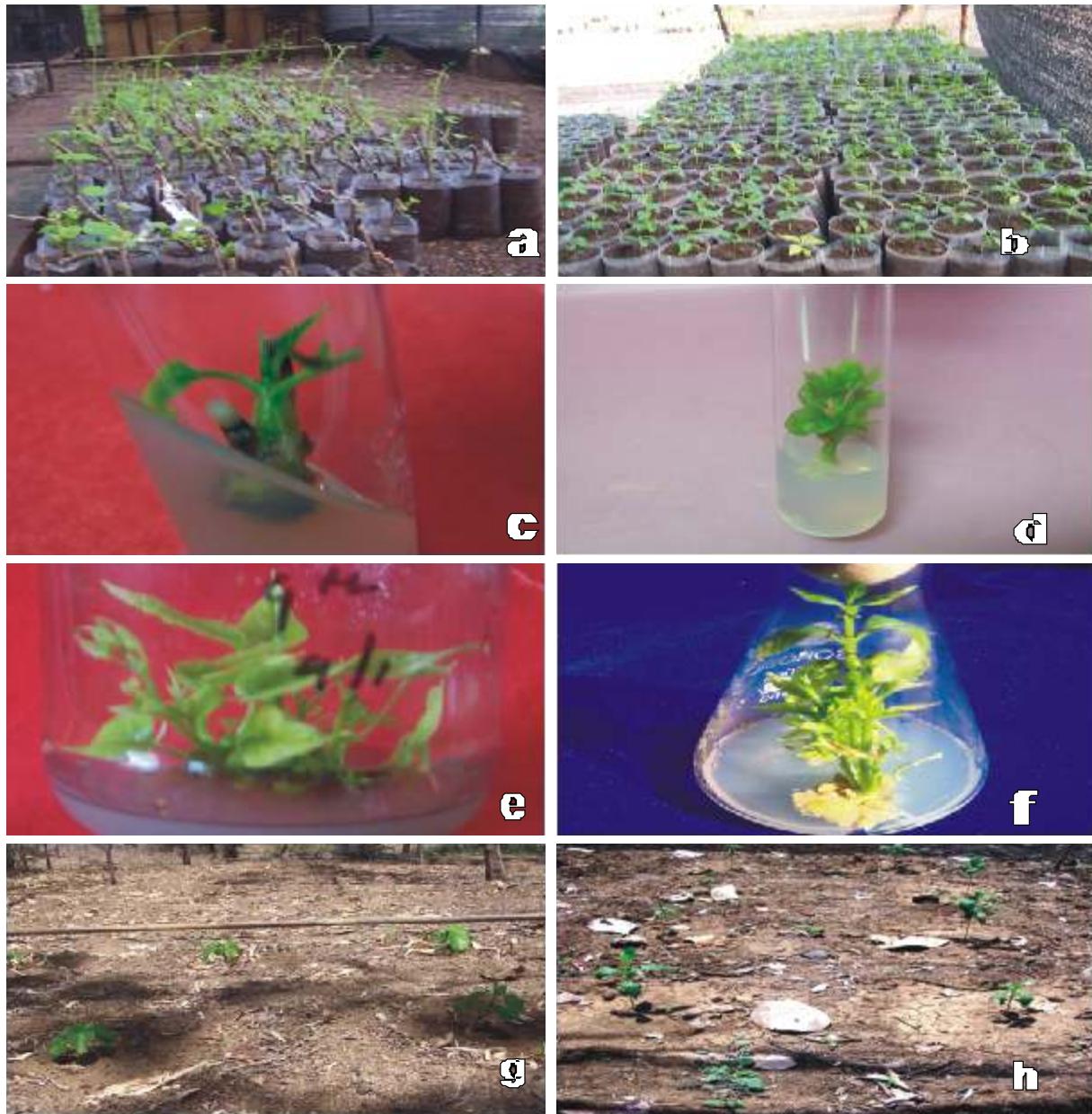
Project 3: Development of integrated insect pest and disease control system for major economically important forest tree species [112/TFRI-2006/ Ento.-4 (MPFD) (15)/ 2006-2009]

Status: Survey were conducted at Hardi / Sirmaur, Rewa; different compartments at Balwara and Katkut ranges, Barwaha Forest Division and Sonaghati, Research and Extension circle, Betul for selection of sites for laying out of experiments. Preliminary screening of six varieties of aonla, *Emblica officinalis* for insect pests and diseases was done. Observations were recorded on dead/dying of teak trees. Five fungi viz. *Diatrype tectonae*, *Phomopsis tectonae*, *Pleospora multiseptata*, *Botryodiplodia theobramae* and *Stagnospora* species on teak and one insect i.e. sap sucker *Scutellera nobilis* on the fruits of aonla were identified.

Project 4: Varietal improvement of *Rauvolfia serpentina* and *Tinospora cordifolia* through germplasm selection, evaluation and breeding [100/TFRI/2006/Gen-1 (MoHFW) (10)/ 2006-2009]

Status: Vine cuttings of 42 individual plants of *Tinospora cordifolia* from 39 different locations were collected and rooting in cuttings induced with different hormones and their concentrations. 100% rooting was achieved in cuttings treated with 100 ppm IBA. *R. serpentina* germplasm from 48 different locations was collected and maintained for seed increase. Scarified seeds of *R. serpentina* of all collected germplasm were germinated using pre-treatment of 500 ppm GA₃, which resulted in 95% germination. *In vitro* shoot cultures from nodal segment explants were successfully established in *Tinospora cordifolia* with treatment of 0.1% HgCl₂ for 7 minutes on MS medium supplemented with 25 µM BA, which resulted in 34% bud break. The shoot cultures of CIMSHEEL variety of *Rauvolfia*

serpentina were established on MS medium enriched with 10 μM BA+1 μM NAA using nodal segment explants. A four fold *in - vitro* shoot multiplication rate was obtained in *T. cordifolia* on MS medium supplemented with 10 μM BA+150 μM Glutamine. The shoot cultures of *R. serpentina* are regularly maintained on MS medium supplemented with 10 μM BA+1 μM NAA. The germplasm evaluation trial of *T. cordifolia* and *R. serpentina* was established.



Propagation and field evaluation selected germplasm of *T. cordifolia* and *R. serpentina*- (a) Rooting in cuttings of *T. cordifolia* (b) Seed germination in *R. serpentina* pretreated with 500 ppm GA₃. In-vitro shoot culture establishment of *T. cordifolia* (c) and *R. serpentina* (d) using nodal segment explant. Multiplication of shoot cultures of *T. cordifolia* on MS medium with 10 μM BA+ 150 μM GI (e) and *R. serpentina* on MS medium with 10 μM BA+1 μM NAA (f). (g-h) Field trial of selected germplasm of *T. cordifolia* (spacing 1m x 1.5 m) and *R. serpentina* (spacing 0.5m x 0.5 m)

Project 5: Studies on *in vitro* regeneration of plantlets and their genetic (molecular) fidelity in *Saraca indica* Linn., a vulnerable medicinal tree [111/TFRI-2006/Gen.-2 (CSIR)(12)/ 2006-2009]



Status: Plant material of *Saraca indica* was collected from JNKVV, Jabalpur. Nodal segments, shoot tips and leaves were inoculated after surface sterilization with mercuric chloride on MS medium supplemented with various plant growth regulators. An experiment on effect of season on aseptic bud break was initiated.

Abstract: No. of Projects

	No. of projects completed in 2006-2007	No. of ongoing projects in 2006-2007	No. of projects initiated in 2006-2007
Plan Projects	4	16	4
External Projects	10	13	5
Total	14	29	9

TECHNOLOGY ASSESSED AND TRANSFERRED

1. Transferred technology of lac cultivation to the VFC members, forest officials and self-help groups in tribal dominated areas of Madhya Pradesh and Chhattisgarh.
2. Demonstrations of techniques for collection, processing and storage of MFPs were organized at Mahendragarh, Baikunthpur, Ambikapur, Jaspurnagar, Sukma, Jagdealpur, Geedam, Bhairamgarh, Kanker, Kondagaon, Narainpur and Bhanupratappur for VFC members and forest officials.

EDUCATION AND TRAINING

1. Dr. N. Kulkarni attended *hands-on* training on “*Entomopathogenic Nematodes for Insect Pest Control*” from 20th to 29th March 2007 at Project Directorate of Biological Control (ICAR), Bangalore (Karnataka).
2. Shri Rajat S.Pal, CF, attended a one-week compulsory training for IFS officers on “Prospects of Micro-Finance in Forestry” held from 19th to 23rd February 2007 at the Indian Institute of Management, Lucknow.
3. Dr. A.K. Pandey, Scientist-E, attended a training programme on “Forest Certification” on 30th November and 1st December 2006 at Indian Institute of Forest Management, Bhopal.
4. Dr. R.K. Verma, Scientist-D, attended short term training on “Molecular Taxonomy of Fungi” at Thaper University, Patiala from 19th to 24th March 2007.
5. Shri Har Prasad attended “Management and Development Programme on Criteria and Indicators for Sustainable Forest Management” at IIFM, Bhopal from 8th to 10th November 2006.
6. Training organized for VFC members of Dhamtari District (C.G.) on 'Sustainable harvesting of medicinal plants and protection of forest against fire' from 21st to 25th August 2006.
7. Three days training was organized for representatives of NGOs and farmers from 16th to 18th August 2006 on 'Strategies for production, processing and development of Bio-fuels'.



8. Three-days training was organized on 'Biofertilizers' from 14th to 16th November 2006 at TFRI, Jabalpur.
9. One-week compulsory training course organized for IFS Officers from 12th to 16th February 2007 on 'Management of Tropical Forests: Issues and challenges'.
10. Training organized for M.Sc. students in the field of Biotechnology and Molecular biology in May, June and July 2006.

LINKAGES AND COLLABORATION

1. 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, New Delhi; National Research Centre for Agroforestry, Jhansi; JNKVV, Jabalpur etc.
2. A collaborative project entitled "Developing coalition approach to non timber forest produce for better livelihood of tribal communities of M.P. DFID.

CONSULTANCIES

1. Monitoring and evaluation of work done under FDA for Mandla, Guna, Hoshangabad, Datiya, Shivpuri, Harda, Dhar and Jhabua (M.P.).
2. Monitoring and evaluation of work done under FDA in Dhamtari, Raipur, Durg and Kawardha (Chhattisgarh).
3. Evaluation of preservation plots in Maharashtra.

CONFERENCE/MEETINGS/WORKSHOPS/SEMINARS/SYPOSIA/EXHIBITIONS

Organised

1. Organised National Conference on "Increasing Forest Productivity, Genetic and Breeding Options" held at TFRI, Jabalpur from 21st to 23rd February 2007.
2. Organised Training/Workshop on "Management of Forests/Tree lots outside Forests under the control of State Forest Departments- role of State Forest Departments" held at TFRI, Jabalpur from 19th to 20th December 2006.
3. 16th RAG meeting of the institute was held at Tropical Forests Research Institute on 30th August 2006.
4. Meeting of the beneficiaries was organized for the consultant who reviewed X Five year Plan of ICFRE.

Participated

Conference

1. Dr. Fatima Shirin, Scientist-D attended a national conference on Increasing Forest Productivity:



Genetic and Breeding Options held from 21st to 23rd February 2007 at TFRI, Jabalpur and presented a paper entitled "Micropagation of *Bambusa nutans* Wall".

2. Dr. S. A. Ansari, Scientist-E and Dr. C. Narayanan, Research Officer attended and presented papers in the "National Conference on Emerging Trends and Future Challenges in Biotechnology" on 22nd and 23rd September 2006 at Peoples Educational Society, Institute of Science and Technology, Bangalore.
3. N. Roychoudhury, Scientist E attended a National Conference on Increasing forest productivity: genetic and breeding options held from 21st to 23rd February 2007 at TFRI, Jabalpur and presented a paper entitled 'Screening resistance in teak clones of Madhya Pradesh against major insect pests'.
4. Dr. N. Kulkarni, Scientist E attended National Conference on Recent Advances in Biology on 2nd and 3rd February 2007 at Bhandara (M.S.).
5. S.P. Tripathi attended National Conference on "Increasing Forest Productivity: Genetic and Breeding Options" held at the Tropical Forest Research Institute, Jabalpur from 21st to 23rd February 2007 and presented paper entitled "Role of Mokokchung Forest Development Agency in rehabilitation of degraded forests in Mokokchung district of Nagaland".
6. Dr. A.K. Pandey, Scientist E attended Regional Conference on Assessment of bio-diversity and traditional knowledge on 27th September 2006 at Research and Extension Circle, Rewa, MP.
7. Dr. A.K. Pandey, Scientist E attended Conference on Natural Products and Biodiversity: Chemistry and Utilization on 2nd and 3rd November 2006 at Forest Research Institute, Dehradun

Workshops

1. S.P. Tripathi presented papers entitled "Tree Farming through Jhum Cultivation in Nagaland and Assessment of Tree Outside Forests and their present status" in Training Workshop "Management of Forest / Tree lots outside forests under the Contract of State Forest Departments "Role of State Forest Department" for Indian Forest Service Officers held on 19th and 20th December 2006 at the Tropical Forest Research Institute, Jabalpur.
2. Dr. A.K. Pandey, Scientist E attended a workshop on Policy and Institutional Framework for NTFP Management in Madhya Pradesh on 27th and 28th October 2006 at Indian Institute of Forest Management, Bhopal.
3. Dr. A.K. Pandey, Scientist E attended the National Workshop on NTFP Taxation, Policies and Management on 20th and 21st November 2006 at India International Centre, New Delhi
4. Dr. A.K. Pandey, Scientist E attended a workshop on Mahua on 27th and 28th February 2007 at Indian Institute of Forest Management, Bhopal.

Symposia

1. Dr. Rajiv Rai attendant National Symposium on "Tribal Health" organized by ICMR, Jabalpur on 19th and 20th Oct. 2006 and presented two research papers.
2. Dr. C. Narayanan, Research Officer presented a paper 'Half sib analysis, estimation of genetic



parameters of growth and wood properties and their interrelationship in plus trees of teak (*Tectona grandis* L.f) of Allapalli region' in National Symposium on Tree Improvement for Sustainable Forestry from 4th to 6th November 2006 at the Department of Forestry, Jawaharlal Nehru Krishi Vishwavidyalaya, Jabalpur, Madhya Pradesh.

3. Dr. R.K.Verma presented a paper entitled 'Fungal diversity in forests of Satpura' in the International Symposium on Microbial Diversity at R.D. Univ. Jabalpur from 19th to 21st November 2006.
4. Dr. Nanita Berry, Scientist C presented a research paper entitled "Women empowerment towards sustainable production" in the National Seminar on "Tree Improvement for sustainable forestry held from 4th to 6th November 2006 at JNKVV, Jabalpur (M.P.).
5. Dr. Nanita Berry, Scientist 'C' attended a National Symposium on "Agroforestry for livelihood security, Environment protection and Biofuel production' and presented a paper entitled "Lac culture: an option for livelihood security" held from 16th to 18th December 2006 at National Research Centre for Agroforestry, Jhansi, (UP).
6. Shri S.P. Tripathi presented paper entitled "Tree productivity and sustainable forestry in Nagaland" in National Symposium on Tree Improvement for Sustainable Forestry Organized by Department of Forestry, Jawaharlal Nehru Krishi Vishwavidyalaya, Jabalpur from 4th to 6th November 2006.

Seminars

1. Dr. V. Nath and Alfred Francis attended National Seminar on "Prospects of organic farming" at Regional Center of Organic Farming, Jabalpur from 26th and 27th April 2006 and presented one research paper.
2. Dr. Rajiv Rai attended National Seminar on "Biotechnology in Sustainable Agriculture Development and Environmental Protection", organized by NGO Jabalpur on 28th and 29th January 2007 and presented two research papers.
3. Dr. V. Nath attended National Seminar on "Increasing Forest Productivity Genetic and Breeding options" at TFRI, Jabalpur from 21st to 27th February 2007 and presented one research paper.
4. Smt. Neelu Singh presented a paper entitled "Effect of drying methods on chemical composition of *Costus speciosus* (Koen) Sm." in the National Seminar on Medicinal, Aromatic and Spices plants- Perspective and Potential held on 18th and 19th December 2006 at Indira Gandhi Krishi Vishwavidyalaya, Raipur, Chhattisgarh.
5. Dr. S. A. Ansari, Scientist-E participated and presented papers in the All India Seminar on "Biotechnology in Sustainable Development and Environmental Protection", on 28th and 29th January 2007 at the Institution of Engineers (India), Jabalpur.
6. Dr. P. B. Meshram attended a National Seminar on "Forest and Forestry Techniques" held on 23rd and 24th March 2007 at G.G. University, Bilaspur and presented a paper entitled "Impact of integrated insect pest management technique on teak (*Tectona grandis*)".



7. Dr. K.C. Joshi and Dr. N. Kulkarni attended "National Seminar on Environment and Ethnobiology" at Govt. New College, Rewa (M.P.) on 9th and 10th February 2007 and presented paper entitled "Butterfly fauna of Kanha National Park".
8. Dr. N.Berry, Scientist C participated in International Seminar on "Sustainable agriculture, food security and bioenergy production" and presented a poster entitled "Potential of bioenergy plants in agroforestry" held from 14th to 16th February 2007 at J.N.K.V.V., Jabalpur (M.P.)
9. Shri Rajat S.Pal, Conservator of Forests attended National Seminar on "Tree Improvement for sustainable production held from 4th to 6th November 2006 at JNKVV, Jabalpur (M.P.).
10. Mrs. Neelu Singh, Scientist D attended a National seminar on "Prospects of organic farming" on 26th and 27th April 2006 at Regional Center of Organic Farming at Jabalpur.
11. Dr. A.K. Pandey, Scientist E attended a National Seminar on "Jatropha Cultivation and Bio-diesel Production" on 27th and 28th January 2007 at Uthhan, Allahabad.
12. Dr. Avinash Jain, Scientist D presented a paper entitled "Effect of thermal power plant emission on vegetation and soil in Korba (Chhattisgarh)" in National Seminar on "Bio-technology in sustainable agricultural development and environment protection" on 28th and 29th January 2007 at The Institution of Engineers, Jabalpur (M.P.).

Mela

Tropical Forest Research Institute participated in the Van Mela organised by Madhya Pradesh Forest Department at Jabalpur from 3rd to 6th February 2007.

Meetings

1. Shri Avinash Jain attended meeting on "Biodrainage Group of Indian National Committee on Irrigation and Drainage (INCID) on 6th February 2007 at Krishi Bhawan, New Delhi.
2. Shri Avinash Jain attended 7th R and D Review Session of Indian National Committee on Irrigation and Drainage (INCID) on 26th and 27th February 2007 at North Eastern Regional Institute of Water and Land Management (NERIWALM), Tezpur (Assam).
3. Dr. K.C. Joshi and Dr. N. Roychoudhury attended a Academia/Industry/Forest Officers interaction meeting on Management and Utilization of Forests for Sustainable Development, held on 28th October 2006, at Guru Ghasidas University, Bilaspur and presented a paper entitled "Insect pests of teak and their management".
4. Dr. N. Roychoudhury attended a Task Force meeting on "New Science and Technology policy, plan and strategy", held on 26th November 2006 at Jawaharlal Nehru Krishi Viswavidyalaya, Jabalpur.
5. Dr. N. Roychoudhury attended a State Steering Committee meeting on Achanakmar-Amarkantak biosphere reserve, held on 30th November 2006 at PCCF Office, Raipur.

DISTINGUISHED VISITORS

Dr. S.N. Paul Khurana, Vice Chancellor R.D. University Jabalpur visited the Institute and



inaugurated the National Conference on Increasing Forest Productivity- Genetic and Breeding options from 21st to 23rd February 2007.

MISCELLANEOUS

1. Celebrated World Environmental day on 5th June 2006.
2. Van Mahotsava was celebrated on 27th July 2006.
3. Celebrated Hindi week from 13th to 15th September 2006.