PROJECTS ONGOING DURING THE YEAR 2008-2009

PLAN PROJECTS

Project 1: Genetic Improvement of *Asparagus racemosus* to enhance root production and saponin Content [FRI/340/G&TP-19]

Status: Total saponin was estimated in all the twenty sources deployed in the field. The flowering was observed in the month of October 2008 in the field trial. Certain seed sources have exhibited precocious flowering at the age of one year. The variation in seed size and shape has been studied in all seed sources of *A. racemosus* bearing fruits. Data recorded on seeds collected from monocarpellary, bi-carpellary and tri-carpellary ovaries. Leaves variation has been observed in same sources with regards to appearance of green leaves after dryness. Variation in saponin content was also recorded in plants of different phenological appearance of the same sources.

Project 2. Establishment of breeding arboretum of Eucalyptus and production of interspecies hybrids [FRI/319/G&TP-15/2005-2010]

Status: Two species of Eucalyptus i.e. *E. pellita* and *E. urophylla* flowered synchronously and are inter-crossable as the reciprocal crosses attempted between two species have yielded fruits with seeds. The open pollinated seeds from *E. pellita* have been collected and progenies have been raised. Controlled hybridization attempted for production of tri-hybrids between *E. urograndis* (di-hybrid) and *E. pellita.* Phenological observation recorded regarding flowering and fruiting in all the species of Eucalyptus established in the trial.

Project 3: Impact of biotic factors on forest biodiversity with particular reference to specific threatened sites and species of Uttar Pradesh (UP), Uttarakhand and Delhi [FRI-359/Bot-54]

Status: Site selection and phytosociological analysis in north, central and south Delhi ridge forest has been completed .Candidate plus trees of important species were selected from Delhi ridge forest for germplasm collection and ex-situ conservation . Threat value assessment of species like *Sophora mollis*, *Dendrocalamus strictus*, *Leonotis nepetifolia* etc. has been completed. Inventorization of threatened sites of Bhagirathi valley, ecotone of betula -Cedrus, threatened *Erythrina arborescens* and *Berberis asiatica* were studied. Threatened sites of Keshav Prayag, Laxmi Van and Auli were studied for threat value assessment.

Project 4: Revision of Indian Woods – their identification, properties and uses, Vol.II.[FRI- 360/Bot-55]

Status: Microstructure studies of the family Linaceae, Zygophyllaceae and Meliaceae completed as per the feature list given by International Association of Wood Anatomists, 1989.

Project 5: Planting stock improvement: Inter and intraclonal variations in relation to shoot production, rooting and subsequent growth in Vegetative multiplication garden of *Dalbergia sissoo* [FRI-358/BOT-53]

Status: Marked interclonal and intraclonal variations in shoot no., days of shoot emergence and shoot length. Maximum shoot number (26) were produced in clone 66 and 6 while maximum shoot length of 68cm observed in clone No. 49. Significant differences were observed in rooting % which was maximum (90 %) in 4 year old hedges in clone No. 41 while in aggregate, 73 % rooting was observed in 4 year old hedges.There were inter and intraclonal variations in sucker production which was maximum of 3 in clone no. 9 . Five months growth data revealed maximum of 23.8 cm length in Cl. 41 and collar diameter of 5.65mm in cl.88 in 4 year old hedges.Overall treatment effect of three different ages of VMG, the best response in shoot production was observed in 9 year old hedges while rooting and subsequent growth was best in 5 year old hedges while 14 year old depicted decline in rooting % as well as subsequent growth of propagules.

Project 6: Field evaluation of different clones of *Dalbergia sissoo* growing in Clonal Seed Orchard at Lachhiwala, Dehra Dun for their growth and physiological parameters [FRI-357/BOT-52]

Status: The best clone regarding height and clearbole was cl.No.123 belonging to Nepal followed by cl. 202,198 and 235 belonging to Gonda. Chlorophyll Fluorescence parameter FV/Fm was alsomaximum in clone no. 123 belonging to Nepal followed by clones 202,196, 194 and 235, all belonging to Gonda. All the clones belonging to Rajasthan have poor growth but pod formation was observed in all the clones. Most of the clones of Rajasthan shed their leaves earlier. No pod formation in 66, 19, 80, 35,123,67,194,84,85.

Project 7: Molecular analysis of high resin yielding genotypes of *Pinus roxburghii* [1.15FRI/384/G&TP-20]

Status: RAPD analysis carried out for 93 high and low resin yielding genotypes of *P. roxburghii* from Uttarakhand and Himachal Pradesh. A total of fifty RAPD primers were initially used in the present study, of which 18 primers were selected based upon their reproducibility and polymorphic nature for screening of germplasm.

Project 8: Recommendation of Land use model for degraded forests of Nainital of Uttarakhand. [FRI-383/FSLR-25/2007-2010]

Status: Adoption of proper land use model for degraded sites may not only increase the productivity but also decrease the soil degradation. Therefore, need to identify existing constraints and suggest proper land use model for forest area of Uttarakhand is imperative. Surveyed the new area at Khurpatal, Naina, Rajgarh, Laldhunga, Herakhan, Lohakhan, Patloghat, Bhimtal, Bhowali, Neelghat etc. and soil profiles were exposed and their

morphological properties were recorded. Soil samples from all genetic horizons were collected and brought to the laboratory. Soil samples so far collected are analysed for their physico – chemical properties.

Project 9: Relative effect of geology, vegetation and climate on soil formation of Uttarakhand FRI-381/FSLR-23/2007-2012].

Status: Uttarakhand forests of North Western Himalaya is a confluence of all the rock formations resulting in different soil and vegetation types on different climatic zones. The importance of geology in forestry research is of great significance in evaluating the soil fertility status and in managing the soil for greater production. As such, the study regarding this project is being carried out in Uttarakhand State. The area was surveyed and the soil and rocks samples were collected from Dehradun, Nainital, Tehri Garhwal, Pauri Garhwal, Chamoli, Rudraprayag, Udham Sing Nagar, Pithoragarh, Champawat districts of Uttarakhand under different natural forests of *Quercus leucotrichophora, Pinus roxburghii, Cedrus deodara, Picea smithana* and *Abies pindrow, Shorea robusta* and miscellaneous forests with different geological formations. Geology of the area was studied. Soil and rock samples so far collected are being analysed for physical and chemical attributes.

Project 10: Soil organic carbon inventory of Uttarakhand. [FRI382/FSLR-24/2007-2012]

Status: In this project, Soil Organic Carbon pool is being estimated under different land uses *viz.* Forests (Silver fir and Spruce, Deodar, Chir, Oak, Sal, Kail and Miscellaneous), Plantations (Shisham, Teak, Chir, Poplar and Eucalyptus), Horticulture (Mango, Letchi, Guava, and Apple), Agroforestry (Poplar + Wheat) and Grasslands of Uttarakhand. Surveyed the various areas and selected the sites. This year, soil samples were collected from different land uses in Dehra Dun, Tehri Garhwal, Pauri Garhwal, Chamoli, Rudrapryag, Nainital, Udham Singh Nagar, Champawat and Pithoragarh districts of Uttarakhand. Total 1155 samples were collected from different land uses in the above mentioned districts and all the samples were analysed for soil organic carbon, bulk density and coarse fragment.

Project 11: Econometric analysis of potential and constraints for farm forestry development in Eastern UP.

Status : Field data collection and its entry in the computer is completed.

Project 12: Development of Organic Cultivation protocols for enhancing productivity of selected medicinal and aromatic plants in Uttarakhand (FRI-359/NWFP- 23 / 2006-09)

Status: Organic cultivation protocol for 3 medicinal plants such as *Asparagus racemosus, Rauvolfia serpentina* and *Ocimum sanctum* is being finalized using different combinations of FYM, and vermicomposts. A Hands on training on cultivation and value addition of medicinal

plants was conducted. Optimization of farm input cost, effective soil moisture conservation, soil nutrient replenishment and weed control using mulch were suggested.

Asparagus racemosus

Ocimum sanctum

Rauvolfia serpentina

Project 13: Studies on nursery diseases of important medicinal plants of Uttarakhand (FRI- 352/NWFP-22/2006-09)

Status: Nursery diseases of Medicinal and Aromatic plants in the state of Uttarakhand have been studied. Diseases attacking over 70 medicinal and aromatic plants have been identified. Pictorial report with nursery management requirements are being suggested for reducing disease incidences and increasing productivity of medicinal and aromatic plants.

Disease on *Coleus barbatus*

Nursery Disease of *Digitalis purpurea*

Infection on *Gymnema sylvestris*

Project 14: Extent and evaluation of die back of shisham (*Dalbergia sissoo*) and identification of disease resistance sources [FRI-385/Path-22]

Status: Combined tours were undertaken in Rishikesh, Lacchiwala Range, Mejia, Durgapur (West Bengal) and Mattewala Range, Ludhiana. The disease severity and incidence were estimated and pathogen was collected. Soil samples and ecological parameters were also taken for future study. Molecular characterization of *Fusarium solani* by RAPD-PCR was done and resistant/susceptible germplasm of *Dalbergia sissoo* were DNA fingerprinted.

Project 15: Mortality of Kikar (*Acacia nilotica*) in Punjab and Haryana and its management [FRI-386/Path-23]

Status: Areas in Punjab viz. Ludhiana, Amritsar, Firozpur, Bhantida and Hoshiarpur were visited for disease incidence. Evaluation of mortality in Kikar with special reference to *Ganoderma* root rot and heart rot caused by *Phellinus badius* were estimated. Soil samples were collected.

Project 16: Screening and hybridizing Indian isolates of *Cordyceps sinensis* for enhanced production of bioactive principles. [FRI-387/Path-24]

Status: Thirty isolates of *Cordyceps sinensis* were brought into pure culture. Cultural characterization of these isolates was done. Growth of *Cordyceps sinensis* on different nutrient media was studied. The isolates were grown in Jhingora as per the protocol developed. Seven isolates were powdered in liquid nitrogen after a growth of 6 months and were analyzed for their bioactive principles by HPTLC. Some of the bioactive principles have been found to be in a higher quantity in the cultivated *Cordyceps sinensis* in comparison to the wild. Cordycepin was detected in these cultures, however, ergosterol was found in only one culture.

Vegetative growth of *C. sinensis* on Mandua (Left) and Jhingora (Right)

Project 17: Molecular variability in *Cylindrocladium quinqueseptatum* causing leaf and seedling blight in Eucalyptus. (FRI-388/Path-25)

Status: Seventy three isolates of Cylindrocladium *quinqueseptatum* from Uttarakhand, Punjab, Haryana and Uttar Pradesh were analyzed through RAPD-PCR and maximum polymorphism was obtained by the operon primers of 'E' series. The UPGMA cluster analysis of 284 loci led to the identification of 11 population lines and an outlier. The ITS region amplification with primer ITS 1 & 4 was done and 18 sequences were submitted to gene bank (NCBI). Three beta tubulin gene sequences were also submitted to the gene bank. All the above sequences were granted accession number and were published on web site of the gene bank (http//www.ncbi.nlm.nih.gov)

Project 18: Identification and Evaluation of Disease Resistance in Different Genotypes of Poplar (FRI-353/Path. 21)

Status: Growth and disease status of G-48, Udai, WSL-22 and WSL-39 at Jawahar nagar (Udham Singh Nagar) and Maheshwari (Haridwar) nurseries were recorded monthly since July till October. Isolation of different pathogens *(Alternaria* (5)*, Drechslera* (25)*,Phoma* (2), *Sclerotium rolfsii* (1), *etc*) from the sample collected from the site and their detailed symptoms were captured. Two generations of crosses (2006 & 2007) of common poplar genotypes are quantified for growth as well as diseases regularly. One hundred seventy genotypes were also scanned for growth and disease status. Pathogenic reactions of shoot juveniles of G-3 for 33 isolates of *Drechslera* were tested. Some of the isolates like D-2, D-4, D-19, D-31, D-32, and D-34 were more aggressive in comparison to others as they initiated blight symptoms earliest after 3h. Most of the aggressive isolates (D-2, D-19, D-31 and D-34) exhibited 100 percent foliage blight while two isolates i.e. D-4, D-32 also showed 86.7 and 96.7 percent blighted foliage,

respectively within 48h. In another experiment, reactions of stem seedlings against 50 isolates were recorded for G-3 clone. Some of the isolates like D-12, D-18, D-31, D-32, D-40, D-44 and D-45 given wilting symptom within 3h. Blighted symptom was also expressed within the same observation period by isolates like D-9, D-10, D-43, D-48, D-49 and D-50.

Project 19: Creation of Photo Gallery for FRI at Shatabdi Kendra, Dehradun (FRI-457/Path. 31)3

Status: In consultation with the designer hired for designing the gallery the project team has segregated the entire gallery into six sections – Genesis, Architecture, Personalities, Events, Visitors and Research. The civil and electrical works in the gallery are at the verge of completion. More than 200 photographs have been sent for digitization and framing to the firm hired for digitization and framing of the photographs and documents. Artifacts to be kept in the gallery have been identified and their collection has been initiated. Write-ups and titles of the photographs were prepared and stories created.

Project 20: Bioconversion of forest waste lignocellulosic biomass into ethanol (FRI-361/C&P-18) partly funded by UCOST

Status: Detoxified hydrolysates of *Lantana camara* and Pine needle were subjected to fermentation with *Saccharomyces cerviseae*. Lantana hydrolysate after fermentation yielded higher alcohol than pine needle after 54 hrs. of reaction time.

Growth of *Saccharomyces cerviseae*

In order to decrease the toxicity, increase the fermentability efficiency of the hydrolysate and to make the process economical viable, *Lantana camara* and Pine needle were extracted with different solvents- Petroleum ether, Alcohol Benzene and Methanol. The extractives removal was more in Alcohol benzene in case of Pine needle whereas extractive solubilities were found maximum in Methanol in case of *Lantana camara.* The hydrolysis of extractive free biomass is under progress.

Project 21: Utilization of soda spent black liquor lignin for value added products. (FRI-361/C&P-19)

Status: Soda spent black liquors collected from M/S Shreyans Papers Ltd, Ahmedgarh (Pb). and M/S ABC Papers Ltd. Sailakhurd, Distt. Hoshiyarpur (Pb.) were analysed for their physico-chemical properties. Prototype for process development for carrying out modification reactions was set up. The soda spent black liquors were modified by the sulphonation at room temperature by passing SO_2 gas initially for 20 minutes.The modified products were concentrated for higher dry solid content. Further modification reactions to get optimum sulphonation are under process.

Project 22: Role of Temple Forests in rejuvenating microclimate of some villages of Uttarakhand

Status: Phytosociological studies of vegetation of Nagdev Forest Range have been done.The number varied according to the slope / aspect of the sites. Soil samples collected from both the study sites were analyzed for their physico-chemical properties, which didn't show much difference in both the sites. Daily compilation of Meteorological data from both the weather stations is done. Tabulation, conversion of meteorological data etc. is in progress.

Project 23: Utilization of Fungi for Bio-fertilizer of Industrial Waste Water

Status: Different fungi like *Aspergilus niger, Schizophyllum commune, Earliela scbrosa Funalia leonine, Lenzylus vespacia*, *Polyporus gramocephalus, Trameteslactinea, Trametes versicolor* and *Trichoderma viride* were tested with tannery effluent and some of them showed good bioremediation potential. Other fungi were also tested against pulp & paper effluents for their adaptive nature and their capability to decolorize and bioabsorption of heavy metals from the effluents.

Project 24: Development of air pollution biomonitoring station for Air Quality Assessment of Dehradun.

Status: Biomonitoring of air quality studies were performed for assessing the air quality by using plant biochemical indicators. Sensitivity index were developed for different species. Air quality index was also developed for shatabdi Van Vigyan Kendra, Dehradun. Already established correlation between sensitivity index value and Air Quality index for different species were used for air quality estimation of that area.

Project 25: Ecological Impact of urbanization on floral diversity in natural and man-made forests of Doon Valley

Status: Diversity of trees was observed in increasing trend from highly disturbed to partially disturbed forest. Disturbances invite invasion of herbaceous species. Decrease in richness of trees from partially disturbed forest to highly disturbed forest was observed. Temperature decrease from open to partially disturbed forest was observed, whereas it was vice-versa in case of Relative Humidity (%) during sunny day observation. Socio economic status of the village and towns located on forest fringe reveals dependency on forest

Project 26: Ecological Impact Assessment of invasion in Lantana, its removal and subsequent Restoration of Habitats in Rajaji National Park of Tropical Moist Forests

Status: Monitoring of vegetation was carried out in two years old *Lantana* removal sites under Sal (*Shorea robusta)* and mixed deciduous forest in Rajajji National Park. Soil samples from these sites were also collected to monitor the change in soil chemical attributes.

Project 27: Biology and control of bamboo, *Phloeobius crassicollis* damaging green standing bamboo. (FRI-374/FED-28)

Status: 1. Studies on the biology of *Phloeobius crassicollis* was taken up in the laboratory. The beetle emerges during the month of May and June and feeds on the outer surface of the bamboo culms preferably near the nodes. It deposits eggs at the nodes conceded in this scale. Larvae feed on the woody tissues of node and internode and deposit frass inside the hollow. Larval period is prolonged from May-June to April-May. Pupation takes place in a pupal cell near the node in a crowded manner. Pupal period lasts for 20 days. Life cycle is completed in one year.

The incidence of attack was 3.5 to 18% on *Bambusa bambos* at Dehradun and 7.18 to 9.21% at Sahansara, Sakumbhari Range, Saharanpur Forest Division.

Chemical control experiments were carried out in the field using systemic and contact insecticide by internodal injections. Contact insecticide perform better than systemic insecticides.

Project 28: Butterfly diversity in moist temperate forests of Garhwal: Evaluating species of conservation priority and indicator taxa of habitat disturbance in Ban oak forest ecosystem [FRI-348/FED-23 /2006-2009]

Status: Oak forest sites in Garhwal namely, Kedarnath Musk Deer Sanctuary (Chamoli& Rudraprayag district), Govind Wildlife Sanctuary (Uttarkashi district), Benog Sanctuary-Mussoorie-Chakarata (Dehradun District); KotiKimoi RF-DhanaultyRF- Nagtibba RF-GhoraghatiRF; BhuddaKedar RF -PangaranaRF (Tehri Garhwal district), were evaluated for butterfly diversity under different habitat conditions and altitudes. Data has been collected on the abundance, distribution, habitat preference, food plants and threatened status of over 225 species.

Project 29: Bio-ecology and control of oak stem borer, *Aphrodisium hardwickianum* (white) (Coleoptera: Cermbycidae)[FRI-348/FED-23]

Status: Bio-ecology of the borer was studied on standing dead trees in Dangan village in Govind Wildlife Sanctuary(Uttarkashi district) and Kanatal (Dhanaulty RF in Tehri Garhwal District) and also in the laboratory on Ban and *Moru oaks* along with data on base line parameters of stands. Natural enemies of this borer were also identified.

Project 30 : Up-gradation and computerisation of National Insect Forest Collection (NIFC). (FRI-233/FED-16)

Status: In the year 2008-09 (up to September 2008) digital imaging work was taken up and about 4000 species were digitally imaged. In all, about 50,000 pictures have been taken. Copyright symbol, scale, name of collection, division and institute was also incorporated in each picture. About 20,000 pictures have been edited.

Database for proper management of National Forest Insect Collection (NFIC) is in the process of development. 17,000 insect species, mainly of forestry importance, are represented in the collection. 44 insect species not represented in the NFIC were also incorporated in the collection.

Project 31: Studies on biodiversity of parasitic Chalcidoidea (Hymenoptera) of Uttarakhand. (FRI-375/FED-29)

Status: Survey and collection of parasitic Chalcidoidea (Hymenoptera) was done in the Tehri District. Various places where collection was made were: Rani Chauri, Badshahithaul, Chamba, near Tehri dam site, Devali (near Ghansayali) and Kadukhal. Collections were also done in the doon valley to study the temporal distribution of the chalcid families. Various places where collection were done were: Barkot, Lachhiwala, Karvapani, Kalsi, etc. Three different collection methods viz. sweeping, yellow pan trap and Malaise trap were used to collect the samples. From the preliminary observations, Family Eulophidae is the most abundant and species rich family in the area followed by Pteromalidae, Encyrtidae, Eucharitidae, Mymaridae, Eupelmidae, Aphilinidae and Trichogrammatidae.

A new record with the description of a new species of genus *Cynipencyrtus* (Chalcidoidea: Tanaostigmatidae) from India was also made. This new species was collected from Badshahithaul under the *Quercus leucotrichophora* trees.

Project 32: Taxonomic studies of parasitoids belonging to subfamily Microgastrinae (Hymenoptera: Braconidae) of Uttarakhand and Haryana. (FRI-371/FED-25)

Status: Survey and collection of parasitic Microgastrinae (Hymenoptera: Braconidae) was done in the Tehri District. Various places where collection was made were Rani Chauri, Badshahithaul, Chamba, near Tehri dam site, Devali (near Ghansayali) and Kadukhal. Collections were also done at Barkot, Lachhiwala, Karvapani, Kalsi, (Doon Valley) in the Uttarakhand. Chichroli Ambala, and Yammuna Nagar of Haryana.

First record with the description of a new species of genus *Cotesia koebelei* (Riley 1889) on *Hyposidra talaca* Walker from India was also made. This new species was collected from Barkot Range.

Collection, identification and Updating of *Cotesia glomeratus* (Linnaeus 1758), on *Pieris brassicae* Linn. *Cotesia taprobanae* (Cameron, 1887), on *Stauropus alternus* Walk.

Proapanteles (Proapanteles) *oblique* (Wilkinson, 1928) on *Diacrisia obliqua* Walk. *Dolochogenidea stantoni* (Ashmead. 1904) on Pyralidae larvae. Two species of *Apanteles*, two species of *Microplitis* are also collected.

Project 33. Studies on the development of biopesticides from *Eucalyptus* hybrid [FRI-344/Chem-16]

Status: Different extracts and pure compounds were screened for their antifungal and insecticidal activities. Three samples namely EO, MET and AS exhibited antifungal activity against *Ganoderma lucidum* at 0.50%, 1.0% and 2.0% concentration respectively. The above samples did not exhibit insecticidal activity against larvae of *Dichomeris eridentis.* Formulations of MET and EO and ursolic acid were prepared for their antifungal screening. A process was developed for the isolation of ursolic acid from the leaves and patent application filed.

Project 34: Studies on *Sapindus mukrossi* fruits for their utilization [FRI-362/Chem.-18]

Status: Extraction of the seed kernel was done with methanol. Fractionation of the methanol extract was done in acetone, benzene and methanol fractions. Column chromatography of the acetone extract was done. Chloroform extract of *Sapindus* seeds collected from FRI and Gyarahdevi were tested against 8 forest fungi namely, *Alternaria* sp., *Colletotrichum gloesporioides, Phoma* sp., *Phomopsis dalbergiae, Fusarium oxysporum, Ganoderma lucidum, Rhizoctonia solani and Trichoderma pilluliferum* at different concentrations i.e. 0.5, 1.0, 1.5 and 2.0 per cent. Chloroform extract (FRI) showed IC_{50} against all fungi except *F. oxysporum* (47 %) at the highest concentration of 2 per cent. *P. dalbergiae* registered highest inhibition of 88 per cent while *Alternaria* sp. showed lowest inhibition (57%). Chloroform extract of Gyarahdevi exhibited IC_{50} against all the test fungi barring *Alternaria* sp. and *F. oxysporum* (47 % each). Further, only *C. gloesporioides* showed less than 70 per cent inhibition while *P. dalbergiae* had highest inhibition of 91 per cent. Minimum Inhibitory Concentration (MIC) of Chloroform extract was also worked against *C. gloesporioides* (2.5%), *Phoma* sp. (3.0%), *P. dalbergiae* (3.0%), *G. lucidum* (1.5%), *R. solani* (4.0%) *and T. pilluliferum* (5.0%).
Chloroform extract of FRI was fungicidal against *C. gloesporioides, Phoma* sp., *P. dalbergiae and G. lucidum.* While, Methanol extract of FRI was fungicidal for *C. gloesporioides, Phoma* sp., *P. dalbergiae, G. lucidum* and *R. solani* and fungistatic for *T. pilluliferum*. Effect of Methanol extract of FRI on spore germination of forest fungi was quantified and it was 94 and 89 per cent inhibition for *C. gloesporioides* after 24 and 48 h, respectively (at very high concentration of 13%). Similarly, varied and high inhibition in the spore germination was recorded for *Phoma* sp. (2.5%; 87 and 83% after 24 and 48h, respectively), *P. dalbergiae* (3%; 89 and 86% after 24 and 48h, respectively), *G. lucidum* (6%; 89 and 86% after 24 and 48 h, respectively) *and T. pilluliferum* (6.5%; 88 and 82% after 24 and 48 h, respectively).

Project 35: Chemical marker of *Eucalyptus* hybrids for wood durability and foliar dense: Characterization, heritability and genetic correlation [FRI 363/Chem-19]

Status: Citronellal (CNAL), citronellol (CNOL) and ursolic acid (UA) were characterized in the foliage of *Eucalyptus citriodora* (EC) and were found to exhibit bioactivity against *Cylindrocladium quinqueseptatum*. GC-FID method for quantification of monoterpenes in eucalyptus foliage was developed. Foliage of different phases from EC, *E. torelliana* (ET) and their hybrid were collected monthly and their hexane extracts were prepared to study phenological variability of bioactive foliage monoterpenes. Extraction of the foliage with petroleum ether: acetone (4:1) for phenological variability of the UA was also initiated and continued. Quantification of CNAL and CNOL in EC foliage using GC-FID analysis of their hexane extracts was initiated and continued. Methanol extracts, EC3 and ET3, from heartwood of the EC and ET, respectively were found active against brown rot and white rot fungi. These extracts were further fractionated into ethyl acetate and n-butanol fractions. Gallic acid and protocatechuic acid were characterized in the EC3. Further work is in progress.

Project 36: Isolation and characterization of phytoecdysteroids from *Achyranthes aspera* and *A. bidentata* and their effect on the economic traits of Bombyx mori L. [FRI-364/Chem- 20]

Status: The leaves, stem, roots and seeds of *Achyranthes aspera* and *A. bidentata* were collected from the adjoining areas of Dehra Dun. The air dried and powdered parts were extracted with petroleum ether, acetone and methanol respectively and yield of the extracts was determined. Two pure compounds were isolated and characterized from the methanol extract of *A.aspera* seeds. Nine extracts and three pure compounds of *A.aspera* and six extracts of *A.bidentata* were tested on silk worm (*Bombyx mori*) for their uniform maturity. Six extracts and two pure compounds exhibited 80% or more maturity of silk worm in 18 hrs. In case of control 69% maturity was observed. The testing of extracts is in progress. The fatty oil content in the *A.bidentata* seeds was found to be 6.1%.

Project 37: Studies on the utilization of seed polysaccharide from *Strychnos potatorum* [FRI-365/Chem-21]

Status: Carboxymethylation of *Strychnos potatorum* seed powder was carried out using sodium hydroxide and chloroacetic acid. Reaction conditions viz. effect of reaction time, concentration of monochloracetic and sodium hydroxide and effect of solvent ratio were optimized. Rheological properties of the product with maximum DS (0.33) were studied. A pure compound was isolated from the methanol extract of the seeds.

Project 38: Comparison of Hydrological regime of a micro watershed having dense Oak forest with a degraded micro watershed (in Mussoorie)

Status: Data collection of the two micro watersheds is going on. Laboratory analysis of data samples of sediment yield and isotopic analysis has been completed. Analysis of data of the year 2008-09 has been completed.

Project 39: Quality assessment of timbers by using ultrasound and microwave techniques.FRI-377/FPD/ (T M)– 63

Status: Studied the effect of moisture content on ultrasonic velocity and microwaves attenuation at 9.89 GHz in timber. Ultrasonic velocity and strength properties (MOE and MOR) of *Cedrus deodara* and *Dalbergia sissoo* have been determined. Testing of *Tectona grandis* and defect detection in timber is under progress.

Project 40: Extent and evaluation of dieback of Shisham (*Dalbergia sissoo*) and identification of disease resistance sources

Status:

- Physiological parameters viz., photosynthesis, transpiration, internal CO_2 and leaf temperature in field and laboratory conditions collected.
- Biochemical estimation of chlorophyll, carotenoids, sugars, protein, starch, amino acids, phenols also collected

Project 41: Clonal screening of *Dalbergia sissoo* in relation to nitrogen utilization and biomass production (FRI-114/BOT-62)

Status:

- Nine clones of *Dalbergia sissoo* viz., 9093(1), 9058 (2); 9058(1); 9065 (2); 9064 (2); 9063 (1); 9015 (2), 9049 (1), 9065 (1) shoot was taken from the pot raised plants and prepared softwood cuttings for multiplication.
- After hormonal treatments cutting material was kept in mist Chamber for rooting.
- Some hardwood cuttings were also prepared and kept in Mist Chamber for rooting.
- All material kept for rooting shows sprouting. After that it will be transferred for hardening**.**

Project 42: Impact of major forest invasive plants on the biodiversity of Chakrata Forest Division (FRI-394/Silva-37)

Status: Selected three sites in different altitudinal zones i.e. tropical, sub-tropical and temperate in Chakrata for collection of field data. Field data were collected from the plots, which are affected by the Forest Invasive Species (FIS) as well as from un-affected plots by laying out of nested quadrats in similar ecological conditions. The forest areas included are Sal forest in

tropical zone, banj and chir forests in sub-tropical zone and deodar and kail in temperate zone. The species composition and regeneration status of desired species have been found out. The forest areas are affected by the Forest Invasive Species (FIS) like *Eupatorium odoratum, Lantana camara, Aegratum coinizoides, Artemisia vulgaris, Sarcococa saligna* etc.

Project 43: **Role of allelopathy on regeneration in silver fir (*Abies pindrow*) and spruce (*Picea smithiana*) forests – Effect of natural leachates on seed germination. [FRI-391/Silva-34]**

Status: Cones/seeds of Silver fir, Spruce, Deodar, Kail and under-storey plants have been collected from Chakrata and Mussoorie. Identification of under story species of Silver fir and Spruce forests has been completed. Leachates/bioassay has also been prepared using specified techniques in laboratories for carrying out effect of leachates on germination of coniferous species.

Project 44: Effect of *Populus deltoides* on shade loving medicinal plants crops [Project No. FRI-305/SF-8]

Status: Plants of *Asparagus recemosus* and Chitrak (*Plumbago zeylanica*) are being maintained under the shade of *Populus deltoids* in the Demo plot at Premnagar, Dehradun. Biomass of *Plumbago zelanica* is taken under poplar shade. Growth of poplar has been recorded. Plantation of *Aloe vera* is done under poplar shade and in open area in Demo plot Premnagar.

Project 45: Tree Crop interactions: Effect of *Melia* spp. on crops. [FRI-306/SF-9]

Status: Demonstration plots of Melia composita are established in farmer's field at Chotla Kalan and Handsera in district Mohali and at Hukran in district Hoshiarpur in Punjab State. Monitoring and maintenance with pruning operation is being done whenever required. Soil studies of the same plots are in progress. Estimation of crop yield has been initiated. Maintenance of seedlings of Melia composite has been done. Plants are distributed to the interested farmers every year. Work on canopy management has been done through pruning of *Melia composita* plants.