

CHAPTER-VIII
INSTITUTE OF RAIN AND MOIST DECIDUOUS FORESTS RESEARCH
JORHAT

Institute of Rain and Moist Deciduous Forests Research, Jorhat caters to various forestry needs of the seven states of north-east India besides Sikkim. The Institute conducts goal oriented research in the following thrust areas:

- Conservation of biodiversity.
- Eco-rehabilitation of degraded lands.
- Improvement of priority species for greater biomass yield by establishing seed production areas, seed orchards and vegetative multiplication garden.
- Seed testing technology and quality seed production, macro and micropropagation of canes, bamboo and selected trees for mass production of improved material.
- Socio-economic studies to develop models for containment of shifting cultivation.
- Extension linkages achieved by supporting demonstration of research results in the field.

PROJECTS COMPLETED DURING 1997-98

Project 1: Micropropagation of Cane (*Calamus tenuis*).

Objectives: Standardisation of protocol for tissue culture from embryo of *C. tenuis* for its mass propagation.

Results

Micropropagation of the Jati Bet (*Calamus tenuis*) through tissue culture from rescued embryos has been standardised through multiple shoot formation. From the results obtained, it is apparent that the auxin NAA and the cytokinin Kn play very important role in the development of multiple shoots in case of *Calamus tenuis* embryo. After the root formation by stimulation with very low dose of NAA, the separated individual plantlets may be transferred to hardening media and environment for acclimatization.

OLD PROJECTS CONTINUED DURING 1997-98

Project 2: Seed Production and Germination.

Objectives : To develop reliable seed germination procedures.

Achievements

In case of *Alstonia scholaris*, *Albizia lebbek* and *Albizia lucida*, external application of growth hormones increase the required hormone level of seed for growth. As a result, germination rate is increased. In case of *Albizia lucida*, *A. lebbek* and *Cassia fistula* acid scarification causes softening of the testa and increases water permeability which will ultimately improve germination percentage and vigor index. In *Bauhinia purpurea* and *Acacia auriculiformis* continuous hot water treatment at 50°C induces enzymatic activity which is

helpful for germination. Mechanical scarification helps in breaking the seed coat dormancy of *Acacia auriculiformis*.

Project 3: Planting Stock Improvement Programme.

Objectives: (a) Establishment of Seedling Seed Orchards of *Dipterocarpus macrocarpus*. (b) Establishment of Clonal Seed Orchards of *Gmelina arborea*. (c) To create seed production areas of important forest tree species of north-east India. (d) To establish vegetative multiplication garden of bamboo and mass vegetative propagation of superior genotypes by conventional and non-conventional methods for plantation forestry.

Achievements

So far 52 plus trees spread over 15 forests areas of four forest divisions under the state of Assam were selected. The score ranged from 88 to 93 with a mean of 90.3. Seeds from these trees are being collected and seedlings are being produced.

Different areas were surveyed for marking seed stands for individual selection across the state of Assam, Meghalaya and Mizoram. Further selection work was carried out in Lunding Reserve forest and three other locations in N. C. Hills. Altogether 53 CPTs were selected and marked, out of which only 36 were identified as plus trees after evaluation as per the prescribed standards. The scores ranged from 90-97 with a mean of 92.8.

Creation of seed production areas has been taken up for four tree species of the region namely (i) *Tectona grandis* (ii) *Pinus kesiya* (iii) *Dipterocarpus macrocarpus* and (iv) *Terminalia myriocarpa*. In case of teak, a total of 226.3 ha. area was surveyed. After stand comparison, 35 ha. has been marked for conversion treatment, spread over three states of Assam, Meghalaya and Mizoram. In 20 ha. area, trees for roqueing have been marked. With regards to pine, hollock and hollong 67ha., 110 ha. and 161 ha. was surveyed and 10, 5 and 15 ha. area respectively has been marked for conversion. Data on individual trees are being collected.

Six species of bamboo have been selected for establishment of vegetative multiplication garden. The species are *Bambusa tulda*, *B. balcooa*, *B. nutans*, *B. bambos*, *B. pallida* and *Dendrocalamus hamiltonii*. For selection of candidate plus clumps of above mentioned six species; surveys were made in different parts of Assam (62 Villages). Meghalaya (8 villages) and Arunachal Pradesh (1 village) from August, 1997 onwards. The main characters considered for selection of candidate clumps were height of the clumps, girth of clumps, length of internodes, number of young and old culms per clump, disease and pest incidence.

Project 4: Studies on the microfaunal components of litter ecosystem and their changes in relation to shifting cultivation.

Objectives : (a) Impact of shifting cultivation on the litter microfauna in terms of species diversity, density and distribution. (b) Entomofaunal diversity of the above ground vegetation and its changes in relation to shifting cultivation. (c) Trends in entomofaunal succession in forest and jhum area litter ecosystems.

Achievements

Before burning litter samples showed presence of Collembola, Coleoptera, Hymenoptera and Acari at very low population levels. After burning, although there was an increase in the ants population, the presence of other faunal groups was not very significant.

The same trend followed during the cropping season also. However, during the post-harvest phase, there tends to be a build up of populations particularly that of collembolans, coleopterans, hymenopterans and acari. In contrast the natural forest litter maintained a rich and diverse microfaunal populations. Assessment of the insect fauna in the above ground vegetation showed that the slashed area sustained little insect population. Incidence of insects started during the cropping season. Grasshoppers particularly acridids like *Aiolopus thalasinus*, *Oxia nitidula* and *Atractomorpha crenulata* and hemipteran bugs dominated in the crop plants like sesame, paddy, brinjal, etc. Species diversity and density reached a peak during the post-harvest period when grasshoppers and leaf hoppers touched a maximum value per unit area on the left over crop plants which are not harvested besides nearby weeds. Other insect groups include Coleoptera, Hemiptera and Lepidoptera. Significant number of spiders were also present in the vegetation. Another important observation was the incidence of wood boring insects and termites on the dried tree stumps.

Litter arthropods populations built up during cropping and post-harvest periods. Standing crops and the surrounding weeds harboured a significant insect populations, some of which may prove pests for the nearby forest stand or the crops maintained elsewhere. The termites and wood boring insects in wooden stumps also posed a threat for the standing trees and household constructional materials since villagers depend mostly on such sources for house making and fire wood.

Project 5: Bio-ecological studies on gall forming aphids infesting *Styrax* sp.

Objectives: Study to explore gall producing aphids in *Styrax* sp., their nature and extent of damage.

Achievements

After detailed taxonomic study, using technical keys of *Fauna of India Aphidoidea*, it was found that there are two separate species of aphids that cause banana and coral gall in *Styrax*. One of them is *Astegopteryx* sp. of the sub-family Cerataphidinae producing coral galls. The other one is probably a new aphid species of the sub-family Hormaphidinae. Like other Cerataphidinae aphids, in *Astegopteryx*, soldier morphs were also found having a pair of sharp horns. These horns are used to attack predatory caterpillars of *Conobathra aphidivora* (Lep., Pyralidae).

So far this is a new record of coral gall and banana gall of *Styrax* from India. It is evident that two different species of aphids produce two different gall on *Styrax*. Alate aphids from sexual generation start infesting fresh shoots of *Styrax* and initiating galls by producing fundatrix. From fundatrix, the parthenogenetic generation starts and the gall proliferates and attain huge sizes. During onset of winter many alate aphids are born and they migrate to bamboo. They pass the winter on bamboo leaves.

Project 6: Bioecological Studies on the insect pests of some important tree species of north-east India and their natural enemies.

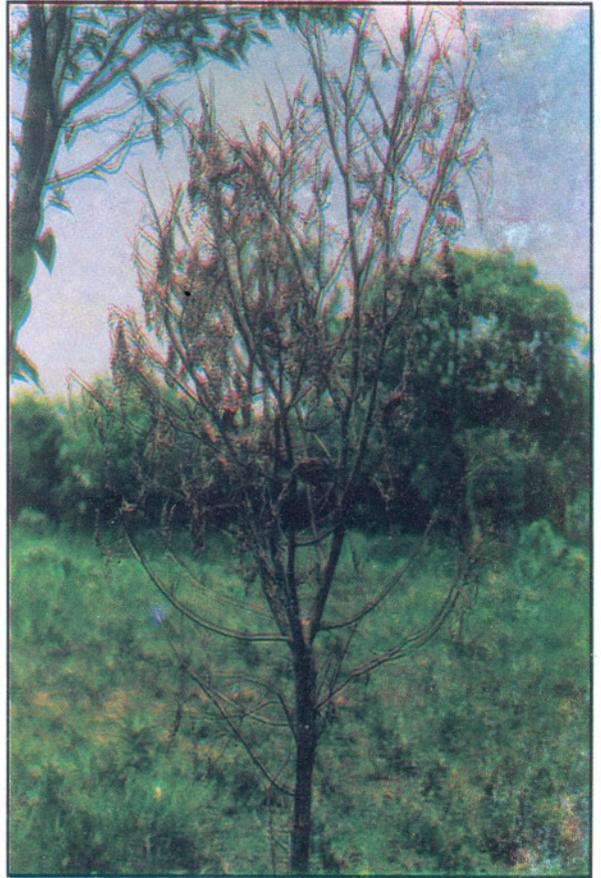
Objectives : To identify the major insect pests of *Aquilaria agallocha* (Agar wood) and *Gmelina arborea* (Gamari), their natural enemies and study their biologies.

Achievements

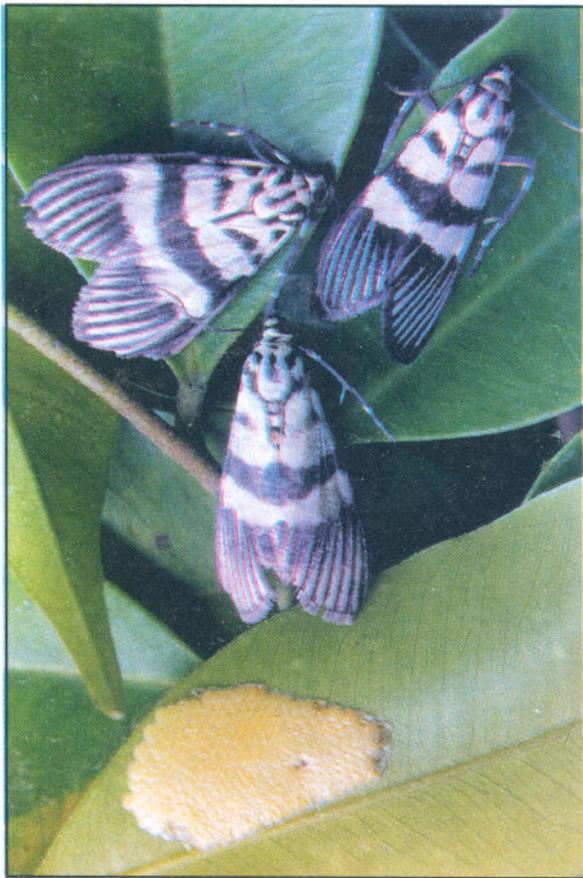
(a) **Agar wood pest:** Surveys conducted to find out the major pests of *Aquilaria agallocha* revealed that *Heortia vitessoides* is major pest of the tree species. This pest is active for about



Wood borers attacking dried tree stumps
at the shifting cultivation site



Young *Aquilaria agallocha* plant completely
defoliated by *Heortia vitessoides*, a major
pest of the species



Adults and egg mass of *Heortia vitessoides*,
a major pest of *Aquilaria agallocha*
(Indian ager wood plant)



Culm die back and rotting symptoms of
Bambusa balcooa blight

8 months from Feb./March to Sept./Oct. depending upon the weather conditions. Life history of the pest was studied in the laboratory. The life cycle is completed in about 28 days.

Heortia vitessoides is a gregarious defoliator, every year there are 5-6 overlapping generations which completely defoliate young trees two times. On isolated young tree when all the leaves are consumed, the pest start feeding on the bark of the branches and stem. Consequently the tree is rendered weak and continued infestation for two years kills the plant.

One Nuclear polyhedrosis virus (NPV) has been discovered to attack this pest. This NPV was cultured *in situ*. Laboratory studies with different concentration of virus have given promising results. Two predators, one Dipterous fly and another *Canthiconidia* sp. have been found to suck the haemolymph of the pest and have great potential as biocontrol agents.

(b) **Gamari pest:** Surveys were carried out around Jorhat for the natural enemies of *Calopepla leayana* a major defoliator of *Gmelina arborea* and following parasitoids were found to attack different life stages of the pest:

Life stage	Parasitoids
Ootheca (egg)	<i>Foerstrella</i> sp. <i>Tetracampe</i> sp.
Pupa	<i>Brachymeria excarinata</i>

Heortia vitessoides, which is a major pest of *Aquilaria agallocha* in the study areas, can be controlled effectively with its NPV. In case of *Gmelina arborea* and *Calopepla leayana* is a wide spread and the most notorious pest in the whole region. This pest can be controlled by augmentation of the parasitoid populations at regular intervals.

Project 7: Study of changes in microflora including mycorrhizae due to shifting cultivation.

Objectives: To assess the status of microflora including VAM fungi in different phases of shifting cultivation as well as in various sites of different fallow periods.

Achievements

In the study area of Silonijan, the length of fallow period was found to be directly correlated with the number of VAM spores/50g soil. As the length of fallow period increases from 5 years to 20 years, the number of VAM spores/50 gm soil also showed an increasing trend (119 to 725). However, the same trend was not observed in case of jhum fallow of other experimental sites.

In case of shifting cultivation sites at Simsangiri, Garo hills, effect of burning on VAM spores was prominent as the number of VAM spores/50g. soil drastically reduced from 230 (before burning) to 70 immediately after burning.

At Silonijan, in both the sites, the number of VAM spores/50g soil was found to be reduced in the soil samples collected immediately after burning and then gradually increased during cropping and after harvest phase.

Project 8: Study of the diseases of important forest tree species in nurseries, plantations and natural forest of North-Eastern Region of India.

Objectives: To identify the causes, symptoms, study epidemiology and work out suitable control measures for diseases of economically important tree species of North-Eastern region of India.

Achievements

Out of the thirty six Phytopathogenic fungi recorded so far in different forest nurseries, plantations and natural forests of north-east India, 19 are recorded for the first time in their respective hosts, nine comprise new fungal-host combinations from north-east India and the *Scaphidium* sp. recorded in *B. balcooa* is a new host record as well as new addition to fungal flora of India. Out of all these, bamboo blight was found to be a major problem posing a potential threat to *B. balcooa* plantation in Assam. Although the progress of the disease is slow, in case of severe infection, the entire clump is of use only as fuelwood. Bamboo blight, causing complete or partial death of growing or fully grown culm mainly of *B. balcooa*, is first report from India.

Project 9: Mycorrhizae screening.

Objectives: (a) Determination of the status of VAM association in economically important forest tree species of wet evergreen forests of Arunachal Pradesh and Assam. (b) *Ex situ* maintenance of pure VAM spores of identified species.

Achievements

Various nurseries and plantations in Assam, Meghalaya, Arunachal Pradesh and Mizoram were surveyed. The highest number of spores was recorded from SCCP social forestry nursery, Silchar, (Assam) whereas the highest percentage was found in the roots of *Melia azadirachta* from Turial miscellaneous nursery Aizwal, (Mizoram). No definite correlation could be established between spore count and mycorrhizal root infection. However, an understanding of the edaphic factors may be helpful in giving a clear picture of VAM associations.

Project 10: (UNDP Project) – Strengthening and developing ICFRE.

Objectives: (a) To identify and establish existing and additional seed production areas besides plus trees of species bamboo, sissoo, poplar and teak. (b) Socio-economic surveys to determine land utilisation pattern, distribution of households, family size, livestock profile, family income from different sources, and peoples involvement in village forestry activities.

Achievements

Identification of plus trees was carried out in collaboration with the state forest Departments of Assam, Mizoram and Meghalaya. Altogether 74066 trees have been identified and marked.

In Meghalaya, 8 ha of area has been identified for *Pinus kesiya*, *S. robusta*, *G. arborea*, *T. grandis* and *M. champaca* as seed orchard of MPT species. A temporary MPT species nursery is maintained at Burnihat, Assam to cater to the needs of that locality of Assam and Meghalaya. In addition to this one MPT nursery is under development at Devon, the IRMDFR campus at Sotai Ali. A total of 34 nurseries of Assam, Meghalaya and Arunachal Pradesh were inoculated successfully with VAM and Rhizobia.

Socio-economic studies were carried out among the rural poor villagers living in and around forests at the demonstration area in order to link people with regeneration and

protection of forest areas, which will generate employment and finally a share in the forest economics study of social forestry. Altogether 9 villages in Assam, Meghalaya and 10 in eastern Himalayas i.e. Arunachal Pradesh were selected for the study and completed.

Project 11: (IDRC Project) - Himalayan Eco-rehabilitation.

Objectives : (a) Assessment and quantification of damage due to shifting cultivation employing Geographic Information System. (b) Baseline socio-economic survey. (c) Development and testing of agroforestry interventions to contain shifting cultivation. (d) Recommendation of national or regional policy for rehabilitation of Himalayas.

Achievements

A part of Jayantia Hills, Meghalaya, covered by toposheet no. 83 C/7 and compared with satellite imageries interpreted at IDRC headquarter at Dehra Dun. It was found that the ground features including jhum cultivation were true. Interpretation of satellite imagery was found very useful in monitoring land use pattern of shifting cultivation area.

NEW PROJECTS TAKEN UP IN HAND DURING 1997-98

Project 12: Study of successional changes in plant communities under shifting cultivation.

Objectives: To identify the plant types and their distribution in shifting cultivation areas during different stages of shifting cultivation and its fallow lands.

Progress made

The dominance of *Mikania* sp. and *Saccharum arundinaceum* was found to be gradually increasing in all the studied fallows. Important endemic species *Gnetum nemon*, *Geodorum* sp., and some medicinally important species like *Costus speciosus*, *Globa* sp. and *Curcuma* sp. were observed as jhum effected species. The distribution pattern in all communities showed random contagious trend. In natural forest, it was observed that *Dillenia pentagyna* and *Hydnocarpus kurzii* got prevailed in the upper canopy while *Litsea laeta* in the middle storey. The regeneration of *Hydnocarpus kurzii* was found to be well promising.

Project 13: Study of the changes in morphological, physical and chemical properties under shifting cultivation.

Objectives : To evaluate the changes of nutrient status in soil in disturbed and undisturbed forest ecosystem.

Progress made

The results showed that the values of pH, exchangeable cations, N and C were considerably higher in the surface soil in comparison to deeper layer. The depletion of the values was also noticed in cropping and harvesting period. Maximum percentage of carbon and nitrogen was recorded in natural forest. Lowest percentage of organic carbon was recorded in monsoon period with gradually recover in post monsoon and winter season attaining maximum value in summer. Lowest nitrogen percentage was recorded in post monsoon and winter season. During monsoon, heavy losses of cations was recorded due to run-off and leaching of nutrients which continued up to post monsoon season. The pH value declined sharply in winter season and only slight difference in values was recorded in monsoon and post monsoon season. Maximum value of pH and exchangeable cations was recorded after burning. Depletion in nitrogen and carbon was also noticed after burning and continued through early successional stages.

Project 14: Ethno-medicinal plants of North Eastern Region of India with special reference to their conservation.

Objectives: Conservation of ethno-botanically important plants available in this region.

Progress made

Collection of information on 55 ethno-medicinal plants and their local use has been made. *Ex situ* conservation of 35 ethno-medicinal plants has been started in earthen pots and demonstrated to the people.

EXTENSION

Various training programmes were organised for foresters, farmers and villagers on different topics. Trainings on Seed technology, seed orchards and seed production areas were given to foresters of State Forest Departments of Assam, Mizoram besides NGOs. Altogether 1520 persons including foresters, NGOs and farmers of Meghalaya, Assam and Mizoram were imparted training and demonstration on identification of VAM and Rhizobia. During 1996-97, 1117 nos. of seedlings were distributed to adjoining villagers and schools for raising in homestead lands, bunds and wastelands. 3 ha of demonstration plantation was raised during 97-98 at Ampher, Burnihat and Assam in which 2 NGOs and 360 farmers received training. In 97-98 4329 trees of various species were distributed in Assam, and Meghalaya. In 1998-99, 3 ha of demonstration plantation was created at Arunachal Pradesh in which 2 NGOs and 141 villagers received training, 12 villagers created Kisan nurseries and supplied their seedlings for creation of the aforesaid plantations. 597 nos. of seedlings were distributed on the Farmers Day, celebrated at Sotai Ali during 19 Feb-22 Feb 98 and thereafter during 23-25 of March 98, another 2248 nos. of seedlings were distributed among the farmers in Arunachal Pradesh.

Distribution of improved seedlings, and printed pamphlets about raising important tree species was also done. Sit-in-drawing competition and essay competition for school children in and around Jorhat was organised. Institutional exhibitions depicting the activities and achievements of the Institute were also organised in which lot of people participated.

FINANCIAL STATEMENT

SL. NO.	HEAD/PROJECT	EXPENDITURE (in Rupees)
1.	REVENUE EXPENDITURE	
	(a) Research	50,88,294.00
	(b) Administrative support	25,27,558.00
2.	LOAN AND ADVANCE	2,00,000.00
3.	CAPITAL EXPENDITURE	2,48,770.00
4.	EXTERNALLY AIDED PROJECTS	
	(a) World Bank FREE Project	21,63,052.00
	(b) UNDP	4,79,309.00
	(c) IDRC	5,44,423.00
	TOTAL	1,12,51,406.00