Annual Report 1989-90

वार्षिक प्रतिवेदन १९८९—९०

Indian Lac Research Institute
(Indian Council of Agricultural Research)
Namkum, Ranchi 834 010, India

Annual Report
1989-90

INDIAN LAC RESEARCH INSTITUTE
(Indian Council of Agricultural Research)
NAMKUM, RANCHI 834 010, BIHAR, INDIA

Citation:
Annual Report 1989-90, Indian Lac Research Institute, Ranchi 834 010, India
(Ann. Rep. 1989-90, Indian Lac Res. Inst., Ranchi)

Published by S. Kumar, Director, Indian Lac Research Institute, Namkum, Ranchi 834 010, Bihar
Printed at Catholic Press, Ranchi 834 001, India

This report pertains to the period: January 1989 -- March 1990. The cooperation rendered by various staff members in the preparation of this manuscript is thankfully acknowledged.

Contents

INTRODUCTION

The Indian Lac Research Institute (ILRI) was started, on the basis of the recommendation of an enquiry committee constituted by the Government of India to enquire into the condition of the Indian lac trade and suggest measures for its all round improvement. In order to implement this suggestion, members engaged in the lac trade at that time constituted themselves into a private registered body under the name, Indian Lac Association for Research. This association set up the ILRI in 1925. In 1931, the Indian Lac Cess Committee took over this institute and continued till its abolition in 1966. Subsequently, ILRI came under the administration of the Indian Council of Agricultural Research (ICAR), from April, 1966.

The Institute

The ILRI is situated in the peaceful suburbs, nine kilometres east of Ranchi, on the Ranchi-Tatanagar high way. Spread over an area of 49 ha, the main campus houses the Entomology, Chemistry, Plant Sciences, and Extension laboratories; the buildings of the Administrative, Finance and Accounts, Library, and Mechanical Sections; and residential quarters. Close to the main campus is a small campus consisting of Technology Laboratories and Staff Quarters. Adjoining the campuses is a 36.5 ha Plantation for field experimentation. The Institute has a Regional Field Research Station at Dharamjaigarh, M.P. and runs an Operational Research Project in a group of villages in Ranchi District.

The Indian Lac Research Institute is the pioneering, organization devoted to researches on cultivation, processing and utlization of lac which is mostly cultivated by the tribals in Bihar and adjoining states comprising about 80,900 sq. km. Since its inception, the Institute has persistently endeavoured to develop and disseminate appropriate technologies to boost lac production. A good number of products and processes have already been developed; efforts are continuing to explore newer areas in view of everchanging requirements of the Industry. ILRI has attained international recognition for its contribution in entomological and chemical aspects of lac.

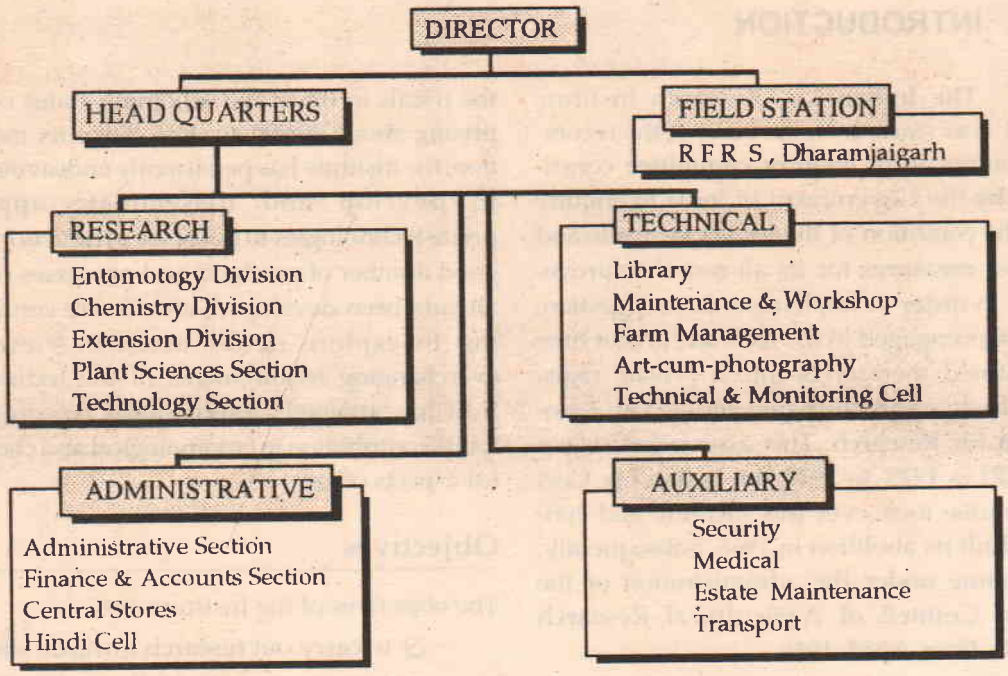
Objectives

The objectives of the Institute are:

- ❑ to carry out research towards effecting improvements in the cultivation, processing and standardisation of lac and study its constitution and modifications so as to intensify lac production and extend its utilisation;
- ❑ to extend the results of research through publicity, maintaining liaison with and providing technical service to the growers and indigenous industries towards increased utilisation of lac and improving the quality of their products; and
- ❑ to impart training in improved methods of lac cultivation and industrial uses of lac.

Organisational Set-up

The Institute is headed by a Director. The scientific manpower is deployed under three divisions: Chemistry, Entomology and Extension; and two Sections: Plant Sciences and Technology. The Administrative wing



comprises of Administrative Section, Finance & Accounts Section and Central Stores. The auxiliary units are: Security, Medical and Estate Maintenance Services. The technical support is provided by the following sections: Library, Farm Unit, Maintenance & Workshop and Technical & Monitoring Cell.

Staff and Budget

The Institute has a sanctioned strength of 61 scientific, 86 technical, 49 administrative, 14 auxiliary and 136 supporting-grade posts.

During 1989-90, the non-plan expenditure was Rs 110.2 lakhs, against a budget estimate of Rs 105.95 lakhs; the plan expenditure was Rs 26.25 lakhs against a budget estimate of Rs 53.0 lakhs.

Research Highlights

Control of Lac Predators with Insect Growth Regulator

The insect growth regulator, diflubenzuron has been found effective in suppressing the lepidopterous lac predators, *Eublemma amabilis* and *Holcocera pulverea*, without any adverse effect on the lac insect. Thus, it is possible to use this chemical in lac pest management.

Technique for raising bhalia *seedlings*

Growth attributes of *bhalia* seedlings raised in nursery beds were better than those raised in polythene bags. Sowing of seeds between 15th April and 7th may was found to be most suitable for raising the seedlings. Out of six weedicides tried, pendimethaline (1.5 kg/ha) and oxadiazon (0.5 kg/ha) were found more effective in reducing the weed population in *bhalia* nurseries than others.

Newer lac hosts

Flemingia strobilifera and *F. stricta* were found to be promising bushy hosts for culturing *kusmi* lac insects.

Synthesis of bioactive compounds from aleuritic acid

The bis-heterocyclic compounds oxadiazole, thiadiazole and triazole were synthesised from thapsic acid (hexadecene-1, 16-dioic acid), prepared from aleuritic acid.

A new shellac-based insulating varnish

A high thermal resistant (200°C) insulating varnish was prepared, based on shellac, double-boiled linseed oil and epoxy resin. The varnish possessed excellent drying properties and showed good compatibility with the thinner. The baked films possessed dielectric strength of 80, 44 and 48 kV/mm at 27°, 200°C and after immersion in water for 48 h respectively.

Extension Highlights

Besides the regular extension activities, a team of scientists was deputed to visit various lac growing villages of Madhya Pradesh, Bihar and West Bengal to provide on-the-spot advice to the cultivators and industrialists.

The technical guidance provided to the Forest Department, Govt. of Bihar for large-scale cultivation of lac at Kundri helped them to earn a profit of about Rs 27,700.

Honours and Awards

Shri A. Bhattacharya, Scientist, Entomlogy Division was awarded Ph.D. degree in Zoology (Faculty of Science) by Ranchi University. The topic of the thesis was " Studies on the effect of synthetic chitin inhibitor on some entomophagous insects associated with Indian lac insect *Kerria lacca* (Kerr)"

DIVISION OF ENTOMOLGY

Researches Completed

1.4.9 Studies on application of insect growth regulators for the control of major lac predators

A. Bhattacharya

Effect of application of diflubenzuron on first instar lac larvae

Larvae of *rangeeni* and *kusmi* strains of the Indian lac insect, reared on potted *bhalia* (*Moghania macrophylla*) plants, were used for the experiment. Thirty-day-old lac larvae (first instar) were sprayed with emulsions of diflubenzuron at various concentrations (0.0125 to 0.2 per cent) for observing its effect on the survival, moulting, male emergence, sex ratio etc. The control insects were sprayed with water. The experiment consisted of six treatments with four replications. Post-treatment observations were taken till the time of male insect emergence.

The results showed that there was no adverse effect of diflubenzuron on survival of lac larvae, sex ratio, moulting and time of male emergence.

Effect of diflubenzuron on the mature female lac insect

Healthy gravid female lac insects were collected from the *katki* generation and immersed in different concentrations (0.0125 to 0.2 per cent) of diflubenzuron emulsions for 30, 60 and 120 seconds. The control insects were immersed for the same period in water. The individual cells, after treatment, were air-dried and kept in glass vials plugged with cotton for recording the number of crawlers emerging from the female cells. Diflubenzuron treatment had no adverse effect on the emergence of the lac crawlers.

Effect of diflubenzuron on the eggs of Eublemma amabilis

Eggs laid by the adult moths of *E. amabilis*, on paper strips, in the laboratory were separated into two sets under various age groups viz., 0-24, 24-48, 48-72 and 72-96 h. One set of eggs along with the paper strips were immersed in the different concentrations (0.0125 to 0.2 per cent) of diflubenzuron emulsions, and the other set, in water (control) for 30 seconds each. The treated eggs were then air-dried and kept in petri dishes for hatching The experiment consisted of six treatments with four replications. The eggs hatched 3 to 7 days after treatment, depending on the age. The results have been presented in Table 1 which reveals that diflubenzuron treatment had a strong ovicidal activity.

Effect of diflubenzuron on the early stage larvae of E. amabilis

Lac insect colonies (*katki* generation) reared on potted *M. macrophylla* plants were sprayed with different concentrations (0.0125, 0.05 and 0.2 per cent) of diflubenzuron emulsions by means of a hand atomizer, and then paper strips containing *E. amabilis* eggs (which were about to hatch within 12 to 24 h) were attached to the cultures (n = 120). The control insects were sprayed with water. The paper strips were removed after two days and the number of hatched and unhatched eggs were counted. After five weeks, the twigs were cut

Table 1 Effect of diflubenzuron on eggs, of various age groups, of *Eublemma amabilis*

Concentration of diflubenzuron (per cent)	Average percent inhibition of egg hatching ⊗			
	0-24 h◊	24-48 h	48-72 h	72-96 h
0.0125	86.77 (98.75)	90.00 (100.00)	90.00 (100.00)	90.00 (100.00)
0.025	86.77 (98.75)	86.77 (98.68)	90.00 (100.00)	90.00 (100.00)
0.05	90.00 (100.00)	90.00 (100.0)	90.00 (100.00)	90.00 (100.00)
0.1	86.57 (98.61)	90.00 (100.00)	90.00 (100.00)	90.00 (100.00)
0.2	90.00 (100.00)	90.00 (100.00)	90.00 (100.00)	90.00 (100.00)
Control	0.69 (0.01)	10.29 (5.88)	10.35 (6.51)	16.25 (14.02)
S.Em±	3.21	3.58	3.67	5.23
CD at 1%	9.48	10.55	10.83	15.41

◊ Age of egg.
⊗ The values are arc sin $\sqrt{\text{percentage}}$; original values are within parentheses.

and the colony scraped for recording the number of surviving predatory larvae. The experiment consisted of four treatments, replicated five times.

The results showed that the hatching of the released eggs were normal, but complete mortality of the predatory larvae occurred in the diflubenzuron-treated lac colonies. Even a 0.0125 per cent concentration of diflubenzuron was highly effective in bringing about a total mortality of the early instar predatory larvae.

Effect of diflubenzuron-treated food on the advanced-stage E. amabilis *larvae*

Field-collected healthy *E. amabilis* larvae, after conditioning in the laboratory, were used for the experiment. The experimental larvae were offered scraped lac as food which was thoroughly mixed with diflubenzuron emulsions (0.0125 to 0.2 per cent). The food was mixed with distilled water, in control. The experiment consisted of six treatments with four replications.

Observations, taken five weeks after, revealed that due to diflubenzuron treatment, mortality and various forms of deformities/malformations/abnormalities occurred in the larvae, pupae and adults (Table 2). The oral LC_{50} and LC_{90} values have been calculated to be 0.016 and 1.345 per cent respectively.

Microplot field trials of diflubenzuron for the control of predatory larvae

Two field experiments were carried out, using randomized block design, for evaluating the effectiveness of diflubenzuron spray in controlling the predator population. *Katki* and *aghani* crops were raised on *M. macrophylla* bushes and *phunki* removed, three weeks after inoculation. The lac colonies were sprayed with 0.0125, 0.05 and 0.2 per cent diflubenzuron emulsions immediately after *phunki* removal. The control bushes were

Table 2 Effect of diflubenzuron-treated food on the larvae of *Eublemma amabilis*

Concentration of diflubenzuron(per cent)	Average per cent mortality and malformation in larvae@ Mortality	Malformation
0.0125	48.93 (56.66)	22.41 (20.01)*
0.025	47.70 (53.33)	19.49 (16.67)*
0.05	70.77 (83.33)**	41.07 (43.33)**
0.01	66.14 (83.33)**	31.92 (30.00)**
0.2	81.14 (93.33)**	53.07 (63.33)**
Control	37.14 (36.66)	0.81 (0.02)
S.Em±	9.72	7.14
C.D. at 5%	21.65	16.79
C.D. at 1%	30.80	23.88

@ The values are arc sin $\sqrt{\text{percentage}}$; original values are within parentheses.
* Significant
** Highly significant.

sprayed with water. Samples were drawn at three-week intervals for assessing the predator population. The experiment consisted of four treatments and six replications.

Results indicate that diflubenzuron is highly effective in suppressing the population of both *E. amabilis* and *Holcocera pulverea* (lac predators), as significant reduction in pest population in both the crops were achieved. The data also indicate a dose-related reduction in the predator population (*Ann. Rep. 1987*).

6.1.2 Survey of genetic variation in lac insects

N. S. Chauhan, R. Ramani and K. Krishan Sharma

To obtain some basic information for breeding, studies were made on the economic characteristics of crossbred lac insects; the intra and interpopulation variation in lac insects; for the settlement behaviour and the melting point (mp) of lac.

Study of crosses

Reciprocal crosses, made between the insects of a stock obtained from Meghalaya and those of Bihar, Orissa and Punjab showed that the Meghalaya lac insect is reproductively isolated from the others.

A cross between Orissa *kusmi* (yellow) female and Kundri *rangeeni* (crimson) male was made in August, 1987. The F_1 progeny took 172-183 days to complete its life cycle, which was similar to that of the maternal parent. The resin productivity was higher than that of maternal parent, whereas, the fecundity appeared to be lower (Table 3).

The time taken by the F_2 to complete its life cycle showed a bimodal distribution with a major peak at about the *kusmi* and a minor one at the *rangeeni* time.

Table 3 Comparison of various economic characteristics of *kusmi*, *rangeeni* and F_1 of a cross between Orissa *kusmi* (yellow) female and Kundri *rangeeni* (crimson) male (N = 30)

Stock	Season	Economic characteristic	Mean±SD	Range
Orissa *kusmi*	*Jethwi*	Life period (days)	182	171-190
		Fecundity (no.)	371.37±127.62	23-551
		Resin productivity (mg)	8.11±1.85	4.4-10.7
Kundri *rangeeni* crimson	*Baisakhi*	Life period (days)	229	224-243
		Fecundity (no.)	449.7±133.8	290-771
		Resin productivity (mg)	12.61±2.99	6.3-19.6
F_1	(Dec-June)	Life period (days)	176	172-183
		Fecundity (no.)	297.57±57.93	195-394
		Resin productivity (mg)	9.28 ±1.88	4.2-12.8

Study of melting point of lac

The variation in the mp of lac produced by individual females of different lac insect populations was studied, as described earlier (*Ann. Rep. 1987*). The Kundri *rangeeni*, Ranchi *kusmi*, Orissa *kusmi* (yellow) and Meghalaya stocks were studied and these did not differ much for the melting point (*Ann. Rep. 1987*). The Kundri *rangeeni* lac insects showed a moderate intrapopulation variance; the summer season generation showed a slightly higher mp (3°C) than the rainy season generation. In another experiment, the variation in the mp was studied in maternal half-sib families of a *rangeeni* stock during a summer and a rainy season generations. The inter-family difference was found significant during the summer, but not so in the rainy season generation.

Study of settlement behaviour

The density of settlement of first instar larvae of *rangeeni*, *kusmi* and Meghalaya lac insects was studied under sub-optimal and excess brood conditions using *bhalia* (*M. macrophylla*) as host. The methodology used has been described earlier (*Ann. Rep. 1986, 1987*).

Under sub-optimal brood conditions, the density of settlement of larvae of *rangeeni* insect was markedly lower than those of *kusmi* and Meghalaya lac insects (Ann. Rep. 1987, 1988). The difference between *kusmi* and Meghalaya insects was not distinct. The *rangeeni* insect did not show any significant effect of the season, but, there was a significant variance component among the families (Table 4). The density of settlement of F_1 of Kundri *rangeeni* female x local *kusmi* male was found significantly higher than that of Kundri *rangeeni* insect.

Under excess brood conditions, the *rangeeni* insect showed much variation with the season, but it was not significant in *kusmi*. The *kusmi* insect showed a higher density of settlement, in general (*Ann. Rep. 1987, 1988*). Comparison of mean density of settlement,

Table 4 Analysis of variance of the density of larval settlement, on *bhalia*, of *rangeeni* insects during *katki* 1989 and *baisakhi* 1989-90, under sub-optimal brood conditions

Source	df	SS	MS	F
Season	1	18.03	18.03	3.84 ns
Family	39	182.88	4.69	1.89 ($p<0.01$)
Within family	560	1387.07	2.48	

between sub-optimal and excess brood conditions, of the *rangeeni*, *kusmi* and Meghalaya insect showed 'crowding effect' in all cases; but, it was highly marked in the case of *rangeeni* insects (Ann. Rep. 1987, 1988).

The above study thus reveals a genetic difference between the lac insect stocks for the settlement behaviour.

Researches in Progress

1.1 Improvements in lac cultivation techniques

1.1.9 To evolve suitable management practices for brood and sticklac production in the light of recent findings

Y.D. Mishra, S.G. Chaudhary and M.L. Bhagat

This project aims at (i) improving the production of quality brood lac and maximising the yield of sticklac from the conventional lac hosts and (ii) developing a method for estimation of brood lac requirement and expected yield.

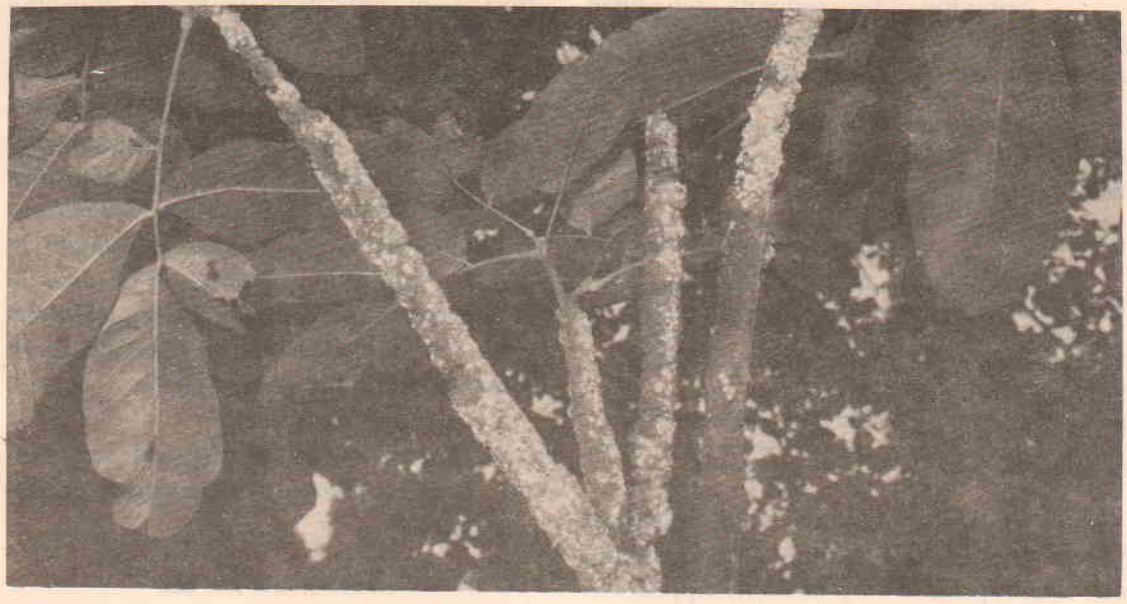
Techniques for kusum

The study was continued as per the technical programme outlined in *Ann. Rep. 1987*. Various lac cultivation operations were performed as indicated under :

Treatment	*Coupe*	Time	Operation
KA, KB, KC, KD and KE	IV	Feb., 1989	Pruning of host trees
-do-	I	-do-	Inoculation; spraying of insecticide
-do-	II	July, 1989	Inoculation; spraying of insecticide
-do-	I	-do-	Harvesting
-do-	III	Feb., 1990	Inoculation; spraying of insecticide
-do-	II	-do-	Harvesting
KF, KG	I	Feb., 1989	Pruning
-do-	II	-do-	Inoculation
-do-	II	July, 1989	Partial harvesting
-do-	I	Feb., 1990	Inoculation
-do-	II	-do-	Harvesting
KH	I	Feb., 1989	Partial harvesting
-do-	I	July, 1989	Harvesting
-do-	II	-do-	Inoculation
-do-	II	Feb., 1990	Partial harvesting

Inoculation was followed by *phunki* removal, spraying of insecticides, as per schedule, and collection of samples at (i) *phunki* removal (ii) sexual maturity and (iii) crop maturity, for assessing initial mortality, sex ratio, pest infestation and final survival of lac insect.

Lac yield data obtained during the period under report showed that four-coupe system involving the use of 20 g brood lac per metre shoot lengh (Treatment KE) was best in terms of quality and quantity of brood lac produced; whereas in terms of sticklac yield, two-coupe system involving inoculation of 12-month-old shoots in June-July with 10 g brood



lac/metre shoot length and completely harvesting after two crop seasons (Treatment KH), was best. Both the treatments incorporate pest control Schedule II described in *Ann. Rep. 1987*.

Under another experiment, correlation between the total shoot length of a tree and girth, height, canopy spread and number of pruned points per tree was studied using ten *kusum* trees. A positive correlation was found with number of pruned points and the canopy spread.

Techinques for palas

The experiments were continued as per the technical programme described in *Ann. Rep. 1987*. Various lac cultivation operations were performed as indicated under:

Treatment	Coupe	Period	Operation
PHA, PHB & PHC	I	April, 1989	Pruning
-do-	II	Oct.-Nov.,1989	Complete harvesting
-do-	I	Oct.-Nov., 1989	Inoculation (*baisakhi*-cum-*katki* 1989-90)

Lac cultivation operation on *palas*

Spraying of lac crop with endosulfan and BHC and raising of trap crops were done as described in *Ann. Rep. 1987*.

Yield data obtained from the *baisakhi*-cum-*katki* 1988-89 crop have been summarised below:

Parameter	Per cent increase over control	
	Treatment PHA*	Treatment PHB
Yield of brood lac	25.2	45.5
Yield of sticklac	33.9	56.9
Reduction in predator population	42.7	58.0

*see Ann, Rep. 1987.

Thus, the treatment PHB, which involves one additional spray of endosulfan, one month prior to crop maturity, appears to be superior to PHA.

In another experiment, correlation of the total inoculable area with height, girth, canopy, total number and length of shoots of *palas* host was studied, after pruning. Observations were made in Oct-Nov. on 108 *palas* trees pruned in April. A positive correlation was found with the canopy spread, confirming the previous year's findings.

To estimate the brood lac requirement per tree, *baisakhi*-cum-*katki* 1988-89 crop was raised using brood rates ranging from 5 to 30g per meter shoot length as described in Ann. Rep. 1989. It was found that the yield increases upto 15 g/metre and starts declining thereafter.

1.2 Physiology of lac insect and associated insects

1.2.5 Analysis of physio-physiological factors causing lac insect preference for host plants

A. H. Naqvi

Experiments were continued, on the effect of soil application of nitrogen, phosphorous and potassium to *bhalia* plants, on some biological attributes of lac insects cultured on them. The methodology employed has been described in *Ann. Rep. 1988*. Observations were made on *aghani* 1988-89, *baisakhi* 1988-89, *jethwi* 1989, *katki* 1989, and *aghani* 1989-90 lac crops. The data collected have been presented in Table 5. Application of nitrogen resulted in better lac yields, in general. The *baisakhi* 1989-90 and the *jethwi* 1990 crops have also been raised and the study is in progress.

1.2.9 Determination of physical and biochemical bases of insect host preference

A.H. Naqvi and A.K. Sen

The experiments were repeated as per the technical programme described in the *Ann. Rep. 1987*, using *rangeeni* and *kusmi* lac insects during the following crop seasons: *katki* 1989, *baisakhi* 1989-90, *jethwi* 1989, *aghani* 1989-90 and *jethwi* 1990. No relationship could be found between the physical characteristics of the plants and the lac insect attributes studied.

1.2.10 Studies on the factors influencing growth and development in the sexually reproducing female insect

A.K. Sen, A.H. Naqvi and P. Chandrika

Work was continued, as per the technical programme described earlier (*Ann. Rep. 1988*), with lac insects of *katki* 1989 generation.

The reproductive organs of virgin and mated female lac insects were dissected out and examined under a microscope. The ovules of the virgin insects did not show any sign of embryonic development till crop maturity. Thus, there is no evidence of parthenogenetic

Table 5 Effect of soil application of N, P and K to *bhalia* bushes, on lac insect attributes

Crop season		N	N+P	N+K	N+P+K	K	P	P+K	Control
					Sticklac yield/bush (g)				
Aghani	1988-89	32.0	20.2	13.3	30.0	13.1	30.0	10.4	16.3
Jethwi	1989	43.7	26.0	28.0	23.0	24.0	21.2	20.0	31.8
Aghani	1989-90	86.0	90.0	70.0	15.6	61.0	_	86.0	54.6
Baisakhi	1988-89	50.0	26.2	35.3	41.0	26.2	11.1	14.3	21.2
Katki	1989	147.5	103.5	28.1	153.7	95.6	45.6	52.5	62.5
					Total larval settlement/2.5 cm shoot length				
Aghani	1988-89	303	321	403	342	340	582	380	375
Jethwi	1989	410	475	552	441	313	283	190	243
Aghani	1989-90	309	274	403	422	206	280	325	230
Baisakhi	1988-89	651	530	460	566	273	413	368	360
Katki	1989	146	386	223	240	313	270	133	236
					Mortality after settlement (%)				
Aghani	1988-89	48.8	53.8	34.4	60.0	52.5	41.0	26.3	45.3
Jethwi	1989	28.1	21.0	34.2	32.8	29.1	26.9	26.8	29.7
Aghani	1989-90	35.2	32.1	27.0	23.6	33.9	34.7	36.0	18.6
Baisakhi	1988-89	41.1	40.0	32.1	36.9	34.0	33.8	27.7	40.0
Katki	1989	32.6	28.4	44.8	27.9	23.0	26.2	27.8	28.3
					Proportion of males (%)				
Aghani	1988-89	12.1	18.1	28.2	16.6	13.2	20.0	33.7	16.1
Jethwi	1989	22.4	33.7	25.9	20.4	24.3	25.7	23.6	15.6
Aghani	1989-89	19.5	19.3	24.8	25.5	25.7	23.8	23.0	27.3
Baisakhi	1988-89	18.8	21.6	26.3	19.9	19.2	27.3	19.8	19.5
Katki	1989	29.3	26.6	21.5	16.6	27.1	20.7	17.2	30.9

reproduction in this insect. Observations on spermatheca of virgin and mated females were in conformity with those earlier (*Ann. Rep. 1988*). The growth rate of virgin and mated females after sexual maturity, was 19.6 and 27.3 µ per month per cell respectively.

1.3 Ecology of lac insect and associated insects

1.3.11 Biology, seasonal incidence, extent of damage and control of important lac parasites

M. L. Bhagat and Rani P. Antony

Twigs bearing *aghani* 1988-89 lac crop were caged to record the relative abundance of parasites emerging therefrom. The results showed that *Tetrastichus purpureus* and *Tachardiaephagus tachardiae* were more abundant compared to other inimical parasites.

1.3.12 Analysis of abiotic and biotic factors causing mortality of lac insect

Y. D Mishra, P. Chandrika, Rani P. Antony and A. Bhattacharya

This project was taken up last year to study the mortality of lac insects at different levels of crowding and to ascertain optimum density of settlement on the host for maximum productivity. The technical programme has been outlined in Ann. Rep. 1988. During

the period under report, trees of coupe II, III and IV, comprising 27 *kusum* trees each, were pruned in February 1989, July 1989 and February 1990 respectively. Inoculation of 27 *kusum* trees of coupe I was done in February 1990 (18 months after pruning) with three brood rates, viz; 10 g, 20 g and 30 g per metre shoot length. After *phunki* removal, samples were collected every fortnight and examined for density of larval settlement, proportion of lac insect mortality and population of predators and parasites.

1.4 Control of enemies of lac insect

1.4.3 Effect of insecticides on the lac insect, *Kerria lacca* (Kerr) and the associated fauna

S. G. Choudhary and A. Bhattacharya

Studies on the effect of trichlorofon (Dipterex), thiocyclam (Evisect) and endosulfan (Thiodan) on lac insects and the two major lepidopterous lac predators were continued. The two sets of experiments, described earlier (*Ann. Rep. 1987*), were repeated. Endosulfan and thiocyclam had no adverse effect on the lac insect, at any stage; trichlorofon, however, was slightly detrimental to even 30-35-day-old lac insects. The results obtained confirmed the earlier findings.

Figure 1 depicts the effect of the three insecticides on predator suppression and lac yield during *aghani* 1989-90. Higher concentration of the insecticide always resulted in better predator suppression with concomitant increase in lac yield. Endosulfan appears to be the best, resulting in 53.2 per cent increase in lac yield with 85.7 and 69.2 per cent suppression of *E. amabilis* and *H. pulverea* respectively, at 0.05 per cent concentration.

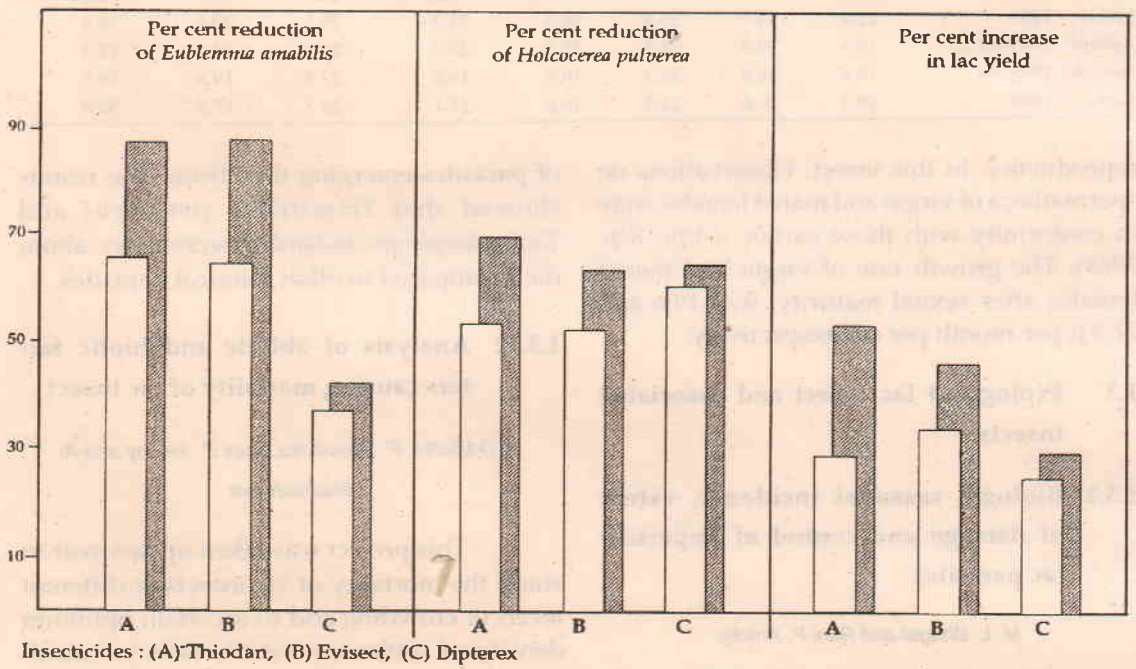


Fig. 1 Effect of different insecticides on the predator populations and lac yield

1.5 Genetics and breeding of lac insect

1.5.8 Studies on germplasm collection, conservation and characterisation of indigenous/exotic lac insect

S.K Jaipuriar and S.K Saha

Evaluation of Orissa *kusmi* yellow stock has shown that it has high fecundity and resin productivity. The life period of *aghani* 1989-90 generation was shorter (160 days) than that of *jethwi* 1989-90 (208 days) confirming the earlier observations.

The physico-chemical characteristics of the resin viz., flow, life, colour, wax content, rate of filtration, acid value and melting point of seven stocks (4 *rangeeni* and 3 *kusmi*) were determined. The melting point of the Orissa *kusmi* yellow stock was marginally higher (*jethwi* 1989: 81°C, *aghani* 1989-90: 80 °C) compared to other stocks.

1.5.11 Studies on chromosomal behaviour of lac insect strains

S.K. Jaipuriar

Study of the germinal tissue of lac insects of stocks originating from Orissa (crimson and yellow) and Ludhiana has confirmed the earlier findings of the occurrence of heteropycnotic residues only in males, not in females.

Researches Contemplated

1. Evolution of cultivation schedule for growing *kusmi* and *rangeeni* crops *on akashmani*.
2. To study the ecomomics of improved method of lac cultivation on *kusum* over villagers' method.
3. Field trials of chitin inhibitors in combination with other pesticides for the control of lac predators.
4. Fortification of pest management for the control of enemies of lac insect.
5. Breeding superior lac insects for the colour, thermal resistance and productivity of the resin.

SECTION OF PLANT SCIENCES

Researches Completed

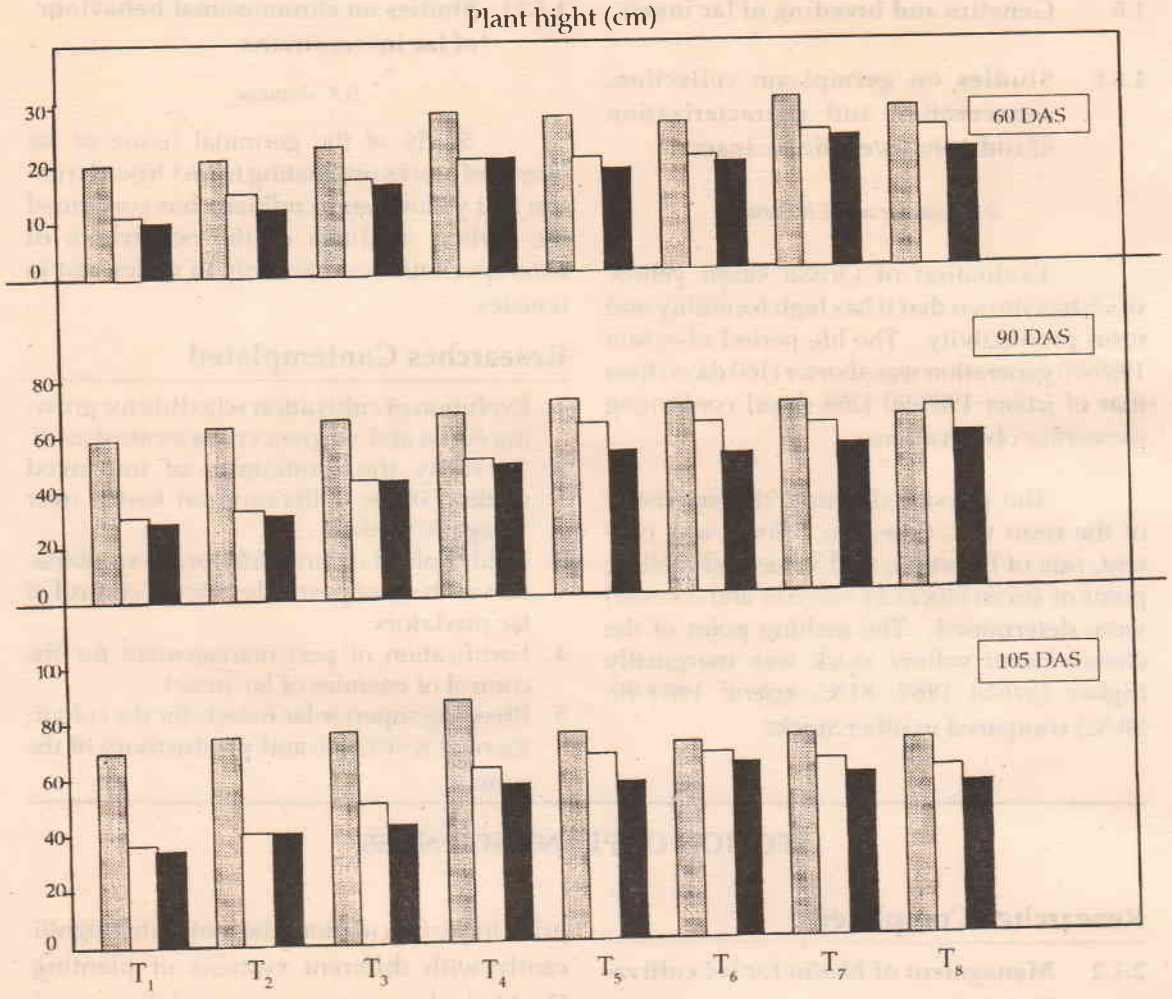
2.1.2 Managment of *bhalia* for lac cultivation

B.P. Singh and B.K. Purkayastha

The project was initiated with a view to rehabilitate intensive lac cultivation on *bhalia* (*M. macrophylla*), a quick growing shrub, on plantation basis.

Effect of planting system and fertilisers on plant growth and lac yield

The exeperiment was conducted using a split-plot design with 16 treatments and 4 replications. It was found that the plant height, number of tillers and total shoot length prior to lac inoculation did not differ significantly with different systems of planting. Double-hedge system, accomodating maximum ntumber of plants, yielded 47.1, 44.9 and 20.7 per cent more sticklac as compared to square, quincunx and single-hedge systems respectively. Appliction of N+P at the time of planting resulted in marked improvement on the plant growth attributes; the effect was, however, not significant at a later stage. The application of 20 g urea+40 g SSP per bush resulted in 36.5 and 33.6 per cent more sticklac yield than with the application of N and P alone, respectively. The double-hedge system also yielded 2 to 2.5 q/ha fuel material per



Nursery bed Polythene bag 25 x 15 cm Polythene bag 25 x 10 cm

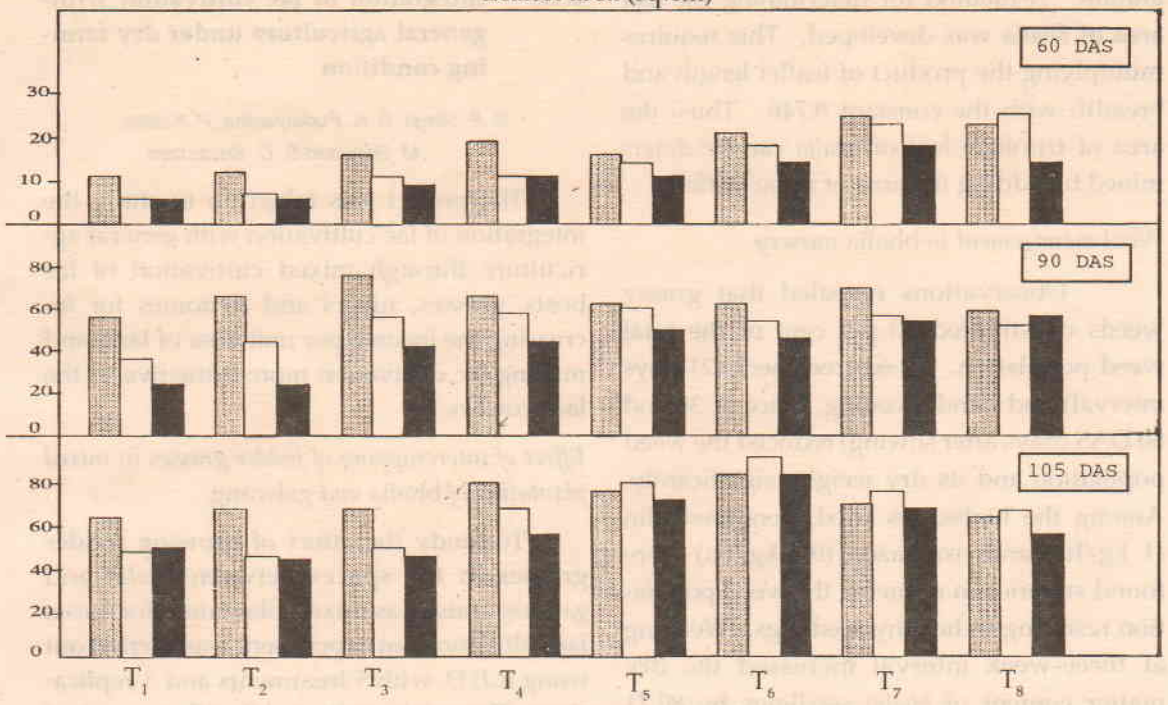
DAS: Days after sowing

Times of seed sowing

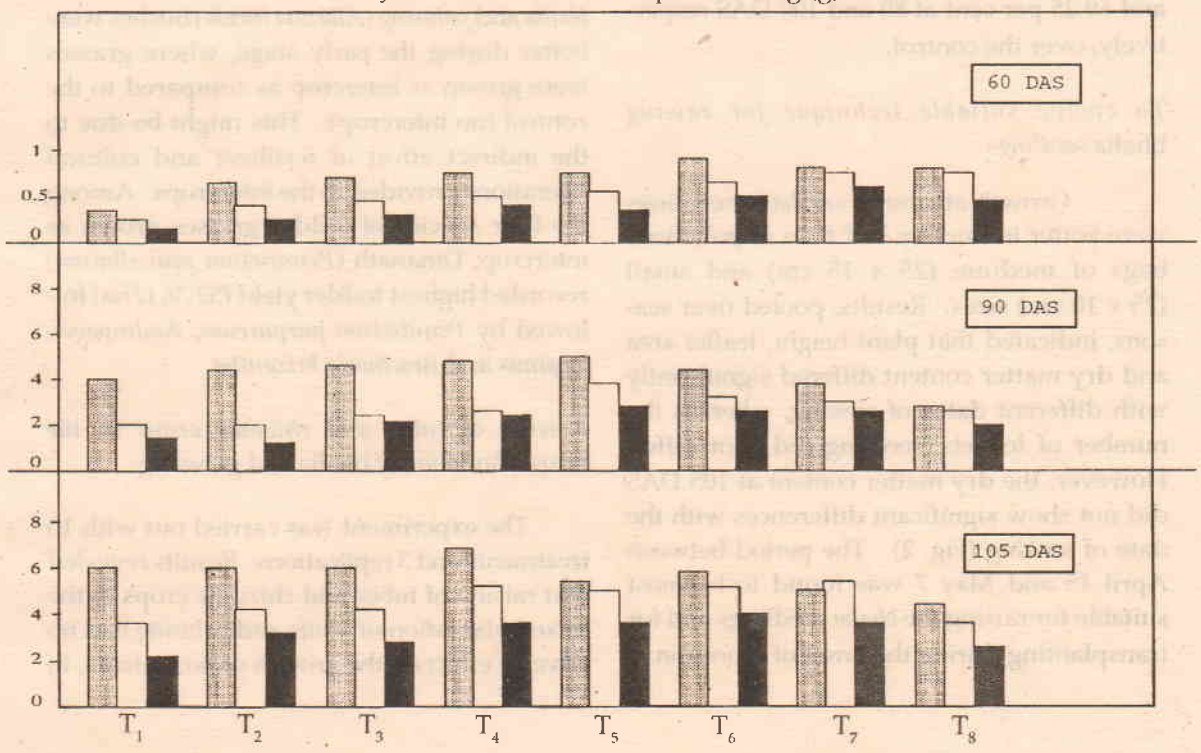
T_1 - I week of April
T_2 - II week of April
T_3 - III week of April
T_4 - IV week of April
T_5 - I week of May
T_6 - II week of May
T_7 - III week of May
T_8 - IV week of May

Fig. 2 Effect of time sowing and nursery conditions on some growth attributes of *bhalia*

Leaflet area (sq.cm)



Dry matter accumulation per seedling (g)



annum. A method for determining the leaf area of *bhalia* was developed. This requires multiplying the product of leaflet length and breadth with the constant 0.746. Thus, the area of trifoliate leaf of *bhalia* can be determined by adding the area of three leaflets.

Weed management in bhalia *nursery*

Observations revealed that grassy weeds constitiuted 90 per cent of the total weed population. Weed-free check (21 days interval) and hand weeding, twice at 30 and 60 DAS (days after sowing) reduced the weed population and its dry weight, significantly. Among the herbicides tried, pendimethalin (1 kg/ha) and oxadiazon (0.5 kg/ha) were found superior in reducing the weed population resulting in healthy seedlings. Weeding at three-week interval increased the dry matter content of *bhalia* seedlings by 80.71 and 69.25 per cent at 80 and 100 DAS respectively, over the control.

To evolve suitable technique for raising bhalia *seedlings*

Growth attributes of *bhalia* seedlings were better in nursery bed than in polythene bags of medium (25 x 15 cm) and small (25 x 10 cm) sizes. Results, pooled over seasons, indicated that plant height, leaflet area and dry matter content differed significantly with different dates of sowing, whereas the number of leaflets/seedling did not differ. However, the dry matter content at 105 DAS did not show significant differences with the date of sowing (Fig. 2). The period between April 15 and May 7 was found to be most suitable for raising the *bhalia* seedlings and for transplanting during the onset of monsoon.

2.1.3 Integration of lac cultivation with general agriculture under dry farming condition

B. P. Singh, B. K. Purkayastha, P. Kumar, M. Ram and S. C. Srivastava

The project was taken up to study the integration of lac cultivation with general agriculture through mixed cultivation of lac hosts, grasses, tubers and rhizomes for increasing the income per unit area of land and making lac cultivation more attractive to the lac growers.

Effect of intercropping of fodder grasses in mixed plantation of bhalia *and* galwang

To study the effect of growing fodder grasses in the spaces between *bhalia* and *galwang*, raised as mixed plantation for *kusmi* lac cultivation, an experiment was carried out using R.B.D. with 5 treatments and 3 replications. The results indicated that the growth of *bhalia* and *galwang* (*Albizzia lucida*) bushes were better during the early stage, where grasses were grown as intercrop as compared to the control (no intercrop). This might be due to the indirect effect of fertilizer and cultural operations provided to the intercrops. Among the four species of fodder grasses grown as intercrop, Dinanath (*Pennisetum pedicellatum*) recorded highest fodder yield (52.36 t/ha) followed by *Pennisetum purpureum*, *Andropogan gayanus* and *Brachiaria brizantha*.

Raising of tuber and rhizome crops in the mixed plantation of bhalia *and* galwang

The experiment was carried out with 10 treatments and 3 replications. Results revealed that raising of tuber and rhizome crops in the mixed plantation of *bhalia* and *galwang* had no adverse effect on the growth of host plants, in

general. On the other hand, it resulted in satisfactory growth except with tapioca, which adversely affected the growth of lac hosts due to its spreading crown and thick foliage. The plant growth attributes of both the lac hosts were found to improve with intercropping. An increase was also observed in the harvested biomass from *bhalia* and *galwang* by 30.0 and 54.9 per cent over the control, respectively. The yield of sticklac also increased substantially (Table 6). These improvements might be due to the indirect effect of fertilisers applied to the intercrops. The most profitable cropping pattern was, growing sweet potato and/or turmeric and colocacia and/or turmeric at the early and later stages of the development of lac hosts respectively.

Lac cultivation on palas *under mixed cropping condition with tuber crop, rhizome and grasses*

Tapioca, turmeric and Dinanath grass were grown as intercrop in the plant-to-plant and row-to-row spaces of *palas* (*Butea monosperma*) trees. The experiment was laid out with five treatments replicated four times. Maximum gross income was obtained from the treatment where Dinanath + turmeric + tapioca were grown as intercrop. Growing of Dinanath grass alone as intercrop was also found promising.

Researches in Progress

2.1 Propagation and management of lac host plants

2.1.6 Agricultural utilisation of lac mud as organic manure

B. P. Singh

Effect of lac mud, farm yard manure alone and in combination with NPK on rice and wheat sequence

The experiment was continued during the period under report with the same technical programme as reported earlier (*Ann. Rep. 1987*). Paddy crop (cv. Sita) was transplanted

Table 6 Effect of intercrops on the growth attributes of *Moghania macrophylla* and *Albizzia lucida* on sticklac yield (pooled over years)

Treatment	*Bhalia* (*M. macrophylla*)				*Galwang* (*A. lucida*)				Sticklac yield (q/ha)
	Plant height (cm)	Shoots per bush (No.)	Total shoot length per bush (cm)	Harvested biomass (stems+ leaves) (q/ha)	Plant height (cm)	Shoots per bush (No.)	Total shoot length per bush (cm)	Harvested biomass (stems+ leaves) (q/ha)	
Control (No intercrop)	137.5	8.4	8.8	16.0	120.3	6.1	4.2	11.5	2.15
Tapioca/colocacia	156.1	9.0	12.9	31.7	151.8	7.4	6.6	15.8	2.76
Sweet potato	167.1	14.4	17.4	28.2	143.1	5.4	7.5	12.4	3.32
Ginger	153.5	10.1	14.4	37.2	152.1	10.6	7.7	17.5	3.25
Turmeric	163.9	10.6	15.6	35.4	140.6	9.0	8.1	22.8	2.87
Tapioca/colocacia+ ginger	167.4	10.9	15.1	25.2	155.6	8.7	7.7	17.8	3.01
Tapioca/colocacia+ turmeric	171.3	12.0	16.2	24.0	154.6	7.8	7.2	21.8	2.95
Sweet potato+ ginger	174.2	12.1	17.1	25.3	159.0	9.5	9.8	20.7	4.36
Sweet potato+ turmeric	172.6	13.0	18.6	27.3	165.7	10.8	10.6	14.2	4.11
Sweet potato+ ginger+turmeric	176.3	13.2	19.2	29.5	148.1	9.9	7.9	17.4	3.60

Experimental plot showing paddy crop for evaluation of lac mud as manure

Air-layer of *kusum*

during the end of July '89 with the application of fertilizers and manures. Results presented in Table 7 show that yield and yield attributes of paddy under application of lac mud were comparable to those with FYM. Paddy yield of 4.08 tonnes/ha was achieved with the application of 10 tonnes lac mud + N 50 P 11 K 12.5 kg/ha, which is statistically at par with N 100 P22 K25 kg/ha and 10 tonnes FYM+N50 P11 K 12.5 kg/ha.

2.1.9 Standardisation of agro-forestry practices for raising high lac yielding *kusum* through air-layering

S. C. Srivastava

In order to develop a suitable technique for air-layering of *kusum*, by application of plant growth hormones, experiments were conducted during May-June, on 18-month-old shoots of *kusum* The treatments tried were :

i. IAA, IBA and NAA (50 and 100 ppm) individually and
ii. in all possible combinations of the two hormones (50/100 ppm)

The media used for air-layering were :

i. *Sphagnum* moss + lanolin paste
ii. FYM + pond soil (1:1) +*Sphagnum* moss + lanolin paste and
iii. FYM + pond soil (1:1) +*Saccharum* grass + lanolin paste.

The highest percentage (36.7%) of root initiation was recorded under the treatments IAA (100 ppm) + *Sphagnum* moss + lanolin paste; IAA (30 ppm) + FYM + pond soil + *Sphagnum* moss + lanolin paste (Table 8). The air-layers were transplanted in earthen pots, which showed heavy mortality. The maximum survival till March 1990 was 13.3%.

Table 7 Influence of different fertilizers and their doses on the yield and yield attributes of paddy (cv. Sita)

Treatment	Plant height (cm)	Panicles (m^2)	Panicle length (cm)	Fertile grains/ panicle	1000-grain weight (g)	Grain yield (q/ha)	Straw yield (q/ha)	Harvest index (%)
Control	69.2	226	18.2	70.9	19.96	29.3	43.1	40.4
Lac mud 5t/ha	71.6	284	18.4	71.9	20.28	33.1	45.9	42.0
Lac mud 10t/ha	71.9	305	18.4	76.4	20.86	36.7	48.3	43.2
F.Y.M. 5t/ha	71.6	300	18.7	74.7	20.18	34.3	47.9	41.7
F.Y.M. 10t/ha	71.9	313	19.3	81.8	20.51	36.6	50.7	42.0
N 100 P 22 K 25/ha	74.5	344	20.4	88.7	22.80	41.5	63.5	39.7
N 50 P 11 K 12.5/ha	73.5	301	19.2	78.2	21.47	35.1	52.0	40.3
Lac mud 5t/ha + N 50 P 11 K 12.5	74.0	316	19.3	77.2	20.35	37.9	55.8	40.6
Lac mud 10t/ha + N 50 P 11 K 12.5	74.3	332	19.5	85.5	21.09	40.8	63.0	39.3
F.Y.M 5t/ha + N 50 P 11 K 12.5	75.4	319	19.0	77.2	20.72	38.0	55.6	40.6
F.Y.M. 10t/ha + N 50 P 11 K 12.5	76.3	334	19.4	86.8	21.02	41.0	63.5	39.3
CD 5%	NS	42.42	1.20	10.65	NS	4.45	8.65	NS

Table 8 Percentage of rooting and survival of air-layers of *kusum* prepared during May-June 1989

Growth hormone (concentration in ppm)	Medium					
	Sphagnum moss + lanolin paste		FYM+pond soil (1:1)+ *Sphagnum* moss+lanolin paste		FYM+pond soil (1:1)+ *Saccharum* grass+lanolin paste	
	Rooted air-layers (%)	Survival (%)	Rooted air-layers (%)	Survival (%)	Rooted air-layers (%)	Survival (%)
IAA (50)	Nil	-	36.7	10.0	Nil	-
IAA (100)	36.7	13.3	30.0	-	3.0	-
IBA (50)	10.0	10.0	3.3	-	Nil	-
IBA (100)	Nil	-	Nil	-	Nil	-
NAA (50)	Nil	-	Nil	-	Nil	-
NAA (100)	Nil	-	13.3	3.3	Nil	-
IAA+IBA (50)	6.7	6.7	Nil	-	Nil	-
IAA+IBA (100)	Nil	-	Nil	-	Nil	-
IBA+NAA (50)	Nil	-	Nil	-	Nil	-
IBA+NAA (100)	13.3	6.7	Nil	-	Nil	-
IAA+NAA (50)	Nil	-	Nil	-	Nil	-
IAA+NAA (100)	Nil	-	Nil	-	Nil	-
Control (without hormones)	23.3	3.3	10.0	6.7	Nil	-

Table 9 ANOVA of different growth attributes of *M. macrophylla* and initial mortality of *kusmi* strain of lac insect during *aghani* 1989-90

Source of variance	Df	Plant height	Shoot length	No .of shoots	Girth of shoot	Mortality of lac insect
Replication	3	4.383 **	9.031**	112.19	2.76	16.54
Treatment	19	0.131	0.746*	15.81	0.11	9.89
Error	57	0.095	0.415	535.57	0.13	8.17
Total	79	0.266	0.784	396.65	0.22	8.90
S. EX	-	2.306	2.696	17.15	1.880	31.79
σ^2 gh	-	0.009	0.083	-130.69	-0.006	0.43
σ^2 e	-	0.095	0.415	538.57	0.129	8.17
σ^2 ph	-	0.104	0.498	407.99	0.123	8.60
GCV %	-	4.114	10.686	-66.67	-4.120	2.06
PCV %	-	13.980	26.175	117.78	18.650	9.22
H^2 %	-	29.430	40.825	-56.61	-22.09	22.37

Note: ** Significant at 1%, * Significant at 5%.

Table 10 Rooting and survival of air-layers of *galwang* prepared during July '89

Growth hormone (conc. 100 ppm)	Medium					
	Sphagnum moss+ Lanolin paste		FYM + pond soil (1:1) *Sphagnum* moss + lanolin paste		FYM + pond soil (1:1) *Saccharum* grass+ lanolin paste	
	Rooted air-layers (%)	Survival (%)	Rooted air-layers (%)	Survival (%)	Rooted air-layers (%)	Survival (%)
IAA	60.0	46.7	Nil	Nil	26.7	Nil
IBA	13.3	13.3	Nil	Nil	26.7	Nil
NAA	30.0	10.0	30.0	6.7	Nil	Nil
IAA + IBA	33.3	20.0	Nil	Nil	Nil	Nil
IBA + NAA	Nil	Nil	Nil	Nil	Nil	Nil
IAA + NAA	23.3	23.3	Nil	Nil	Nil	Nil
Seradix B (No. 3)	Nil	Nil	Nil	Nil	Nil	Nil
Control	33.3	26.7	Nil	Nil	Nil	Nil

2.2 Genetics and breeding of lac host-plants

2.2.6 Survey of genetic variation in lac potential of host plants

S. C. Srivastava, Y. D. Mishra and P. Kumar

Survey of genetic variation in bhalia

Plants of *bhalia* were pruned during Jan-Feb and inoculated with *kusmi* brood lac during June-July for raising the *aghani* crop. The crop, in general, suffered heavy mortality. Statistical analysis of the results obtained revealed 40.8% heritability for total shoot length and 22.4% for lac insect mortality (Table 9).

Survey of genetic variation in galwang

As a pre-requisite for the study, vegetative propagation through air-layering was tried in July using IAA, IBA and NAA (at 100 ppm concentration) individually and all combination of two of the above hormones. The media used were:

i) *Sphagnum* moss + lanolin paste
ii) FYM + pond soil (1: 1) + *Sphagnum* moss + lanolin paste and
iii) FYM + pond soil (1:1) + dried *Saccharum* grass + lanolin paste

Root initiation was observed in 60% of the air-layers with the treatment of IAA using lanolin paste + *Sphagnum* moss. Air-layers transplanted in pots showed 46.7% survival up to March '90 (Table 10).

2.2.7 Collection, maintenance, evaluation and characterisation of lac hosts

P. Kumar

Seedlings of *M. macrophylla* (Colchiploid), *Flemingia (= Moghania) macrophylla, F. paniculata* and *F. similata* transplanted earlier did not produce suitable shoots for lac inoculation.

Cajanus cajan varieties/cultivars viz., Basant, Pusa, Bahar, Laxmi, MA-1, ICP Nos. 6973, 6971. 3783, 8131, K 35/6 were procured and sown in the field during last week of June with 3 replications. The plants were inoculated during October with *rangeeni* brood lac to raise the *baisakhi* crop. Maximum grain yield was obtained from the Assam var. followed by Bahar, Pusa, ICP Nos.: 3783, K 35/6, MA-1 respectively (Table 11).

The potential of *F. stricta* and *F. strobilifera* for lac cultivation was evaluated and the yields

Aghani 1989-90 crop on *Flemingia strobilifera*

Air-layering of *palas*

Table 11 Growth attributes of different varieties of *Cajanus cajan* prior to lac inoculation (*Baisakhi* 1989-90)

Variety	Length of shoot (cm)	Basal diameter at internode (cm)	Primary branches/ plant (no.)	Secondary branches/ plant (no.)	Plant height (cm)	Length of sixth inter-node(cm)	Canopy spread (cm)	Grain yield plant (g)
K 35/6	612.2	0.49	12.0	2.3	146.7	3.4	186.7	21.9
ICR 8131	839.2	0.54	12.8	1.8	140.9	2.6	196.6	13.1
ICR 3783	510.9	0.41	13.8	2.0	134.5	2.7	188.3	23.3
ICR 6971	375.7	0.35	11.7	1.6	111.1	2.7	161.7	10.4
ICR 6973	743.8	0.47	17.2	2.2	147.2	2.9	242.2	17.3
ASSAM	727.8	0.50	16.2	2.2	141.7	3.1	211.0	39.6
MA-1	566.4	0.51	10.6	2.7	130.0	2.9	193.3	21.3
Laxmi	455.7	0.37	10.4	1.7	122.8	2.8	153.8	14.5
Bahar	400.9	0.29	11.9	1.5	107.8	2.3	176.2	30.0
Pusa	404.5	0.39	10.7	2.0	116.1	2.6	170.6	24.3
Basant	445.2	0.35	10.9	3.3	108.9	2.7	173.9	10.8

Table 12 Air-layering of *palas* using growth hormones

Growth hormone	Concentration (ppm)	Percentage of air-layers showing root formation		
		May	June	July
N A A	50	86.66	60.00	53.33
	100	73.33	66.66	60.00
I B A	50	86.66	60.00	53.33
	100	93.33	66.66	60.00
I A A	50	93.33	53.33	46.66
	100	80.00	60.00	66.66
I P A	50	80.00	40.00	60.00
	100	80.00	60.00	53.33
N A A + IBA	50	86.66	60.00	60.00
	100	93.33	46.66	73.33
N A A + IPA	50	86.66	53.33	33.33
	100	73.33	73.33	60.00
I B A + IAA	50	80.00	60.00	53.33
	100	86.66	66.66	40.00
I B A + IPA	50	66.66	80.00	66.66
	100	66.66	60.00	66.66
N A A + IAA	50	73.33	60.00	46.66
	100	66.66	73.33	40.00
I A A + IPA	50	66.66	73.33	53.33
	100	80.00	80.00	46.66
Seradix	-	80.00	60.00	80.00
Control	-	73.33	66.66	46.66

recorded were.454.5 and 500 g brood lac per plant respectively during the *katki* 1989 crop season. Similarly, *F. strobilifera* plants were also evaluated for *aghani* 1989-90 crop season and an yield of 558 g brood lac per plant was obtained.

Plants of *F. simialata, F. strobilifera, F. paniculata, F. macrophylla, Acacia auriculaeformis* and *putri* (*Croton oblongifolius*) were inoculated with *kusum* brood lac to raise *jethwi* 1990 crop.

2.2.8 Vegetative propagation in *palas* through air-layering

P. Kumar

Like previous years, air-layering on selected twigs of *palas* was done during May, June and July. Hormones tried were: i) NAA, IAA, IBA and IPA (50 and 100 ppm) individually; ii) all possible combinations of the hormones (50/100 ppm) and iii) Seradix. The medium used was *Sphagnum* moss + lanolin paste. In all, there were 22 treatments (including control) with 3 replications. Five twigs were used for air-layering under each treatment. Maximum rooting was observed in May (Table 12). At least 70% rooting was observed even without application of hormones (control). These results are in conformity with the previous findings. Rooted air-layers were cut from the parent plant after one month and planted in the field as well as in the pots. Survival percentage was better in pots than in fields.

Researches Contemplated

1. Scheduling of lac cultivation under multistoreyed system.

DIVISION OF CHEMISTRY

Researches Completed

3.1.12 Degradation studies on lac

S. C. Agarwal and N. Prasad

A systematic study was carried out on the oxidative degradation of lac, its major constituent acids and hydrolysed lac. Since nitric acid has been reported to be a powerful oxidising agent and is used for the oxidation of fatty acids containing polar groups, it was tried in the present study.

Experiments were carried out to evolve optimum conditions for the oxidation reactions using (i) nitric acid (50, 60, 70 and 100%) with manganese dioxide (MnO_2) as catalyst and (ii) nitric acid (70%) without catalyst. The materials taken for the study were: (a) aleuritic acid, (b) jalaric acid, (c) total hydrolysed lac, (d) jalaric acid-free hydrolysed lac, (e) aleuritic acid-free hydrolysed lac and (f) shellac.

Reactions were carried out under the above mentioned conditions at the reflux temperature on water bath for 12-16 h. The products from each set of experiments were recovered by pouring the material into ice-cold water. Solid product, if any, was separated out and then extracted with ether and ethyl acetate separately. The above products were examined for physical appearance, melting point and subjected to TLC. The reactions carried out with nitric acid (70%) along with trace amount of MnO_2, yielded better resultant products. Hence, all the oxidation reactions were carried out with the above optimum concentration of nitric acid to obtain the pure components in quantity from the aforesaid samples. Altogether twelve samples of pure compounds were isolated through nitric acid oxidation reaction of shellac, its major constituent acids and hydrolysed lac samples.

Five pure compounds were obtained, which appeared to be new, based on the data of elemental, IR and mass spectral analysis. These seemed to resemble α-β- unsaturated

pimelic and suberic acids, glutaric semialdehyde, keto-heptanoic acid and α-β-unsaturated octanoic acid.

The dégradation studies were then attempted on shellac with SeO_2 which oxidises reactive methylene or methyl groups to dicarboxyl groups and also causes dehydrogenation, allylic hydroxylation etc. Dioxan was found to be the most suitable solvent to carry out the above experiment. Only one pure liquid component could be isolated from shellac and an indication was obtained for the presence of an unsaturation in it.

3.2.11 Synthesis of bis-heterocyclic compounds from aleuritic acid

R. N. Majee

The project was undertaken with an aim to synthesise bis-heterocyclic compounds from aleuritic acid and to test their biological activity. Aleuritic acid, the major component acid of lac, on periodate oxidation yielded 7-hydroxy heptanal and azelaic acid aldehyde. The former, on oxidation, gave pimelic acid while the latter gave azelaic acid. These were then converted into the corresonding oxadiazoles adopting the standard procedure. The compounds were characterised by IR, PMR spectra and elemental analysis. Their melting points were 240 and 112-113°C respectively.

Oxadiazoles of pimelic and azelaic acids prepared by a modified method were found to be identical to those obtained by the standard procedure. The modified reaction sequence was as follows:

Thiosemicarbazide in 4N NaOH was heated under reflux in methanol and then iodine in KI solution was added, till the colour of iodine persisted. The mixture was then concentrated, cooled and the solid which separated was filtered, dried and crystallised. In order to standardise the procedure, oxadiazoles were also prepared from suberic and sebacic acids adopting the above procedure. The melting points of the compounds were found to be 233-35 and 180°C respectively.

Thiadiazoles were prepared from pimelic, suberic and azelaic acids using the following reacion sequence:

Thiosemicarbazide prepared by the condensation of methanolic solution of hydrazide with phyenyl isothiocyanate on water bath for 4h was treated with ice-cold conc. sulphuric acid for 2h, poured into crushed ice. The precipitated solid was filtered, washed with water, dried and crystallised from methanol. Their meling points were 87-89, 226-28°C respectively. Triazoles from pimelic, suberic, sebacic and azelaic acids were prepared by the cyclisation of thiosemicarbazides with 2N NaOH at reflux temperature separately, whose melting points were found to be 140-42, 243-45, 228-30 and 102-3°C respectively.

Triazoles, oxadiazoles and thiadiazoles were synthesised from hexadecane-1, 16-dioic acid, prepared from aleuritic acid, adopting the sequence given above. Similarly oxadiazole, thiadiazole and triazole were prepared from undec-2-ene-1, 11-dioic acid, which was prepared by reacting azelaic acid aldehyde (one of the periodate oxidation products of aleuritic acid) with malonic acid, in the presence of pyridine, on steam bath till the effervescence of CO_2 ceased.

All these compounds were prepared in quantity and evaluation is in progress. Sodium salt of the compounds were also prepared.

3.4.5 Studies on anticorrosive primers/ paints for use on ferrous metals

S. Kumar, M. Mukherjee and A. Rahman

The study was taken up with an aim

to develop suitable compositions of shellac-based red oxide primer which may be thinned with cheaper aromatic hydrocarbon solvents and may be used for painting ferrous metal structures such as railway wagons, coaches etc.

Lac-double boiled linseed oil primers

A few samples of vehicles were prepared based on dewaxed lac-double boiled linseed oil and ordinary shellac (*bhatta* shellac)-double boiled linseed oil. These vehicle samples were pigmented with red oxide of iron, zinc chromate and other minor ingredients to prepare suitable primer compositions. The primers so obtained were uniform in texture and on application by brush produced hard, smooth and characteristic egg shell films on mild steel panels. These films showed good adhesion and passed the tests for flexibility and resistance to scratch. The water and solvent resistance of the films were also good. In regard to corrosion resistance, even the baked films showed fine rust spots. It was observed that the performance of the primers based on dewaxed lac-double boiled linseed oil and *bhatta* shellac-double boiled linseed oil was almost similar and therefore, further experiments were carried out with *bhatta* shellac-double boiled linseed oil vehicle/primer.

Effect of incorporation of corrosion inhibitor

The effect of incorporation of corrosion inhibitor, namely, N-butylamine (0.5%) in the above composition was studied with a view to improve upon the corrosion resistance of the primer films. Both air-dried and baked films of the resultant composition passed the tests for flexibility, scratch hardness and resistance to water but none of the films passed the tests for corrosion resistance.

Modification with polyisocyanate

Further, experiments were carried out to improve upon the corrosion resistance of the primer films. The primer based on lac-double boiled linseed oil was modified with a polyisocynate (Desmodur N). The modified primer produced smooth, uniform and adherent films on mild steel panels. Both air-dried and baked films of the primer passed the tests for flexibility, scratch hardness and resistance to water, alkali and solvents. However, in regard to corrosion resistance only baked films passed the test satisfactorily.

Modification with epoxy resin

In another experiment, lac-double boiled linseed oil-epoxy resin varnish was used as vehicle for the preparation of primer. The varnish was prepared by reacting a mixture of shellac and epoxy resin (9:2) with the mixed glycerides of linseed oil at 290 ± 5°C. The resultant product was thinned with heptane to the desired consistency. This varnish on pigmenation with red-oxide of iron etc. gave a primer which produced smooth, uniform and highly adherent films on ferrous metals. Both air-dried and baked films passed the tests for flexibility, scratch hardness and resistance to water and solvents. However, in regard to corrosion resistance only baked films passed the test.

Suitability of lac-dehydrated castor oil varnish and lac-rosin varnish as vehicles for the preparation of primers was also studied but even baked films of these primer compositions did not pass the test for resistance to corrosion.

As a result of comparative study of the performance of different compositions studied under this project, it was observed that the compositions based on lac-linseed oil-polyisocyanate and lac-linseed oil-epoxy resin gave the best results especialy in respect of resistance to corrosion. These primers can, therefore, be used as baking-type primers for painting of ferrous metals.

3.4.6 Styrenation of lac-oil combinations

B. B. Khanna and P. M. Patil

Films obtained from lac-oil combinations, prepared earlier, gave good flexibility but their hardness and chemical resistance were poor. The present work was taken up with an objective to impart good chemical resistance and hardness to the films obtained from lac-oil combinations by reacting the latter with styrene.

Lac-linseed oil combination and styrene were reacted in the proportions of 50:50, 30:20 and 20:30 using benzoyl peroxide (2.5% and 5%) as initiator and xylene as solvent. Samples were collected after refluxing for 10 and 20h. Films were prepared on glass slides and tin panels and air-dried for 7 days.

It was observed that baked films possessed good water and acid resistance but poor alkali resistance. There was an appreciable increase in the scratch hardness of the baked films.

Since lac-linseed oil combination did not give very good results, dewaxed decolourised lac-linseed oil combination was used for styrenation. Dewaxed decolourised lac-linseed oil (alkali refined) combination was prepared as usual and reacted with styrene in different proportions viz., 50:50 and 30:20 using benzoyl peroxide as initiator (5% and 10%) with refluxing for 10 and 20h. An appreciable increase was observed in scratch hardness, water and acid resistance. Some improvement was also observed in the alkali resistance, as the amount of styrene was increased in the composition. Compositions prepared from dewaxed decolourised lac showed better performance compared to those from ordinary shellac.

3.5.5 Slow-release lac-urea formulation for animal feed

B. C. Srivastava

Studies were undertaken to develop a slow-release lac-urea formulation as a source of nitrogen for animal nutrition facilitating improved nitrogen conversion to microbial protein.

Slow-release lac-urea combination

Machine-made shellac and urea (0 to 100% on the weight of lac resin) were reacted at 150 ± 5°C. It was found that shellac-urea combinations containing urea up to 31.5% on the weight of lac resin can be prepared in the powdered form.

Slow-release lac-encapsulated urea granules

Another approach was applied to develop a slow-release lac-encapsulated urea granules employing the pan encapsulation unit developed at this Institute earlier (Srivastava B. C. and Bhowmik T., 1976). In this method, lac-rosin (1:2) ester powder was used as a wall material and double-boiled linseed oil as an anchoring agent, for the encapsulation of urea granules. The encapsulation, having single, double and triple wall material, was carried out by the mechanical process with the help of the pan-encapsulation unit. Hard paraffin wax was used as a sealant as a last coat for the preparation of another set of encapsulated urea granules.

Slow-release characteristics

To study the release characteristics of urea from the lac-urea combination products, the percentage of urea dissolved out in water at room temperature was estimated and it was observed that the available urea was dependent on the amount of urea taken in the composition. The combination products

possessed slow-release characteristics.

The effect of temperature and pH on the dissolution of urea from the lac-urea (10% w/w) formulation was investigated. The dissolution behaviour of this formulation was studied at pH 6.6, 6.8 and 7.0 and at temperatures 38, 44, 48 and 52°C, these values being close to the ruminant's intestine temp. and pH. The dissolution was found to increase with the increase of temperature and pH.

The dissolution behaviour of encapsulated urea granules was also studied. It was observed that the dissolution of urea occurred through the micropores left on the material during the process of encapsulation. To overcome this, a sealant was used whose desirability in cattle feed, however, is to be examined.

Lac-urea formulation in free-flowing powder form was supplied to NDRI, Karnal and A.P.A.U., Hyderabad for nutritional evaluation.

3.6.3 Studies on the tracking resistance of shellac-based varnishes

D. N. Goswami

The study was initiated with an aim to investigate the resistance to tracking of various shellac-based varnishes for use in the electrical industry for antitracking insulating purpose. Formation of tracking was investigated on the films of shellac-based varnishes in the presence of NH_4Cl solution following IS: 8264-1976 and IS: 10026-1982. A Beckman Insulation Tracking Test Set was used for this study.

Study with shellac and seedlac

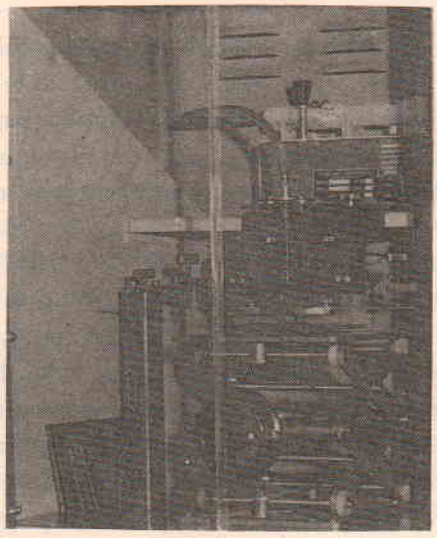
The tracking index values of air-drying varnishes prepared from seedlac and ordinary shellac were found to be 224 and 256V respectively.

Study with shellac and epoxy resin blends

The study was then extended to varnishes prepared after curing shellac and epoxy resin (M.W. 1000) both in the cold and by fusion.

(i) Curing in the cold

Air-dried films: For studies in the cold, requisite proportions of shellac and epoxy resin solutions, prepared in 2:1 methyl ethyl ketone and denatured alcohol (distilled) were blended. After curing for at least 6 days in the solution stage, the films were prepared on the phenolic resin bonded paper laminates following the above IS standards. The films were air-dried and kept over anhydrous $CaCl_2$ for at least 48h before testing for the tracking property. The varnishes prepared by curing 70:30 and 50:50 (parts) shellac and epoxy resin were found to pass the test, specified in the above standard (IS:10026-1982) for 135 and 200V. The tracking index values for the above varnishes were found to be 270 and 300V respec-



Testing of tracking property

Table 13 · Tracking property of shellac-epoxy resin varnishes

Varnish		Observation made (up to drops)*	Remarks	Tracking index (volts)	Thermal resistance (short duration test)
Cured in the cold					
70: 30	Shellac-epoxy resin, air-dried films	147	No failure	270	No marked improvement (over shellac)
50: 50	Shellac-epoxy resin, air-dried films	163	No failure	300	-do-
70: 30	Shellac-epoxy resin baked films (2 h at 120°C)	135	Tracking occurred	270	120°C (passes)
50: 50	Shellac-epoxy resin baked films (2 h at 120°C)	141	-do-	310	120°C (passes)
70: 30	Shellac-epoxy resin baked films (30 min at 175°C)	-	-	262	180°C (passes)
Cured by fusion					
70: 30	Shellac-epoxy resin, air-dried	180	No failure	-	-
50: 50	Shellac-epoxy resin, air-dried films	90	Tracking occurred	-	-

*The requirement as per IS : 10026-1982 for testing at 200 V is 50 drops.

Note : No tracking was observed at 135 V for 90 min, observation was hence discontinued thereafter (contamination used was 0.1% solution of NH_4C1).

tively. The observations made have been summarised in Table 13.

Baked films: Tracking tests were carried out on the films baked for 2h at 120°C. These films also passed the requirments of the IS: 10026-1982 for 135 and 200V. The tracking index values of the baked films prepared from the 70:30 and 50:50 shellac-epoxy resin varnishes were 270 and 310V respectively. No marked effect was noticed in the thermal resistance of the air-dried and the baked (30 min at 120°C) films. An appreciable change in the thermal resistance was, however, noticed for the films baked at 175°C for 30 min. The films passed the short duration test for thermal resistance upto 180°C. There was, however, no appreciable change in the tracking index value (262 V) for these baked films compared to those of air-dried films and films baked at 120°C.

(ii) Curing by fusion

Curing reaction between shellac and epoxy resin was carried out by fusion at 150°C. Experiments on tracking resistance were carried out on the air-drying varnishes prepared from the cured products of 70:30 and 50:50 (parts) shellac and epoxy resin. The varnishes passed the tests for 135 and 200V satisfactorily. The above shellac-epoxy resin varnishes showed increased resistance towards tracking. However, no marked improvement in the thermal resistance of the films was observed.

Curing between shellac and epoxy resin was studied upto 400 g lot. No gelling of

the varnishes was noticed, due to storage upto two years and these were found to be thinnable with the solvent.

Study with shellac and polymer blends

Similar studies were carried out with the blends of shellac and Ultem (a polyetherimide) or a polycarbonate resin in the solution stage using tetrahydrofuran (THF) as solvent. The molecular weight of Ultem (GEC, USA) and the polycarbonate (ICI, U.K.) were about 45,000 and 35,000 respectively. The thermal resistance of these polymers was more than 250°C. Both the polymers were partly soluble in THF. The concentrations of shellac, Ultem and the polycarbonate resin used were 10%, 1% and 1% respectively. The blends of the solutions were kept in the cold for 7 days before making films. Films were prepared on the laminates as stated above. The finish of the films were found to be non-uniform. Baking of the films for 30 min at 100°C resulted in some improvement in the appearance of the films.

The films prepared from the solutions of Ultem and polycarbonate resin alone, however, were more uniform. The tracking index values of the above resins were found to be 120 and 140V respectively. These values were low, as compared to that of shellac (256V). Both the 70: 30 (parts) shellac-Ultem and shellac-polycarbonate and also the 30: 70 (parts) shellac-Ultem resin blends showed increased resistance towards tracking at 200V. The tracking occurred at more than 50 drops as required by IS: 10026-1982. The 30:70 (parts) shellac-polycarbonate resin, however, showed decreased resistance towards tracking at 200V. A detailed study is required to be done in a good solvent medium.

Thus, the air-drying type varnish prepared by curing a blend of 70:30 (parts) shellac and epoxy resin in the solution stage may be used as general purpose antitracking insulating varnish. It was observed that the tracking index does not depend on the thermal resistance of the films.

Researches in Progress

3.1 Chemistry of lac/constituents

3.1.9. Thermal polymerisation of lac: Studies on mol. wt., shape and size

A. Kumar

During the period under report, intrinsic viscosities of seedlac and its polymers were determined. One per cent solution of seedlac and its polymers were prepared separately in ethanol and filtered. Viscosity measurements of the solution were made at 30 ± 0.5°C using a thermostatic temperature bath. The plot of $\log_{10}[\eta]$ versus $\log_{10}M$ was found to be linear.

3.2 Fine chemicals from lac

3.2.10 Synthesis of pheromones and juvenile hormone analogues from aleuritic acid

R. N. Majee and R. Ramani

Insect sex pheromone components, methyl 9(Z)-tetradecenoate; 9(Z)-tetradecen-1-ol and is acetate; and 9(Z)-tetradecen-1-al were synthesised from azelaic acid aldehyde, one of the periodate oxidation products of aleuritic acid. Methyl 9(Z)-tetradecenoate was obtained from ester of azelaic acid aldehyde adopting Wittig synthesis.

9(Z)-tetradecen-1-ol was obtained from the above ester by its reduction with lithium aluminium hydride in tetrahydrofuran. Its acetate was obtained by treatment with Ac_2O/pyridine. 9(Z)-tetradecen-1-al was obtained from its alcoholic treatment with pyridinium chlorochromate in dichloromethane.

Insect sex pheromone component, 9(Z)-hexadecen-1-al was prepared in quantity from the azelaic ester aldehyde applying Wittig synthesis. Some candidate compounds such as methyl 9, 10-diketohexadecane-1-16-dioate, 8 - hydroxyhexadecanoic acid, methyl 8-keto-hexadecanoate etc. were again prepared for juvenile hormone activity.

3.2.12 Synthesis of coumarine derivatives from jalaric acid

N. Prasad

The synthesis of dimethyl shellolate by esterification of shellolic acid obtained by oxidation of jalaric acid, with silver oxide was reported last year. During the period under report, di-methyl shellolate was prepared in quantity (approx. 4 g) by esterification of shellolic acid with methanol sulpuric acid mixture (10:1) at water bath temperature for synthesising C-15 lactone diacid. The product was chromatographed over alumina and a pure fraction of dimethyl shellolate (m.p.152-153^{0}C,Rf 0.46, TLC solvent system--Trichloroethylene : chloroform : methanol, 15:6:3 v/v) was obtained in an yield of approx 30% on the weight of shellolic acid taken. The pure fraction of dimethyl shellolate, taken in a nickel crucible, was mixed with potassium hydroxide (1:4) and fused at 200^{0}C in an oven for half an hour. C-15 lactone diacid was isolated from the fused product and purified.

3.2.13 Synthesis of prostaglandin analogues from aleuritic acid

N. Prasad and R. N. Majee

The methyl ester of azelaic semialdehyde was prepared first in quantity (5 g) adopting the procedure reported last year. The synthesis of the next step product i.e., lactone ester (γ-lactone) through the half ester, was carried out by condensation reaction of methyl ester of azelaic semialdehyde and dimethyl succinate in the presence of sodium methoxide. The product, isolated from the reacted material, was refluxed at water bath temp. in the mixture of hydrobromic acid, acetic acid and water (3:2:1 v/v, 20 ml) for about 15 h. The product obtained after the reaction was extracted with ether and on evaporation of the solvent, yielded a liquid compound which is being purified by column chromatography for its characterization and also to carry out the next step of synthesis to get prostanoid synthon.

3.2.14 Derivatisation of shellac acids-synthesis and characterisation of dioxalanes, organic nitrates and tetrazoles

S. C. Agarwal, I. Rajendran and P. C. Sarkar

The crude aleuritic acid, prepared by alkaline hydrolysis of shellac, was purified through repeated crystallisation using binary solvent mixtures. The purified white, amorphous acid melted at 98-99^{0}C. The acid was converted into its methyl ester and chromatographed over silica gel column for purification. The product was treated with ethyl orthoformate to obtain unsaturated acid, which will be used for the preparation of organic nitrates.

3.3 Modifications of shellac/constituents and their utilization

3.3.11 Modification of lac with ethyl cellulose

A. K. Dasgupta

A varnish composition was prepared by dissolving 80 parts of ethyl cellulose and 20 parts of shellac (*bhatta*) in denatured alcohol. Dibutyl phthalate (20% on the weight of lac) was then added to it. Films were then prepared from the varnish and the changes in acid and hydroxyl values were investigated at

different stages of air-drying up to two months. It was observed that the acid and hydroxyl values reduced to 35.7 and 70.9 respectively, indicating the reaction between the hydroxyl and carboxyl groups of shellac during air-drying of the films.

3.3.12 Modification of lac wax

K. M. Prasad and B. B. Khanna

It was reported earlier that lac wax, obtained from lac mud when modified with sodium bisulphite at different temperatures, showed considerable improvement in its desirable characteristics. But when the same was modified with ammonia, the improvement was not significant.

During the period under report, lac wax, recovered from lac mud, was reacted with urea (2, 4, 6 and 10% w/w) at 100 and 180°C. The physico-chemical characteristics of the products are being determined.

3.4 Use of shellac and modified shellac in surface coating

3.4.7 Modification of by-product obtained during preparation of aleuritic acid and its use in surface coating

A. K. Dasgupta

The by-product (gummy mass), obtained during the preparation of aleuritic acid, was modified with 20% melamine resin (BIOMINE 1651) in denatured alcohol and subseqently 2% cobalt naphthanate was added.

The film properties of this composition were then investigated. The hard-dry period of the film was found to be 20 days. The films passed the test for flexibility. However, they did not show adequate resistance to solvents like alcohol and acetone. The flims also did not pass the test for impact resistance.

3.4.8 Lac-based coating compositions for out-door applications

B. B. Khanna and P. M. Patil

Preparation of the urethane paint formulations based on shellac, ethylene glycol, adipic acid (pigmented with titanium dioxide) and TDI/Desmodur N/Desmodur VL/ Desmodur Z was reported last year. During the year under report, panels prepared from the above paint formulations were exposed to atmospheric conditions and were examined every month for weather resistance. The paint based on shellac, adipic acid, ethylene glycol and Desmodur N remained unaffected up to 15 months of exposure to atmospheric conditions with good colour retention. For the other paint compositions, corrosion was found to occur in 10-15 months of exposure.

Urethane paints were also prepared using terephthalic acid in the place of adipic acid and using different polyisocyanates as described above. The paint based on shellac, terephthalic acid, ethylene glycol and Desmodur N remained unaffected up to eight months with good colour retention. Corrosion was found to occur, for all other paints, after two months of exposure to the atmospheric conditions.

3.6 Electrical properties of lac and modified lacs

3.6.4 Studies on the modification of lac for use as high thermal class insulating varnishes

M. Mukherjee, S. Kumar and D. N. Goswami

Development of an insulating varnish possessing thermal resistance up to 200°C, dielectric strength of the order of 1.9 kV/mil (76 kV/mm) and good drying characteristics (30 min at 150°C) was reported last year.

During the period under report, further studies were made on the above mentioned varnish i.e., the varnish prepared from the reaction product of shellac, epoxy resin and double-boiled linseed oil. Improved properties were obtained when baking of the films was done at 175°C for 30 min. The dielectric strength values of the varnish at 27°C, 200°C and after immersion in water for 24h, were found to be 80, 44 and 48 kV/mm respectively. The corresponding values required by the IS : 10026-1982 are 50, 35 and 35 kV/mm. Thus the varnish prepared met the requirements of the Indian Standard Specifications. The varnish passed the test for resistance to transformer oil up to 130°C. However, difficulty was experienced when the tests were carried out at 155°C and above, when the transformer oil itself became dark due to carbonisation, causing difficulty in making any assessment of the performance of the varnish. These films, however, passed the test for flexibility over 5 mm mandrel.

The results of the preliminary experiments have revealed that the varnish possesses increased resistance towards tracking as per IS:10026-1982.

Preliminary studies were also carried out on the varnish prepared from the reaction product of shellac, epoxy resin and alkali-refined linseed oil. Good properties were obtained when the films were cured at 200°C for 30 min. The varnishes passed the short duration test for thermal resistance up to 200°C.

Evaluation

Shellac-epoxy resin double-boiled linseed oil and shellac-epoxy resin-alkali refined linseed oil varnishes were supplied to a leading micanite manufacturer in the country. They have observed that micanites, manufactured with the help of these varnishes (i) did not delaminate, (ii) possessed very good dielectric strength without showing any deterioration up to 200-220°C and (iii) were flexible. They expressed the suitability of the varnishes for the manufacture of flexible type of micanites.

The varnish prepared from the reaction product of shellac, epoxy resin and double-boiled linseed oil was also supplied to a local consumer of insulating varnish for coating of coils/armatures of electric motors, transformers etc. The varnish was applied on a 25 H.P., 440V, 3-phase electric motor and the performance was reported to be satisfactory.

3.8 Studies on biochemical aspects of insect host plant relationship

3.8.1 Studies on transformation of sap constituents and their incorporation in lac secretion

S. C. Agarwal, K. M. Prasad and P. C. Sarkar

Extraction of *kusum* bark with different solvents viz., petroleum ether, methanol and water; fractionation of petroleum ether fraction (A) into waxes (A1) and lipids (A2); refractionation of Fr.A1 into four fractions viz., A1-1, A1-2, A1-3 and A1-4 and isolation of one pure component were reported last year.

During the period under report, the fractions A1-2 and A1-3 were refractionated into six fractions in which one component with Rf value 0.93 appeared to be pure. Attempts are being made to obtain it in good quantity for further study.

The methanol extract of *kusum* bark was chromatographed over different adsorbents viz., silica gel, florosil and alumina to isolate phenols, organic acids and sterols. An organic acid was isolated, purified and portion of it was also esterified using

thionyl chloride. The acid and the ester possessed m.p. 115 and 99°C respectively. Both these products were sent for analysis. The acid gave negative test for 2,4-DNP indicating the absence of keto group.

Researches Contemplated

1. Synthesis of isoambrettolide and exaltone from aleuritic acid, on bench scale.
2. Slow-release lac-based multilayer pesticidal system for roach control.
3. Development of lac-based insulating material/varnishes having improved electrical properties.

SECTION OF TECHNOLOGY

Researches Completed

4.1.6.(ii) Improvement in dewaxing and decolourising techniques in solvent medium

R. K. Banerjee

Dewaxed decolourised lac is very much in demand. The present study was taken up with a view to improve upon the techniques of preparation of dewaxed decolourised shellac in the solvent medium.

Powdered (30-40 mesh) *kusmi* seed lac (C.I. 8-12, wax content 4.5%) was dissolved in methylated spirit in the ratio of 1:9 (w/w) at 11-14°C with intermittent stirring for three hours. The solution was then filtered using silver sand as filter-aid. After filtration, the wax-free solution was decolourised by treating with activated carbon of commercial and LR grades (20% on the weight of seed lac) at 78°C for 1 h. The colour index of shellac so obtained was in the range of 1.2 to 1.4. The colour index could further be lowered to 0.7-0.9 by using activated carbon of E. Merck, Germany in the place of commercial (Bengal Chemicals) and LR (Sarabhai Chemicals) grades mentioned above. The clear filtrate was distilled off as much as possible and was poured into boiling distilled water. The precipitated dewaxed decolourised lac was then flaked off with the help of a roller. The average yield was found to be 80% and satisfied the IS: 16-1956 of D_1 grade and ISO/R-56-1956 (E).

To reduce the cost of the processing and to avoid difficulties faced during filtration, granular carbon of Bengal Chemicals was used alongwith the used carbon in the presence of 0.2% oxalic acid.

4.6.1. Preparation of improved cation-exchange resin from shellac on large scale

P. C. Gupta and K. K. Sharma

Cation-exchange resin from shellac was prepared following the method of Rahman *et al.* (1979), the cation exchange capacity was found to be only 0.02 m. eq./g contrary to that reported by the authors (4.8 m.eq./g). Hence, a systematic study was initiated converting lac into gel using resorcinol paraformaldehyde method of Dhar *et al.* (1954). The gel was sulphonated using concentrated sulphuric acid, oleum (20%) and chlorosulphonic acid separately. The cation exchange capacities were found to be 1.9, 4.1 and 5.84 m.eq./g respectively. It was inferred that oleum and chlorosulphonic acid were better sulphonic agents. Since sulphuric acid is the cheapest of the three, it was used for sulphonation of gelled shellac for large scale trial by taking one kg lot and the result obtained was reproducible.

4.2 Rubber-shellac combinations

4.2.3 A comparative study of shellac with other resins (synthetic and natural) which are used in rubber industry

R. Singh

Comparison of wood rosin with shellac into natural rubber gum stock and filled stock

During the year under report, a comparative study was made on the effect of incorporation of shellac and rosin separately into HAF-filled stock of natural rubber. The changes in different properties are presented in Table 14. The optimum time of cure remained almost the same for both shellac and rosin. Modulus at 200% elongation and elongation at break decreased with shellac as well as rosin, but the effect was more pronounced with rosin. Tensile strength was found to increase with the incorporation of five parts of shellac per hundred parts of rubber and decreased with further addition of shellac; however, a decrease was observed with incorporation of rosin. Tear resistance increased with 2.5 parts of shellac or rosin and decreased with further addition. Hardness was found to increase with the addition of either shellac or rosin into natural rubber filled stock. Flexing properties remained constant with shellac and decreased with rosin. It is inferred that shellac showed better properties than rosin.

4.5 Use of lac in printing inks

4.5.1 Development of printing inks based on lac/modified lac

A. Pandey

It was reported last year that printing ink vehicle based on lac-linseed oil combination gave encouraging result. During the year under report, vehicle was prepared by modifying lac with alkyd forming materials (glycol, linseed oil, linseed oil fatty acid and phthalic anhydride). Compositions of black printing ink were then prepared by varying the proportion of the components (lac-alkyd binder, Fisons channel carbon black (21752) and alkali-refined linseed oil/mineral oil). Flow, consistency, hue and shine of the above formulations were comparable with those of a commercial sample.

Table 14 Effect of incorporation of shellac and rosin into the filled stock (HAF Black filler) of natural rubber

Property	Shellac (phr)					Rosin (phr)			
	0	2.5	5	7.5	10	2.5	5	7.5	10
Optimum time of cure (min)	30	30	30	30	40	30	30	30	30
Modulus at 200% elongation (kg/cm^2)	21.86	13.7	9.3	18.8	6.8	10.2	6.9	6.8	6.8
Elongation at break (%)	600	560	570	520	470	560	530	500	540
Tensile strength (kg/cm)	78.1	68.5	99.8	51.3	43.8	57.5	49.4	42.9	31.1
Tear resistance (kg/cm)	22.5	23.6	17.3	11.6	4.2	25.5	7.2	11.3	6.3
Hardness	60	62	66	62	64	61	62	64	64
Resilience (%)	42.8	34.5	58.4	53.5	33.3	-	51.8	48.7	-
Flexing properties (Cracking started after thousand revolution)	30	30	30	30	20	30	20	15	-

Researches Contemplated

1. Modification of *bhatta* for use of different fuels.
2. Standardisation of the process for the recovery of lac dye and its pilot plant study.
3. Preparation of lac-based hot melt adhesives.

DIVISION OF EXTENSION

Researches in Progress

5.5 Operational research project for maximising lac production in Chhotanagpur area

R. C. Mishra and J. Lal

Operational researches on the technologies developed at this Institute for lac culture were continued in the new operational area (Phase III) comprising of two backward tribal villages, Chitir and Dundu in the Namkum Development Block of the Ranchi District. Demonstrations of other agricultural and horticultural crops etc. were also arranged in the area, through other organisations/agencies.

Farmers' forum meetings were organised to discuss the new technologies, constraints and needs of the farmers.

Lac Culture

Trial-cum-demonstrations of improved methods of lac cultivation on *ber* and *palas* were continued.

From *rangeeni* sticklac coupe, *baisakhi* 1988-89 *ari* (immature) crop was harvested from a set of 17 *ber* trees during May/June 1989. An average yield of 5.66 kg sticklac/tree was obtained as against 0.67 kg/tree using traditional practice.

From *rangeeni* brood lac coupe, *baisakhi*-cum-*katki* 1988-89 crop was harvested for brood lac purpose from a set of 15 *palas* trees during October 1989. An average yield of 2.80 kg brood lac/tree was obtained as against 0.61 kg/tree using traditional method.

A special drive to popularise unconventional host plants was made and for this purpose group discussions, lectures and door-to-door persuation was done.

Lac host seedlings of *ber* (844 Nos), *bhalia* (1159 Nos) and *galwang* (805 Nos) were distributed among the farmers for planting in the backyards.

Apiculture

Farmers in the area were encouraged to maintain bee colonies. Fifty farmers were selected for a training programme on bee-keeping through Khadi and Village Industries Board, Bihar.

Agriculture

Farmers were motivated to cultivate IR 36, an improved variety of paddy, for which arrangements were made for the exchange of local seeds. Demonstrations using this seed were conducted on 0.6 ha area and an average yield of 23 q/ha was obtained.

Twenty-five minikit demonstrations of pigeonpea (ICPL 87) and 4 demonstrations of groundnut (AK-12-24) were arranged in an area of 6.8 ha through the State Agriculture Department. Satisfactory results could not be obtained due to grazing.

A field day on the use of grain storage

structures and plant protection equipments was organised through the State Plant Protection Department.

Arrangements were made for digging ten wells in the area, under the Jaldhara scheme. Four diesel pumping sets (4.5 HP) were also arranged at highly subsidised rate of Rs. 1400 per set from Rama Krishna Mission Ashram, Ranchi.

Horticulture

Training and demonstration on budding of *ber* and rose was organised in the month of July.

A field day on vegetable production was organised through the National Seed Corporation and farmers were motivated to cultivate improved varieties of Tomato (Pusa Ruby, Pusa early dwarf, Indo-American hybrid), Cowpea (*Arka komal*), Pusa (*katki*) and Okra (*Pusa sawni*).

5.6 Pilot studies on pre-harvest forecasting of yield of sticklac

S. K. Saha, A. K. Jaiswal and B. H. Singh

Data on crop yield and certain biometrical characters collected during the *baisakhi* 1987-88 and *katki* 1988 crop seasons, at various stages of crop growth last year (*Ann. Rep. 1988*), were statistically analysed and the results are furnished below (Tables 15 and 16).

Baisakhi *1987-88 crop*

The yield of sticklac showed positive and significant correlation with certain biometrical characters.

The regression analysis was carried out using following linear models:

Model I: $Y = a_0 + a_1x_1 + a_2x_2 + \ldots + a_n x_n + e$

Model II: $Y = b_0 + b_1 \log x_1 + b_2 \log x_2 + \ldots + b_n \log x_n + e$

Model III: $Y = c_0 + c_1 \sqrt{x_1} + c_2 \sqrt{x_2} + \ldots + c_n \sqrt{x_n} + e$

Model IV: $Y = d_0 + d_1 / x_1 + d_2 / x_2 + \ldots + d_n / x_n + e$

Where Y denotes the yield of sticklac and x_1, x_2 etc. are biometrical characters, namely, number of shoots, density of lac insect etc. and e represents error.

Multiple regression coefficients (R^2) of lac yield on biometrical characters were observed to be highly significant at all the four stages of crop growth studied and with all the models. About 30-38 per cent variation in yield could thus be explained by these biometrical characters, with and without considering the brood lac weight.

Partial regression coefficients of yield on 'number of shoots with lac' were significant with all the models, and on the height of tree, in most cases.

Katki *1988 crop*

The variables considered in this crop were same as in *baisakhi*. In addition, the number of petioles with lac, of each tree, was also included as one of the variables.

The yield of sticklac showed positive and significant correlation, only with the weight of brood lac, number of stumps and number of shoots with lac.

Multiple regression coefficients (R^2) of yield on the biometrical characters were observed to be highly significant at all the four stages of crop growth and with all the models, if the weight of brood lac was considered. About 21-46 per cent variation in yield could be explained by the biometrical characters, when weight of brood lac was also considered.

The multiple regression coefficient (when weight of brood lac was not included) was significant only for the harvesting stage

Table 15 Percentage variation in yield of sticklac due to its affecting characters during various stages of crop growth

Crop	Days after inoculation	Model I		Model II		Model III		Model IV	
		a[1]	b[2]	a	b	a	b	a	b
Baisakhi 1987-88	10-30	36**	36**	35**	34**	36**	35**	31**	31**
	90-120	37**	36**	36**	34**	37**	35**	30**	30**
	121-150	36**	36**	34**	34**	36**	35**	32**	32**
	151-180	38**	37**	37**	36**	38**	37**	32**	32**
Katki '88	10-30	25**	9	25**	9	26**	9	21**	8
	40-60	26**	9	25**	9	26**	9	21**	7
	61-90	28**	10	26**	9	28**	9	21**	7
	91-120	27**	14**	33**	21**	30**	17**	46**	37**

* Significant at 5% level.
** Significant at 1% level.
1. Weight of brood lac included as a variable.
2. Weight of brood lac not included as a variable.

Table 16 Partial regression coefficients of yield of sticklac vs. its affecting characters at 10-30 days stage with linear models

Crop	Variable	Model I		Model II		Model III		Model IV	
		a[1]	b[2]	a	b	a	b	a	b
Baisakhi 1987-88	Height of crown of host tree	0.058 (0.041)	0.073 (0.039)	0.369 (0.249)	0.489* (0.226)	0.280 (0.205)	0.379* (0.190)	-2.932* (1.295)	-3.075* (1.198)
	No. of shoots with lac insects	0.006** (0.002)	0.007** (0.002)	0.319** (0.111)	0.357** (0.107)	0.092** (0.031)	0.104** (0.030)	-10.486* (4.337)	-10.884** (4.109)
Katki - 88	Weight of brood lac used	0.187** (0.042)	-	0.089** (0.020)	-	0.278** (0.062)	-	-0.027** (0.007)	

*, ** Significant at 5% and 1% level respectively.
Figures in parentheses are standard errors.
1. Weight of broodlac included as a variable.
2. Weight of broodlac not included as a variable.

(IV stage) with all the four models. The partial regression coefficient of yield, on only weight of brood lac, was found significant with all the models during different stages of crop growth. But, on number of living lac insects (after 90-120 days of inoculation) it was significant with log and reciprocal models, when weight of brood lac was included and with all the models when weight of brood lac was not considered.

It is to be noted that values of R^2 were very low in the models when weight of brood

lac was not considered. Therefore, it is not advisable to adopt the model without considering the weight of brood lac. Thus, the analysis of data of above crops have indicated that Model I can be adopted for its suitability and simplicity in computation.

The data on biometrical characters and lac yield for *baisakhi* 1988-89 and *katki* 1989 have also been collected and are being analysed.

SUMMARY

DIVISION OF ENTOMOLOGY

Researches Completed

1.4.9 Studies were made on the efficacy of diflubenzuron, a chitin inhibitor, for the control of lac predators. This compound had no adverse effect on one-month-old lac larvae and mature female lac insects. It was also found highly effective against eggs, early-stage and advanced-stage larvae of *Eublemma amabilis*, a major lac predator. Application of diflubenzuron, under microplot field trials, resulted in significant reduction of the major lac predators, *E. amabilis* and *Holcocera pulverea*.

6.1.2 The Meghalaya lac insect has been found reproductively isolated from the insects originating from Bihar, Orissa and Punjab.

Study of crosses between *kusmi* and *rangeeni* strains of the Indian lac insect revealed segregation of *kusmi* and *rangeeni*-type life periods. The melting point of lac produced by individual female lac insects showed moderate intrapopulation and seasonal variance. Study of density of settlement of first instar larvae of *rangeeni*, *kusmi* and Meghalaya lac insects under sub-optimal and excess brood conditions using *Moghania macrophylla* as host, revealed significant differences between them indicating genetic differences for settlement behaviour in these insects.

Researches in Progress

1.1.9 Experiments conducted on *kusum* during the period indicate that for brood lac production, four coupe system using 20 g brood lac per metre shoot length with 2-3 sprays of insecticide(s) was best; for sticklac production, two-coupe system incorporating use of 10 g brood lac per metre shoot length, inoculation of 12-month-old shoots in Jun-Jul, 2-3 sprays of insecticide(s) and complete harvest after two crop seasons was best.

Correlation between total shoot length and certain other attributes of *palas* and *kusum* was studied. A positive correlation was found with respect to number of pruned points and canopy spread in case of *kusum*, and with only the number of pruned points in case of *palas*.

Experiment to find out the brood lac requirement showed that lac yield starts declining with brood rates exceeding 15 g per metre shoot length.

1.2.5 Experiments on the effect of soil application of N, P and K to *bhalia* plants, on some biological attributes of lac insects showed that sticklac yields were better with the application of nitrogen.

1.2.9 Studies on some physical characteristics of certain lac host plants and lac insect attributes showed no relationship between them.

1.2.10 Studies on the *rangeeni* strain of the Indian lac insect confirmed the absence of parthenogenetic reproduction in this insect.

1.3.11 Analysis of inimical parasites emerging from caged samples of twigs bearing *aghani* 1988-89 crop showed that *Tetrastichus purpureus* and *Tachardiaephagus tachardiae* were more abundant than others.

1.3.12 The *jethwi* 1990 crop has been raised to study the mortality of lac insects at different crowding levels.

1.4.3 Evaluation of the insecticides, endosulfan, trichlorofon and thiocyclam (0.025 and 0.05%) showed that they have no deleterious effect on the lac insect. Higher concentration of the insecticide always resulted in better predator suppression with concomitant increase in lac yield.

1.5.8 Evaluation of various lac insect stocks revealed that the Orissa *kusmi* yellow stock is distinct with regard to the life cycle and resin melting point.

1.5.11 Occurrence of heteropycnotic residues, only in nuclei of male lac insects, has been confirmed in certain stocks of these insects.

SECTION OF PLANT SCIENCES

Researches Completed

2.1.2 Double-hedge system of planting of *bhalia* (*M. macrophylla*) accommodating larger number of plants per hectare resulted in 47.1, 44.9 and 20.7 per cent more sticklac yield than square, quincunx and single-hedge systems of planting respectively. The appplication of 20 g urea + 40 g S.S.P/plant yielded 36.4 and 33.6 per cent more sticklac respectively than N and P applied alone. Studies on the weeds in *bhalia* nursery showed that grassy weeds were predominant constituting 90% of the total weed population. Pendimethalin (1.5 kg/ha) and oxadiazon (0.5 kg/ha) were found highly effective in controlling the weeds in *bhalia* nursery.

The plant growth attributes of *bhalia* seedlings were better in nursery beds than in polythene bags of 25x15 cm and 25x10 cm. The period between April 15 and May 7 was found to be most suitable for sowing of *bhalia* seeds in nursery bed.

2.1.3 Out of four fodder grasses grown as intercrops with *bhalia* and *galwang*, Dinanath grass gave the highest fodder yield compared to others. Indirect effect of fertilizer applied to the intercrops, was noticed on the growth of *bhalia* and *galwang* bushes at early stage. Raising of intercrops in the mixed plantation of *bhalia* and *galwang* increased the harvested biomass of these lac hosts and also sticklac yield. The most profitable cropping pattern was, growing sweet potato and/or turmeric and colocacia and/or turmeric at the early and later stages of the development of lac hosts respectively. Growing of Dinanath + turmeric + tapioca as intercrop with *palas* bushes resulted in maximum gross income.

Researches in Progress

2.1.6 Trials on use of lac mud as organic manure for paddy cultivation showed that its performance was at par with FYM. The dose of NPK could be reduced to half by application of lac-mud @ 10t/ha.

2.1.9 Air layers of *kusum* prepared in May-

June showed 36.7% root initiation with the treatment of IAA (50 and 100 ppm). The survival of the air-layers was only 13.3%.

2.2.6 Study on the plant growth attributes of *bhalia* showed 40.8% and 22.4% heritability (in broad sense) for total shoot length/plant and for initial mortality of lac insect, respectively.

Study on the use of different growth hormones for air-layering of *galwang* showed that the treatment of IAA (100 ppm) resulted in root initiation in 60% air-layers. Survival in potted condition was 46.7%.

2.2.7 Out of different varieties of *arhar* (*C. cajan*) screened, maximum of grain yield/plant (39.6 g) was recorded in var. *Bahar*.

F. stricta was evaluated for *katki* and *F. strobilifera* for both *katki* and *aghani* crops of lac and encouraging results were obtained.

2.2.8 Experiments on air-layering of *palas* showed that root initiation was maximum in May. More than 70% of the air-layers showed rooting even without application of hormones. Root initiation was better with the use of hormones.

DIVISION OF CHEMISTRY

Researches Completed

3.1.12 Five compounds, which appeared to be new, were isolated from the oxidative degradation products of shellac, hydrolysed lac and its component acids with nitric acid.

3.2.11 Triazoles, oxadiazoles and thiadiazoles and their sodium salts were prepared from pimelic, suberic, sebacic, azelaic hexadecane-1, 16-dioic acid and undec-2-ene-1,11-dioic acids.

3.4.5 Primer compositions based on dewaxed shellac-double boiled linseed oil and *bhatta* shellac-double boiled linseed oil were prepared and tested for their film properties. These compositions produced smooth, uniform and highly adherent films on ferrous metals. Both air-dried as well as baked films passed the tests for flexibility, scratch hardness and resistance to water, acid and alkali. In regard to corrosion resistance even the baked films showed fine rust spots. The performance of both the compositions was almost similar. Incorporation of corrosion inhibitor in the primer composition did not improve the performance of the film to any appreciable extent.

Suitability of shellac-double boiled linseed oil-polyisocyanate varnish and lac-double boiled linseed oil-epoxy resin varnish as vehicles for the preparation of primer was also studied. Both air-dried and baked films of these primers passed the tests for flexibility, scratch hardness and resistance to water. But in regard to corrosion resistance, only baked films passed the test satisfactorily. These two primer compositions can be used as baking-type primer for painting ferrous metals.

3.4.6 Styrene and lac-linseed oil combinations were reacted in different proportions and the resultant products were tested for chemical resistance and scratch hardness. Compositions prepared based on DL-shellac showed better performance as compared to those based on plain shellac.

3.5.5 Shellac-urea combinations having urea upto 31.5%, on the weight of lac resin, was prepared in the powdered form

which possessed slow-release characteristics. Slow-release lac encapsulated urea granules using paraffin wax as sealant was also prepared.

3.6.3 The air-drying type varnish prepared by curing a blend of shellac and epoxy resin (70: 30) in the solution stage may be used as anti-tracking insulating varnish. It was observed that the tracking index does not depend on the thermal resistance of the films.

Researches in Progress

3.1.9 The intrinsic viscosities of seedlac and its polymers were determined.

3.2.10 Insect-sex pheromone components, methyl 9(Z)-tetradecenoate, 9(Z)-tetradecen-1-ol and its acetate, and 9(Z)-tetradecen-1-al were synthesised from azelaic acid aldehyde, one of the periodate oxidation products of aleuritic acid. Some candidate compounds were again prepared for juvenile hormone activity.

3.2.12 Dimethyl shellolate (m.p. 152-153°C) obtained by esterification of shellolic acid, was fused with caustic potash to get C-15 lactone diacid.

3.2.13 The synthesis of lactone ester through the half ester from methyl ester of azelaic semialdehyde was carried out.

3.2.14 The methyl ester of aleuritic acid was prepared and converted into unsaturated acid for the preparation of organic nitrate.

3.3.11 When shellac was modified with ethyl cellulose and dibutyl phthalate, its acid and hydroxyl values were reduced to 35.7 and 70.9 respectively.

3.3.12 Lac wax, recovered from lac-mud, was reacted with different proportions of urea.

3.4.7 Surface coating properties of the varnish prepared from gummy hydrolysed lac(factory waste) were studied.

3.4.8 Polyester, prepared using shellac, ethylene glycol, and terephthalic acid, was reacted with various Desmodurs to obtain urethane paints. Best results were obtained when Desmodur N was used. Urethane paint formulations based on shellac, prepared earlier, were also tested for weather resistance.

3.6.4 An improved baking-type insulating varnish was developed from the reaction product of shellac, epoxy resin and double-boiled linseed oil. The films of the varnish possessed good drying characteristics, adequate dielectric strength and thermal resistance up to 200°C.

3.8.1 Two pure components were isolated from petroleum ether and methanol extracts of *kusum* bark.

SECTION OF TECHNOLOGY

Researches Completed

4.1.6 (ii) A process for the preparation of dewaxed decolourised lac was standardised which satisfied the IS-16 - 1956 of D_1 grade and ISO/R-56 - 1956 (E).

4.6.1 Cation exchange resin was prepared from shellac using either sulphuric acid, oleum (20%) or chlorosulphonic acid and their cation exchange capacities were found to be 1.0, 4.1 and 5.84 m.eq./g respectively.

Reseaches in Progress

4.2.3 A comparative study was made on the changes in the mechanical properties of filled stock of natural rubber due to the incorporation of shellac and rosin separately and was found that shellac behaved better than rosin.

4.5.1 Lac was modified with alkyd forming materials and black printing ink was prepared.

DIVISION OF EXTENSION

Researches in Progress

5.5 Trial-cum-demonstrations of *rangeeni* lac cultivation were given in the operational research area, which have resulted in several-fold increase in lac yield. Special measures to popularise unconventional lac hosts were also undertaken. Besides, demonstration of agricultural and horticultural crops etc. were also arranged through other organisations.

5.6 Preliminary investigation on the correlation of lac yield and certain parameters pertaining to lac insect and lac host have indicated significant correlation between the former and some of the parameters investigated. About 30-38 and 21-46 per cent of the variation in the lac yield could be explained by the parameters considered, during *baisakhi* 1987-88 and *katki* 1988 crops respectively.

EXTENSION ACTIVITIES

Large scale cultivation of lac at Kundri

Regular technical assistance and guidance were continued to be provided to the Forest Department, Govt. of Bihar in running their Kundri lac farm (13 ha) having 48,945 *palas* trees. During April-May 1989, pruning-cum-*ari* harvesting operations were carried out on 17,276 trees (coupe A) yielding 4,359 kg of sticklac. During July-August, lac from 523 trees was partially harvested yielding 105 kg of brood lac, which was utilised for inoculating 123 trees. During October-November, lac from 14,523 trees of coupe B was harvested yielding 10,618 kg brood lac, of which 8,690 kg was utilised for inoculating 16,500 trees of coupe A.

A view of *palas* plantation at Kundri lac farm

Technical advisory service

During the period, 172 queries received from all over the country regarding lac farming, manufacture of lac and lac-based products, availability of raw materials and machineries, and schemes on lac-based industries were attended to. Advisory services were provided to the visiting industrialists, entrepreneurs, extension workers and government functionaries.

Information was provided to M/s. Bharat Coking Coals Ltd. for introducing lac cultivation under their social obligation programme. M/s. Encee Aromatics Pvt. Ltd., Mettupalayam, Tamil Nadu has taken up production of aleuritic acid with the know-how provided by the Institute. During the period, 50 samples of lac crop were examined for forecasting larval emergence and ascertaining reasons for insect mortality.

A team of scientists of the Institute visited three villages in Purulia, six villages in Bankura (W.B.), nine villages in Raigarh and

Lac growers of Dantia village, Purulia district (W.B.) listening to the scientists about the improved methods of lac cultivation

Scientist explaining the villagers about the selection of brood lac, at Dantia

Sakti (M.P.), and also Bundu, Daltongunj and the Krishi Gram Vikas Kendra at Neori (Bihar) for providing on-the-spot advice and demonstration to the cultivators and processing units.

Publicity

Exhibition stalls were put up in Krishi Melas at Getalsud and Kanke organised by Divyayan Krishi Vigyan Kendra, Ranchi and Birsa Agricultural University, Ranchi respectively. A stall was also put up at the National Tribal Festival, organised by the Bihar Govt. at Morabadi, Ranchi.

Exhibits were also sent for display in International Trade Fair 1989 at New Delhi; R. K. Mission, Morabadi, Ranchi; Department of Entomology, College of Agriculture, Rajendra Nagar, Hyderabad; Agriculture College, Bapatala (A.P.) and Tamil Nadu Agriculture University, Madurai.

Testing activities

The Institute provided testing facilities for lac and lac products to various manufacturers and Govt. organisations. During the period, 328 samples of seed lac, shellac and other lac-based products were analysed.

Training

The following training courses were organised during the period under report :

Course	Beneficiary	No. trained
Six-month certificate course on "Improved methods of lac cultivation"	Nominees from Forest Department of the States of Maharashtra, Orissa and Bihar; a voluntary organisation of Purulia, West Bengal; private candidates.	11
Three-month certificate course on "Industrial uses of lac".	Entrepreneurs	2
One-month course on the manufacture of gasket-shellac compound and insulating varnish.	Candidates sponsored by KVIC, Bombay.	4
Entrepreneurs, training programme on the manufacture of aleuritic acid.	Entrepreneur	1

Lectures were arranged at the Institute for 260 farmers of R. K. Mission, Ranchi, 50 farmers of Jamgoria Sevabrata, Purulia (W.B.) and 51 Range Officers of Balghat (M.P.)

On-the-spot training was given to 41 farmers of Dantia village (West Bengal), 10 farmers of D.V.C., Dhanbad and 710 farmers of Palamau (Bihar).

Production Unit

Lac-coated urea (75 kg) and water-soluble lac (5 kg) were prepared and supplied to C.P.C.R.I., Kasargod and Khadi and Village Industry Commission, Bombay respectively.

Demonstrations were given for the preparation of shellac varnish, air-drying insulating varnish, gasket shellac compound, hydrolysed lac and water-soluble lac to different trainees.

PUBLICATIONS

Research Papers

Agarwal, S. C. and Srivastava, B. C. (1989) Utilisation of aleuritic acid free-gummy hydrolysed lac in surface coatings (Precis paper), *JOCCA*, 72 (12), 491

Banerjee, R. K. and Gupta, P. C. (1989) Aqueous adhesives from Rebulac for metallic surfaces (Precis paper), *JOCCA*, 72, 491

Bhagat, M. L. (1989) Use of certain plants as brood preservers in lac culture, *Indian Shellac* (March), 26

Goswami, D. N. and Kumar, S. (1989) Insulating varnishes from shellac (Precis paper), *JOCCA*, 72 (12), 489

Gupta, P. C., Singh, R., Chatterjea, J. N. and Ghosh, P. K. (1989) A Semi-pilot plant study on utilisation of waste mica (Precis paper) , *JOCCA*, 72, 488

Kumar, P. (1989) Vegetative propagation in *palas* (*Butea monosperma*) through air-layering, *Indian J. of Forestry*, 121 (3), 188-190

Kumar, P. and Sinha, S. S. N. (1989) Gamma rays induced meiotic abnormalities in two cultivars of *Cajanus cajan* and two species of *Moghania*, *Indian J. Forestry*, 12 (2), 122-131

Majee, R. N., Agarwal, S. C., Sengupta, S. C., Mukherjee, S. N. and Chatterjea, J. N. (1989) Improved synthesis of exaltone from aleuritic acid, *Indian Perfumer*, 33 (3), 156-158

Majee, R. N. (1989) Synthesis of thiosemicarbazides, triazoles, thiadiazoles and oxadiazoles, *Curr. Sci.*, 58 (21), 1198

Mukherjee, M., Majee, R. N., Kumar, S. and Mukherjee, S. N. (1989) Column chromatography separation of glyceryl-aleuritates (Precis paper), *JOCCA* 72 (11), 460

Mukherjee, M., Majee, R. N., Kumar, S. and Mukherjee, S. N. (1989) Thin layer chromatography separation of glyceryl aleuritates (Precis paper), *JOCCA*, 72 (11), 461

Prasad, K. M. and Khanna, B. B. (1989) Standardisation of lac wax for industrial uses, *Research and Industry*, 34 (6), 129-131

Prasad, K. M., Prasad, N., Ghosh, A. K. and Khanna, B. B. (1989) Separation of components of laccaic acid by thin layer chromatography (Precis paper), *JOCCA* 72 (11), 459

Prasad, K. M., Prasad, N., Ghosh, A. K. and Khanna, B. B. (1989) Standardisation of lac dye for use as a food colour (Precis paper), *JOCCA*, 72 (11), 459

Patil, P. M. and Khanna, B. B. (1989) Modification of lac, hydrolysed lac and lac-oil combinations with polyisocyanates (Precis paper), *JOCCA*, 72 (12), 491

Prasad, N. and Agarwal, S. C. (1990) A convenient method for isolation of jalaric and aleuritic acids from shellac, *Res. Ind.*, 35, 164-166

Srivastava, B. C. and Agarwal, S. C. (1989) Slow-release lac-2,4-D weedicides, *Pestology*, 13 (9), 5-8

Srivastava, B. C. and Teotia, T. P. S. (1989) Lac-based stickers, *Pestology*, 13 (1), 9-14

Srivastava, B. C. (1989) Solubility parameter of aleuritic acid and its alkyl esters by contribution techniques (Precis paper), *JOCCA*, 72 (12), 491

Papers Presented in Seminar

Kumar, S. and Mishra, R. C. (1989) Lac a lesser known cash crop, *Annam Bahu Kurveet* Souvenir, Sixth National Seminar-cum-Workshop on Krishi Vigyan Kendra, 9-13, September 1989, R. K. Mission Ashram, Ranchi, Bihar, India, pp. 48-52.

Srivastava, B. C., Agarwal, S. C. and Kumar, S. (1989) Products/processes for lac based industry, presented in the seminar on Forest-based industry (Tech-Session-1) organised by Small Industries Service Institute, Cuttack held at Bhubaneswar, August 17.

Pamphlets, Booklets etc. Published by the Institute

Lac - a multipurpose resin (a folder), 6 pp.
A Souvenir on Lac (a booklet), 24 pp.

SEMINARS, SYMPOSIA ETC.

Organised

The Institute organised National Science Day 1989 celebrations during 22-28 February to popularise science. An 'Open Day' was observed on 24 February, especially for school children. About 600 school children were taken around the Institute and explained about various aspects of lac and its cultivation. A film on lac was screened.

A popular lecture on 'Environmental Issues' by Prof. M. A. Mohsin, Dean, Faculty of Agriculture, Birsa Agricultural University, Ranchi was arranged on 28th February. A special publication entitled "A Souvenir on Lac" was also released on that day.

A student viewing a lac insect specimen

Prof. M.A. Mohsin, BAU releasing a booklet entitled 'A Souvenir on Lac' presented by Shri S. Kumar, Director (on his right) on the occasion of National Science Day 1989

Attended by the scientists

Shri S. Kumar, Director and Shri R. C. Mishra, Scientist SG, Incharge, O.R.P. participated in the Sixth National Seminar-cum-Workshop on Krishi Vigyan Kendras held during 9-13 September 1989 at Ramakrishna Mission Ashram, Ranchi, Shri R. C. Mishra presented a paper entitled " Lac a lesser known cash crop" authored by S. Kumar and R. C. Mishra.

Shri R. C. Mishra, Scientist SG, Incharge, O.R.P. participated in Ninth Annual Meeting of Ex-Trainees of Divyayan, Krishi Vigyan Kendra held during 5-6 May 1989 at Ramkrishna Mission Ashram, Ranchi and addressed the trainees on the subject *'Lah utpadan mein takneeki krauti'*.

Shri R. C. Mishra participated in the National Workshop on Extension Management for Tribal Areas held during 21-24 March 1990 at Birsa Agricultural University, Ranchi.

Dr. P. Kumar, Principal Scientist and Head, Section of Plant Sciences attended a training course on " Human Resources Management" from 22nd August to 2nd September 1989 at National Academy of Agricultural Research Management, Hyderabad.

Dr. A. Bhattacharya, Scientist, Entomology Division, participated in the Summer Institute on " Natural Plant Products in the Integrated Pest Management", held at the University of Agricultural Sciences, Bangalore, from 26.06.89 to 15.07.89. The Summer Institute was sponsored by Indian Council of Agricultural Research, New Delhi.

Dr. B. C. Srivastava, Sr. Scientist, Division of Chemistry, attended a Seminar on Forest Based Industry, organised by Small Industries Service Institute, Cuttack held at Bhubaneshwar, Aug. 17, 1989 to present a paper entitled " Products/Processes for Lac-based Industry"

AUXILIARY/SUPPORTING SERVICES

Library

A veiw of the new building of division of Extention and Library.

Library continued to provide information services to the scientists of the institute, research workers/students of the Ranchi University, Birla Institute of Technology, Mesra and other scientific organisations. Free mailing of Institute publications to various research organisations, Universities, entrepreneurs, farmers were continued to keep them informed with the latest development of researches on lac.

In order to provide information to the research workers of the institute about the symposia, seminars and conferences etc., a bulletin entitled " Selected list of forthcoming conferences, seminars, symposia" was prepared and circulated. Details of the library holdings are described below :

Documents	Addition during the period	Total holding
Books, bound volumes	292	19,692
Annual Reports	89	1,741
Reprints, photo-copies , etc.	7	187
Bulletins, Research notes etc.		501

A sum of Rs. 4.52 lakhs was spent on the purchase of scientific periodicals and books during the period. Other details of the library acquisions are :

Particulars	National	International	Total
Number of journals subscribed	66	53	119
Number of journals acquired in exchange or on gratis	24	11	35
Number of research institutes/information centres with whom Institute library maintains exchange relationship	95	15	110

Technical and Monitoring Cell

The Cell convened meetings of the Staff Research Council to review the progress of

ongoing research projects and to examine the new research projects to be undertaken and also prepared the proceedings of the meetings for circulation. Besides, the Cell maintained research project files. Activity milestones of different research projects were also compiled for onward transmission to the Council. Various reports, such as monthly report for the Cabinet, quarterly report for the O.R.P., twenty-point programme, material for DARE report and Research Highlights of ICAR were also compiled. The cell also processed the research papers for forwardal to scientific and popular journals.

Farm Unit

Management and upkeep of the plantation (36.5 ha) and other areas of the institute were continued. Hoeing, weeding and mulching operations were also carried out in different plots of various lac hosts. Seedlings of various species of lac host plants namely, *kusum, palas, ber, galwang* and *bhalia* were raised in the nursery beds for utilisation in research experiments and distribution among the farmers under O.R.P. Pruning and maintenance of various lac host plants in the demonstration plot were done. Lac crop was raised in some of the host plants for display purposes. Foliage and ornamental mother plants were also established and multiplied for beautification. Seedlings of seasonal flowers and ornamental plants were also raised and planted at various locations of the Institute.

A nutrition garden of vegetables and food crops was maintained in the vacant plot near the nursery. The total revenue from the plantation through the sale of vegetables, grass, firewood, ornamental plants etc. was Rs. 5,891.

Maintenance and Workshop

The workshop unit of the institute undertook the maintenance of water and electricity supply lines to the laboratories and the campus, including staff quarters, farm etc. Minor repairs of laboratory and farm equipments and fabrication of parts were also undertaken. Number of different jobs undertaken were: electrical, 682; mechanical and plumbing, 470; welding etc. 180; carpentry, 230; instrument repairing, 246.

Art and Photography

Services in support of research and extension activities were rendered. 313 photographs (colour and black & white), of the various research materials and at different functions of the Institute were taken.

Health Care

A part-time Authorised Medical Attendant visits the Institute to attend to the medical needs of the staff and their dependants, on all working days. He is supported by one Compounder-cum-Stockman and an attendant. During the period 5172 consultations were made by the staff members and their dependants at the ILRI dispensary, eight patients were examined at their residence; 52 patients were referred to medical specialists and RMCH, Ranchi; 1262 bills submitted by the staff were also processed for medical reimbursement.

MISCELLANEA

Important Committees

Management Committee

The Management Committee assists the Director in monitoring the progress of research under various research programmes of the Institute and suggests suitable modifications, new researches etc. It helps in solving the problems related to research and administration. The Committee also helps in formulating the proposals for Annual and Five Year Plans.

The constituent members of the committee were as follows :

1. Sri S. Kumar — Chairman
   Director
   Indian Lac Research Institute
   Namkum, Ranchi
2. Dr A. Alam — Member
   Assistant Director General (Engg.)
   Indian Council of Agric. Res.
   Krishi Bhavan, New Delhi-11000
3. Sri N. M. Prasad — Member
   Chief Conservator of
   Forests, Government of
   India, Ranchi (Bihar)
4. Sri R. N. Mohanty, I.F.S. — Member
   Addl. Chief Conservator of Forests
   Government of Orissa
   Bhubaneswar (Orissa)
5. Dr S. Muhammad — Member
   Dean, Forestry
   Birsa Agricultural University
   Kanke, Ranchi-834 006 (Bihar)
6. (i) Sri Karamjit Singh — Member
   Sangar Villa, Charbagh
   Lucknow 4 (U.P.)

   (ii) Sardar K. S. Bhullar — Member
   Moga-Ferozpur Road
   Ferozpur Cantt. (Punjab)
7. The Accounts Officer — Member
   Jute Technol. Res. Labs.
   Calcutta - 700 040 (W.B.)
8. Dr D. N. Goswami — Member
   Scientist S-2
   I.L.R.I., Namkum, Ranchi
9. Dr B. C. Srivastava — Member
   Scientist S-2
   I.L.R.I., Namkum, Ranchi
10. Dr N. Prasad — Member
    Scientist S-2
    I.L.R.I., Namkum, Ranchi
11. Sri R. Ramani — Member
    Scientist S-2
    I.L.R.I., Namkum, Ranchi
12. Sri S. N. Sharma — Member-Secretary
    Administrative Officer
    I.L.R.I., Namkum, Ranchi

The 15th meeting of the Management Committee was held on 13th and 14th June 1989 at this institute.

Official Language Implementation Committee

The committee was constituted at the Institute on 27.1.1978. The committee continued to provide suggestions for implementation of official language policy and rules and regulations of Govt. of India issued from time to time. During the period under report, the committee met on 20th April, 15th June and 6th December, 1990 and discussed several issues regarding implementation of Hindi language. The Committee comprised of the following members :

Sri S. Kumar, Director	- Chairman
Dr S. K. Saha, Principal Scientist and Head, Division of Extension	- Member
Dr S. C. Agarwal, Principal Scientist and Head, Division of Chemistry	- Member
Dr P. Kumar, Principal Scientist and Head, Section of Plant Sciences	- Member
Dr P. C. Gupta, Sr. Scientist and Head, Section of Technology	- Member
Sri A. H. Naqvi, Scientist S.G. and Head, Division of Entomology	- Member
Sri S. N. Sharma, Administrative Officer	- Member
Sri N. K. Sharma, Farm Supdt.	- Member
Sri Pradeep Kumar, Accounts Officer	- Member
Sri R. P. Tewari, Technical Officer	- Member
Sri R. K. Singh, Asstt. Administrative Officer	- Member
Sri L. Kant, Hindi Officer	- Member
Sri S. K. M. Tripathi, Sr. Technical Officer and I/c Hindi Programme	- Member-Secretary

Sports

The Institute team, comprising of 55 participants, took part in Inter-Institutional Tournament (Zone-III) of I.C.A.R. for the year 1988-89 held at Indian Veterinary Research Institute, Izatnagar, U.P. during 2.3.1989 to 9.3.1989.

Sri N. K. Dey won first prize in Badminton (Singles); Sri Anil Kumar Sinha and Sri C. Kachhap got third prize in high-jump and cycle race (5000 m) respectively.

The Institute team comprising 41 participants took part in Inter-Institutional (Zone-III) Zonal Tournament of (Zone-III) of I.C.A.R. for the year 1989-90 held at Indian Institute of Sugarcane Research, Lucknow, U.P. during the period 11.12.89 to 16.12.89.

Visitors

The Institute continued to attract visitors from the country as well as from abroad. During the period, the Institute received 1,437 visitors which included 964 students, 135 V.I.P's, 11 foreign nationals (from U.K., Uganda, Philippines, Thailand, Vietnam, Venezuela, Indonesia and Bangladesh), educationists, scientists and others. Some of the distinguished visitors were :

Mr R. Venkatesan, Secretary to the Govt. of India.
Mr Alimian, DGM, NABARD, Bombay.
Dr P. K. Majumdar, Ex-Head and Prof. of Horticulture, IARI, New Delhi.
Mr H. G. Sen, Dean (Agriculture), C. S. Azad University of Agriculture, Kanpur.
Mr P. Singh. IFS, Director, Lac Development, Ranchi.
Mr M. R. Challegr, Jt. Director, CASSI, W.B.
Mr N. M. Prasad, Chief Conservator of Forests (Development) Bihar, Ranchi.
Mr M. E. Stone, Manchester, U.K.
Dr S. N. Pandey, Director, J.T.R.L., Calcutta.
Mr Gosco, P.O. Box 7005 KIN, Uganda.
Mr C. R. Molon, Philippines.
Mr Aemprapa, Thailand.
Mr Nguyen Hun Nhan, Vietnam.
Mr F. B. Cupit, Philippines.
Mr Aurea C. Roxas, Cisu Nueva, Ecija, Philippines.
Mr Luis Sierra, Venezuela.

Mr Alwis, Indonesia.
Mr Lutfer Rehman, Bangladesh.
Mr Arnaldo Silva Alvarez, Merida, Venezuela.
Mr M. S. Ali, Bangladesh.
Mr T. E. Krishnan, Divisional Manager, Central Bank, Ranchi.
Sri Devendra K. Sikri, Director, M/O Welfare, Loknayak Bhavan, New Delhi.
Sri B. B. Lal, Manager, Swarnarekha Watch Factory, Ranchi.
Sri S. K. Mishra, G.M., H.T.I.F., Ranchi.
Dr Ram Karan Pal, Vice-Chairman, B.S.I.D.C., Patna.
Dr K. V. Subalmengan, Director (M & E), MANAGE, Hyderabad.

Personnel

i) List of personnel as on 31.3.1990

Director

Sri S. Kumar

Division of Entomology

Head of Division

Sri A.H. Naqvi

Scientist S.G.

Sri R. Ramani (Agric. Entomol.)

Scientist

Sri S. G. Choudhary (Agric. Entomol.)
Dr A. K. Sen "
Sri B. N. Sah "
Dr S. K. Jaipuriar "
Dr A. Bhattacharya "
Sri Y. D. Mishra "
Sri M. L. Bhagat "
Sri K. K. Sharma "

Technical Officer

Sri M. K. Choudhury (T-5)

Field/Farm Technician

Sri A. K. Sahay (T-4)
Sri R. N. Vaidya "
Sri R. D. Pathak (T-1-3)
Sri K. P. Gupta (T-1-3)
Sri H. N. Shukla "
Sri R. L. Ram "
Sri M. L. Rabidas (T-2)
Sri D. K. Singh "
Sri A. K. Sinha "
Sri D. W. Runda (T-1)
Sri P. A. Ansari "

Lab Technician

Sri G. M. Borkar (T-1-3)
Sri S. K. Chatterjee "
Sri Bhola Ram "
Sri Ghanshyam Das "
Sri R. K. Swansi (T-2)

Regional Field Research Station, Dharamjaigarh

Field/Farm Technician

Sri R. S. Maliya (T-II-3)
Sri Jiwan Lal (T-1-3)

Lab Technician

Sri A. Hussain (T-1-3)

Section of Plant Sciences

Head of Section

Dr P. Kumar

Scientist S. G.

Dr B. P. Singh (Agro)

Scientist

Sri S. C. Srivastava (Plant breeding)

Field/Farm Technician

Sri K. A. Nagruar(T-2)

Lab Technician

Sri D. D. Prasad (T-1-3)
Sri Mohan Singh (T-2)

Division of Chemistry

Head of Division

Dr S. C. Agrawal

Principal Scientist

Dr B. B. Khanna (Org. Chem.)

Scientist S. G.

Dr A. Kumar (Phys. Chem.)
Dr D. N. Goswami (Physics)
Dr B. C. Srivastava (Org. Chem.)
Dr N. Prasad "
Dr R. N. Majee "

Scientist Sr. Scale

Dr K. M. Prasad (Org. Chem.)

Scientist

Sri A. K. Dasgupta (Org. Chem.)
Dr M. Mukherjee "
Sri P. M. Patil (Phys. Chem.)
Sri I. Rajendran (Org. Chem.)
Sri P. C. Sarkar "

Technical Officer

Sri B. P. Banerjee (T-5)

Lab Technician

Sri N. K. Dey (T-4)
Sri D. D. Singh "
Sri T. K. Saha "
Sri M. Ekka "
Sri S. N. Sharma "
Sri U. Sahay (T-1-3)
Sri B. P. Keshry "
Sri P. B. Sen (T-2)
Smt. P. Devi "

Glass Blower

Sri B. S. Choudhary (T-1)

Jr. Stenographer

Sri B. K. Rajak

Section of Technology

Head of Section

Dr P. C. Gupta

Scientist S. G.

Dr A. Pandey (Phys. Chem.)

Scientist

Sri R. K. Banerjee (Org. Chem.)
Sri R. Singh (Phys. Chem.)

Technical Officer

Sri M. Islam (T-5)

Lab Technician

Sri K. K. Prasad (T-4)
Sri N. Minz (T-1-3)
Sri M. K. Singh "
Sri Tulsi Ram "

Sr. Mechanic

Sri S. K. Bhaduri (T-4)

Division of Extension

Head of Division

Dr S. K. Saha

Scientist S. G., Incharge, O.R.P.

Sri R. C. Mishra

Scientist

Sri J. Lal (Agric. Entomol.)
Dr A. K. Jaiswal "

Technical Officer

Sri A. K. Ghosh (T-6)
Sri A. Rahman (T-5)
Sri R. C. Maurya "
Sri R. L. Singh "

Publicity Officer (Auxiliary)

Sri Lakhan Ram

Field/Farm Technician

Sri L. C. N. Sahdeo (T-4)
Sri H. Bhengra (T-4)
Sri S. S. Prasad (T-1-3)
Sri K. C. Jain (T-2)
Sri S. B. Azad (T-1)

Lab. Technician

Sri Deepak Ghosh (T-4)
Sri K. M. Singh "
Sri Jagdish Singh "
Sri D. Runda (T-1-3)
Sri B. P. Ghosh (T-2)
Sri J. K. Ambuj (T-1)

Jr. Artist-cum-Photographer

Sri R. P. Srivastava (T-2)

Museum Assistant

Km. R. Dutta (T-1)

Jr. Stenographer

Sri A. K. Sinha

Administrative and Accounts Sections

Administrative Officer
Sri S.N. Sharma

Finance and Accounts Officer
Sri Pradeep Kumar

Assistant Administrative Officer
Sri R. K. Singh

Superindendent
Sri H.S. Munda
Sri D.P. Sengupta

Assistant
Sri Enamul Haque
Sri Md. Samiullah
Sri A. K. Lal
Sri E. Tirkey
Sri N. Mahto
Sri A. K. Chaudhury
Sri A. Haque
Sri S. K. P. Keshri (*ad hoc*)

Sr. Clerk
Sri R. B. Singh
Sri K. D. Pandey
Sri K. N. Sinha
Sri S. Ram
Sri D. Ram
Sri D. N. Mahto (Estate Caretaker)
Smt. Sati Guha
Sri K. L. Choudhury
Sri . R. K. Upadhaya
Sri N. Topno
Sri B. Ram
Sri Md. Mubarak (*ad hoc*)
Sri Ravi Shankar

Sr. Stenographer
Sri R. Rabidas

Junior Stenographer
Smt. S. Prasad

Jr. Clerk
Sri Vijay Ram
Sri Emil Gari
Sri J. P. Srivastava
Sri N. Gope
Sri T. Minz
Sri B. N. Gope
Sri A. Pandey
Sri P. Singh
Sri S. C. Lal
Sri R. N. Mahto
Sri Bihari Sahu
Sri Wilson Guria

Technical and Monitoring Cell

Technical Officer
Sri S.K.M. Tripathi (T-7)
Sri R. Prasad (T-5)

Library

Technical Officer
Sri R. P. Tewari (T-5)

Library Assistant
Sri V. K. Singh (T-4)

Farm Unit

Farm Superintendent
Sri N. K. Sharma (T-6)

Field/Farm Technician
Sri M. A. Ansari (T-1-3)
Sri R. C. Singh (T-1-3)
Sri V. K. Tewari (T-1)

Tractor Driver
Sri M. Surin (T-1-3)

Maintenance and Workshop Unit

Chief Mechanic
Sri S. K. Srivastava (T-4)
Turner
Sri A. S. Manoranjan (T-2)
Instrument Maker
Sri H. L. Bhakta (T-1)

Medical Unit

Authorised Medical Attendant (Part-time)
Dr S. S. Sahay
Stockman-cum-Compounder
Sri C. Pandey (T-3)

Hindi Cell

Hindi Officer
Sri Lakshmi Kant

Transport

Driver
Sri B. Runda (T-2)
Sri M. Khalkho "
Sri Jaswant Tewari (Auxiliary)
Sri Arvind Kumar "
Sri Narayan Lakra "

(ii) Promotions etc. during the period

Promotions

	Promoted to	*Effective form*
Dr A. Panday	Scientist S-2	1.7.85
Sri S. K. Srivastava	Technician T-4	1.7.87
" S. K. Bhaduri	Technician T-4	1.7.87
Smt. P. R. Ghatak*	Technician T-4	1.1.87
Sri Lakshmi Kant	Technician T-4	1.7.87
" G. Das	Technician T-1-3	1.1.87
" Bhola Ram	Technician T-1-3	1.1.86
" Jiwan Lal	Technician T-1-3	1.1.87
" R. K. Swansi	Technician T-2	1.7.87
" Mohan Singh	Technician T-2	1.7.87
" D. K. Singh	Technician T-2	1.7.87
" K. A. Nagruwar	Technician T-2	1.7.87
" A. K. Sinha	Technician T-2	1.7.87
" Mango Khalkho	Technician T-2	1.7.87
" Lakshmi Kant	Hindi Officer	1.12.89
" D. P. Sengupta	Superintendent	21.3.89
" R. P. Singh	Superintendent	21.3.89
" A. K. Choudhury	Assistant	21.3.89
" A. Haque	Assistant	21.3.89
" S. K. P. Keshri	Assistant	10.11.89
" Ravi Sankar	Sr. Clerk	21.3.89
" Budhan Ram	Sr. Clerk	21.3.89
" Md. Mubarak	Sr. Clerk (Adhoc basis)	10.11.89

*She was transferred to J.T.R.L., Calcutta in 1988 but her assessment was done at I.L.R.I. Ranchi during 1989-90.

Transfers

	Transfered to	*Date*
Smt. M. Joardar, Scientist	C.I.C.R., Nagpur	14.3.89.
Smt. Rani Antoni, Scientist	C.P.C.R.I., Kasargod	7.7.89.
Smt. P. Chandrika, Scientist	I.I.H.R., Bangalore	19.8.89.

Retirements

	Designation	*Date*
Sri N. S. Chauhan	Scientist S-3	30.11.89 (voluntary)
" P. K. Choudhury	Superintendent	31.1.89
" P. Das	Commercial Artist (T-4)	31.1.89
" Musafir Singh	Assistant	31.7.89
" R. P. Singh	Assistant	31.1.90
" Chhedilal	Lab. attendant	30.6.89
" Mangra Oraon	Lab. Attendant	19.7.89
Smt. Mundri	*Safaiwali*	28.2.90
Sri Bitan Oraon	*Chowkidar*	31.1.90

Resignation

	Designation	*Date*
Dr M. K. Mishra	Technician T-11-3	1.9.89

Deaths

	Designation	*Date*
Sri Hawaldar Singh	*Chowkidar*	7.5.89
Sri Gandur Singh	*Daftari*	10.11.89
Sri Bandu Mahto	*Beldar*	18.12.89

(iii) Category-wise break-up of number of emplyees and the number of Scheduled Castes and Scheduled Tribes amongst them as on 31.3.1990

Class of post	No. of posts sanctioned	Total No. of employees in position	No. of S.C. employees	No. of S.T. employees
Scientific				
Director	1	1	-	-
Principal Scientist		4	1	-
Scientist S.G.	60	10	-	-
Scientist (Sr. Scale)		1	-	-
Scientist		18	1	-
Total :	61	34	2	-
Technical				
Category III	4	3	-	-
Category II	36	25	-	2
Category I	46	44	5	8
Total :	86	72	5	10
Administrative				
Administrative Officer	1	1	-	-
Finance & Accounts Officer	1	1	-	-
Asst. Admini. Officer	1	1	-	-
Hindi Officer	1	1	-	-
Superintendent	3	2	-	1
Senior Stenographer	1	1	1	-
Junior Stenographer	4	3	1	1
Assistant	8	8	1	1
Senior Clerk	13	13	1	2
Junior Clerk	16	12	-	3
Total :	49	43	4	8
Auxiliary				
Class I	2	1	1	-
Class II	1	-	-	-
Class III	11	3	-	1
Total :	14	4	1	1
Supporting IV	11	7	1	-
Supporting III	18	18	5	8
Supporting II	36	35	4	17
Supporting I	71	50	6	22
Total :	136	110	16	47
Grand Total :	346	264	28	66

Meteorological Data

Month	Mean barometric pressure (mm)	Mean Maximum temperature (°C)	Mean Minimum temperature (°C)	Mean dry bulb temperature (°C)	Mean wet bulb temperature (°C)	Mean humidity (%)	Total Rain fall (mm)	Highest Maximum temperature (°C)	Lowest Minimum temperature (°C)
1989									
January	707.69	23.58	6.26	20.01	15.04	57.70	2.6	27.5	3.3
February	707.08	28.53	9.20	24.69	21.21	70.42	Nil	30.5	6.6
March	706.55	31.32	13.81	26.79	21.50	62.63	Nil	35.0	10.5
April	703.11	37.30	19.80	34.35	26.95	52.33	Nil	41.0	11.6
May	700.53	36.85	21.75	33.32	27.30	61.67	70.8	42.5	18.3
June	699.13	32.35	22.71	30.08	26.43	76.56	336.8	39.0	17.7
July	700.01	30.08	22.59	28.11	26.17	82.12	295.8	32.0	21.6
August	699.72	29.35	22.51	27.75	25.32	81.77	350.4	31.0	21.1
September	700.95	30.33	21.76	28.78	26.46	82.00	244.4	31.5	20.5
October	703.88	30.04	17.66	28.19	25.46	79.51	161.8	32.0	13.3
November	708.06	28.33	10.67	25.28	19.56	57.70	7.6	30.5	8.8
December	709.51	23.87	7.76	20.98	16.96	65.80	22.6	25.5	5.5
1990									
January	708.40	25.64	5.99	20.93	18.11	75.51	Nil	27.0	5.5
February	701.61	28.92	11.73	22.21	18.73	71.11	Nil	31.0	9.4
March	705.72	33.96	15.98	24.76	20.83	68.29	Nil	36.5	13.3

The highest maximum temperature	:	42.5°C on 12th May 1989
The lowest minimum temperature	:	3.3°C on 13th January 1989
Total rainfall during the above period	:	1492.8 mm
Monsoon rainfall	:	1227.4 mm (June - September)
Hailstorms	:	13th May 1989 and 5th June 1989.

वार्षिक प्रतिवेदन 1989 - 90

(संक्षिप्त)

भारत में लाख उद्योग की स्थिति की जाँच एवं इसमें बहुमुखी उपयोग हेतु सुधार लाने के लिए, भारत सरकार द्वारा गठित जाँच समिति की अनुशंसा पर, 1925 में भारतीय लाख अनुसंधान संस्थान (भा० ला० अ० सं०) की स्थापना की गई।

भारतीय लाख अनुसंधान संस्थान, राँची टाटा नगर राष्ट्रीय राजमार्ग पर राँची नगर के पूरब दिशा में 9 कि० मी० की दूरी पर एक शांतिमय उपनगर नामकुम में अवस्थित है। मुख्य परिक्षेत्र में कीट विज्ञान, रसायन विज्ञान, पादप विज्ञान, प्रसार विभाग की प्रयोगशालायें, पुस्तकालय तथा प्रशासनिक, लेखा परीक्षा एवं खाता, यांत्रिकी अनुभाग एवं आवासगृह स्थित है। मुख्य परिक्षेत्र के निकट ही एक अन्य परिक्षेत्र भी है, जिसमें प्रौद्योगिकी प्रयोगशाला एवं आवास गृह स्थित हैं।

दोनों क्षेत्रों के साथ ही 36.5 हेक्टेयर का एक बगान है जिसका प्रयोग अनुसंधान संबंधी क्षेत्रीय परीक्षणों हेतु होता है। संस्थान का एक क्षेत्रीय अनुसंधान केन्द्र वर्तमान में धरमजयगढ़ (म० प्र०) में स्थित है। इसके अतिरिक्त संस्थान द्वारा चलाई जा रही एक संक्रियात्मक अनुसंधान परियोजना भी राँची जनपद के कुछ ग्रामों में कार्यरत है।

यह संस्थान देश का एक महत्वपूर्ण अनुसंधान संस्थान है, जिसमें लाख की खेती, परिष्करण और उपयोग संबंधी अनुसंधान कार्य हो रहे हैं। लाख की खेती अधिकांशतः जनजातियों द्वारा देश के लगभग 80,900 वर्ग कि० मी० क्षेत्र में की जाती है। यह बिहार और इसके निकटवर्ती राज्यों मध्यप्रदेश, उड़ीसा, उत्तर प्रदेश और पश्चिम बंगाल में प्रमुख रूप से पैदा की जाती है। संस्थान ने प्रारंभ से ही लाख के उत्पादन शुद्धीकरण एवं उपयोग के क्षेत्र में उल्लेखनीय योगदान दिया है।

संस्थान के वैज्ञानिकों द्वारा अधिक एवं अच्छे किस्म की लाख उत्पादन के लिए उन्नत विधियाँ विकसित की गई हैं। इसके अतिरिक्त लाख के बहुमुखी उपयोग हेतु वैज्ञानिकों ने अनेक उपलब्धियाँ भी अर्जित की हैं। इस दिशा में सतत् प्रयास अब भी जारी है ताकि बदलती हुई परिस्थितियों में लाख के उत्पादन हेतु उन्नत तरीके तथा लाख के नये उपयोग विकसित किये जा सकें। लाख के कीट विज्ञान एवं रसायन के क्षेत्र में भारतीय लाख अनुसंधान संस्थान ने अंतर्राष्ट्रीय ख्याति अर्जित की है।

उद्देश्य

संस्थान के मुख्य उद्देश्य निम्नलिखित हैं:

★ लाख की खेती, शुद्धीकरण एवं मानकीकरण के क्षेत्र में सुधार लाने हेतु अनुसंधान कार्य करना तथा लाख की रासायनिक संरचना एवं संशोधित उत्पादों का अध्ययन करना ताकि लाख के उत्पादन एवं उपयोगिता के क्षेत्रों में वृद्धि की जा सके।

★ शोध कार्यों के परिणामों का प्रचार एवं प्रसार तथा उत्पादकों के साथ सम्पर्क सूत्र बनाये रखना एवं उन्हें तकनीकी सेवायें उपलब्ध कराना। लाख उद्योग इकाइयों द्वारा लाख की गुणवता और उपयोगिता में सुधार लाने हेतु संपर्क सूत्र रखना।

★ लाख की उन्नत तरीकों द्वारा खेती और औद्योगिक उपयोग विषयों पर प्रशिक्षण उपलब्ध कराना।

संगठनात्मक व्यवस्था

संस्थान के प्रधान निदेशक हैं, तथा वैज्ञानिकगण, रसायन शास्त्र, कीट विज्ञान और प्रसार विभागों एवं पादप विज्ञान तथा प्रौद्योगिकी अनुभागों में आवंटित है। प्रशासनिक खण्ड में प्रशासन अनुभाग, लेखा परीक्षा एवं खाता अनुभाग तथा केन्द्रीय भंडार हैं तथा सहायक इकाइयों के अंतर्गत, सुरक्षा, चिकित्सा तथा संपदा अनुरक्षण सेवायें उपलब्ध हैं। तकनीकी सहयोग हेतु पुस्तकालय, यांत्रिक कार्यशाला तथा तकनीकी एवं मानीटरिंग इकाइयां कार्यरत हैं।

स्टाफ एवं बजट

संस्थान में 61 वैज्ञानिक, 86 तकनीकी, 49 प्रशासकीय, 14 सहायक तथा 136 चतुर्थ वर्गीय स्तर के पद स्वीकृत हैं।

वर्ष 1989-90 की अवधि में गैर योजना मद में बजट अनुमान रु० 105.95 लाख था जबकि खर्च रु० 110.2 लाख हुआ। योजनामद में बजट अनुमान रु० 53.0 लाख के अंतर्गत रु० 26.25 लाख खर्च हुआ।

अनुसंधान की मुख्य उपलब्धियाँ

लाख के परभक्षियों का कीट वृद्धि नियंत्रकों द्वारा नियंत्रण

कीट वृद्धि नियंत्रक डाइफ्लूबेनज्यूरोन को, लेपीडोप्टेरस लाख परभक्षियों (यूब्लेम्मा एमाबिलिस तथा होल्कोसेरा पल्वेरिया) के दमन में प्रभावशाली पाया गया है। डाइफ्लूबेनज्यूरोन का लाख कीट पर कोई प्रतिकूल प्रभाव नहीं पड़ता है, अतः इस रसायन का प्रयोग लाखनाशी प्रबंधन में उपयोगी हो सकता है।

भालिया के पौध उगाने की तकनीक

पोलीथीन के थैले में उगाये गये भालिया पौधों की तुलना में क्यारी में उगाये गये पौधों के वृद्धि गुण बेहतर पाये गये । 15 अप्रैल से 7 मई के बीच बीज की बोआई पौधा उगाने के लिए सर्वाधिक उपयुक्त पाया गया। भालिया की क्यारियों में प्रयोग किये गये छः खरपतवार नाशक में से पेण्डीमेथालीन (0.5 कि० ग्रा०/हे०) एवं औक्साडाएजोन (0.5 कि० ग्रा०/हे०) को अन्य की तुलना में खरपतवार नियंत्रण हेतु अधिक प्रभावशाली पाया गया।

नवीन लाख परिपालक

फलेमिन्जिया स्ट्रोविलीफेरा और फलेमिन्जिया स्ट्रिक्टा को कुसमी लाख पैदा करने हेतु संतोषप्रद पाया गया।

एल्यूरिटीक अम्ल से जैव सक्रिय यौगिकों का संश्लेषण

एल्यूरिटीक अम्ल से तैयार किया गया थैप्सिक अम्ल (हेक्जाडीसीन-1-16- डायाइक अम्ल) का वीस हेटरोसाईक्लिक यौगिकों, आक्साडायाजोल, थायाडायाजोल और ट्रायाजोल से संश्लेषण कराया गया।

चपड़ा आधारित नयी विद्युत रोधी वार्निश

साधारण चपड़ा, डबल बॉयल्ड लीनसीड तैल एवं इपोक्सी रेजिन पर आधारित एक उच्च ताप अवरोधक विद्युत रोधी वार्निश तैयार किया गया। इस वार्निश में सूखने का गुण बहुत अच्छा है एवं थिनर के साथ अच्छी सुसंगतता है। भर्जित फिल्म में 27 से0, 200 से0 एवं 48 घंटे पानी में डुबाने के पश्चात क्रमशः 88, 44 एवं 48 के० वी० प्रति एम० एम० डाइइलेक्ट्रिक शक्ति पाई गई।

प्रसार उपलब्धियाँ

नियमित प्रसार गतिविधियों के अतिरिक्त वैज्ञानिकों के एक समूह को म० प्र०, बिहार एवं प० बंगाल के विभिन्न लाख उत्पादक ग्रामों में किसानों एवं लाख उद्यमियों को लाख संबंधी जानकारी हेतु भेजा गया।

बिहार सरकार के बन विभाग द्वारा कुन्दरी (पलामू जिला) में बड़े पैमाने पर लाख की खेती के लिए संस्थान द्वारा तकनीकी सलाह उपलब्ध कराया गया जिसके फलस्वरुप उन्हें लगभग रु० 27,700 की आमदनी प्राप्त हुई।

वैज्ञानिक प्रकाशन

वर्ष 1989-90 की अवधि में अनुसंधान लेख 20, सेमिनार पेपर 2 एवं 2 उपयोगी प्रकाशन किये गये।

विभिन्न विभागों/अनुभागों में किए गए अनुसंधान के सारांश

कीट विज्ञान विभाग

सम्पूरित अनुसंधान

1.4.9 लाख के घातक कीड़ों के नियंत्रण हेतु डाइफल्यूबेनजुरान (एक काइटिन निरोधक) की क्षमता का अध्ययन किया गया। इस यौगिक का प्रतिकूल प्रभाव एक माह के लाख पिल्लू एवं परिपक्व मादा कीट के ऊपर नहीं पाया गया। इसका अत्यधिक प्रभाव सफेद तितली (यूप्लेमा एमाविलिस) के अंडे प्रारंभिक तथा विकसित पिल्लू पर देखा गया। माइक्रोप्लाट फील्ड ट्रायल के अंतर्गत डाइफल्यूबेनजुरान के प्रयोग से लाख परभक्षी सफेद तितली (यूप्लेमा एमाविलिस) और भूरी तितली (हल्कोसेरा पल्वेरिया) में सार्थक ह्रास पाया गया।

6.1.2 मेघालय का लाख कीट, बिहार, उड़ीसा एवं पंजाब के लाख कीटों से प्रजनन में भिन्न पाया गया। भारतीय लाख कीट के कुसमी और रंगीनी प्रभेदों के बीच क्रास करने से कुसमी और रंगीनी प्रभेदों के जीवनकाल के विसंयोजन का पता चलता है। प्रत्येक मादा लाख कीटों द्वारा पैदा किये गए लाख का द्रवणांक साधारणतया कीटों की संख्या और मौसमी विभिन्नता पर निर्भर करता है।

रंगीनी, कुसमी और मेघालय लाख कीट के प्रथम इन्स्टार पिल्लूओं के सघनता की व्यवस्था का अध्ययन भालिया पौधा के ऊपर सामान्य से कम और अधिक बीहन लाख का प्रयोग कर दिया गया। इन लाख कीटों में आपस में सार्थक विभिन्नता पाई गई जिससे व्यवस्थापन व्यवहार के लिए आनुवांशिक विभिन्नता का संकेत मिलता है।

क्रियमाण अनुसंधान

1.1.9 कुसुम पर चार खंड प्रणाली के अंतर्गत किए गए प्रयोग में प्रति मीटर तने की लम्बाई पर 20 ग्राम बीहन लाख का उपयोग एवं दो से तीन बार कीटनाशी दवा का छिड़काव, बीहन लाख उत्पादन हेतु उत्तम पाया गया है। कच्ची लाख उत्पादन के लिए दो खंड प्रणाली में प्रति मीटर तने की लम्बाई पर 10 ग्राम बीहन लाख का उपयोग, एक वर्ष पुराने

तने पर जून-जुलाई में संरोपन तथा तीन बार कीटनाशी दवा का छिड़काव तथा लाख की पूर्ण कटाई, दो फसल बाद सबसे उत्तम पाया गया है।

पलास और कुसुम के कुल तने की टहनियों की लम्बाई तथा कुछ अन्य गुणों के बीच सह संबंध का अध्ययन किया गया। कुसुम में छांटे गए बिन्दुओं की संख्या और फैले हुए बितान तथा पलास में सिर्फ छांटे गए बिन्दुओं की संख्या में सकारात्मक सह संबंध पाया गया।

बीहन लाख की आवश्यकता की जानकारी के लिए किए गए प्रयोग से ज्ञात हुआ कि प्रति मीटर तने की लम्बाई पर 15 ग्राम से अधिक बीहन लाख की मात्रा बढ़ाने से लाख उत्पादन में गिरावट होने लगती है।

1.2.5 भालिया के पौधों में नेत्रजन, फासफोरस और पोटाश का प्रयोग कर उनका प्रभाव लाख कीट के जैविक गुणों पर देखने से ज्ञात हुआ कि नेत्रजन के उपयोग से लाख की फसल अच्छी हुई।

1.2.9 कुछ लाख परिपालकों के भौतिक गुणों और लाख कीट के गुणों पर किए गए अध्ययन से ज्ञात हुआ है कि उनमें आपस में कोई संबंध नहीं है।

1.2.10 भारतीय लाख कीटों के रंगीनी प्रभेद पर किए गए अध्ययन से इसमें अनिषेक प्रजनन, नहीं होने की पुष्टि होती है।

1.3.11 अगहनी 1988-89 फसल के पिजड़े में बंद टहनियों के नमूनों से निकले शत्रु परजीवी के विश्लेषण से ज्ञात हुआ कि टेट्रास्टीकस परप्यूरियस एवं टेकार्डीफेगस टेकार्डी अन्य की अपेक्षा ज्यादा बाहुल्य में थे।

1.3.12 लाख कीट की मरणशीलता, विभिन्न साधन स्तरों पर अध्ययन हेतु जेठवी 1990 फसल उगाई गई है।

1.4.3 इण्डोसल्फान, ट्राइक्लोरोफॉर्म और थायोसाइक्लैम (0.025 एवं 0.05 प्रतिशत) कीटनाशी के मूल्यांकन से ज्ञात हुआ कि उनका हानिकारक प्रभाव लाख कीट पर नहीं है। कीटनाशी के उच्च सान्द्रण के उपयोग से हमेशा लाख परभक्षी के बेहतर उन्मूलन के साथ लाख फसल में भी सहगामी बढ़ोत्तरी पाई गई।

1.5.8 विभिन्न लाख कीट स्टाक के मूल्यांकन से ज्ञात हुआ कि उड़ीसा कुसमी पीला स्टाक, जीवन चक्र और लाख रेजिन के द्रवणांक के लिहाज से सर्वथा भिन्न है।

1.5.11 लाख कीटों के कुछ स्टाक में केवल नर लाख कीटों के नाभिक में हेटरोपिक्नोटिक अवशेष के उपस्थिति की पुष्टि की गई।

पादप विज्ञान अनुभाग

सम्पूरित अनुसंधान

2.1.2 भालिया (एम० मैक्रोफाइला) की दोहरी झाड़ रोपण पद्धति में प्रति हेक्टेयर अधिक पौधे समायोजित होते हैं, परिणामस्वरूप इस पद्धति में वर्ग, पंचक (क्वीकंस) तथा एकल झाड़ पद्धति की तुलना में क्रमशः 47.1, 44.9 तथा 20.9 प्रतिशत अधिक लाख का उत्पादन हुआ। भालिया के पौधों में एन० (नेत्रजन) एवं पी० (फास्फेट) अलग-अलग देने की अपेक्षा 20 ग्राम यूरिया जोड़ 40 ग्राम एस०एस०पी० मिलाकर देने से उनकी तुलना में क्रमशः 36.4 और 33.6 प्रतिशत अधिक लाख का उत्पादन हुआ।

भालिया के पौधशाला में खरपतवार नियंत्रण संबंधित अध्ययन से पता चला है कि शस्य पूर्ण तृण की मात्रा सम्पूर्ण घास-पात का लगभग 90 प्रतिशत था। भालिया के पौधशाला में अपतृण-नाशी, पेन्डीमेथालीन (1.5 किलोग्राम प्रति हेक्टेयर) और औक्साडाइजिन (0.5 किलोग्राम प्रति हेक्टेयर) का प्रयोग घास-पात रोकथाम में उपयोगी पाया गया।

पोलीथीन की थैली (25x15 एवं 15x10 से० मी०) की अपेक्षा पौधशाला में भालिया का पौधा उगाने पर उनकी पौध गुण वृद्धि में बेहतर परिणाम पाये गये। भालिया के बीज को नर्सरी में लगाने का समय 15 अप्रैल से 7 मई तक उपयुक्त पाया गया।

2.1.3 भालिया एवं गलवांग के मिश्रित बगान के बीच अन्तः फसल के रूप में लिए गये 4 चारा घासों में दीनानाथ घास की उपज अन्य घासों की तुलना में अत्यधिक पायी गयी तथा अन्तः फसल को दिये गये खाद एवं उर्वरक का अप्रत्यक्ष प्रभाव भालिया एवं गलवांग के झाड़ियों की प्रारम्भिक अवस्था में वृद्धि पर देखा गया।

भालिया एवं गलवांग के मिश्रित बगान में अन्तः फसल लेने से लाख परिपालकों के जैवमात्रा (बायोमास) तथा छीली लाख की उपज में भी वृद्धि पायी गयी। इन लाख परिपालकों के बीच प्रारंम्भिक अवस्था में शकरकंद या हल्दी और बाद के वर्षों में कच्चू या हल्दी की पैदावार अन्तः फसल के रूप में लाभदायक सिद्ध हुआ है। पलास के झाड़ियों के बीच दीनानाथ जोड़ हल्दी जोड़ टैपियोका, अन्तः फसल के रूप में लेने से अत्यधिक आमदनी हुई।

क्रियमाण अनुसंधान

2.1.6 "लैक मड" को कार्बनिक खाद के रूप में धान पर

प्रयोग किया गया, जिसका प्रभाव गोबर खाद के अनुरूप पाया गया। इसका (लैक मड) उपयोग दस टन प्रति हेक्टेयर की दर से करने पर एन० पी० के० (नेत्रजन, स्फूर एवं पोटाश) की अनुशंसित मात्रा को आधी की जा सकती है।

2.1.9 कुसुम पर मई-जून माह में गूटी बांधने (एयर लेयरिंग) तथा उन्हें आई० ए० ए० (50 और 100 पी०पी०एम०) से उपचारित करने पर 36.7 प्रतिशत गूटियों में जड़ निकला पाया गया जिनमें से सिर्फ 13.3 प्रतिशत पौधे (गूटी द्वारा लगाए गए) जीवित पाए गए।

2.2.6 भालिया में पौध-गुण-वृद्धि के अध्ययन से पता चलता है कि प्रति पौधा टहनियों की कुल लम्बाई और प्रारंम्भिक अवस्था में लाख कीट की मृत्यु दर क्रमशः 40.8 तथा 22.4 प्रतिशत वंशानुगत है।

गलवांग में गूटी बांधने हेतु विभिन्न वृद्धि हारमोनों के उपयोग पर किए गए अध्ययन से ज्ञात हुआ है कि आइ० ए० ए० (100 पी० पी० एम०) के उपचार से 60 प्रतिशत गूटियों में जड़ निकलना आरम्भ होता है परंतु इन गूटियों (एयर लेयर्स) को गमलों में लगाने पर सिर्फ 46.7 प्रतिशत ही जीवित पाए गए।

2.2.7 अरहर (कैजनस कजान) के विभिन्न किस्मों की बुआई जुलाई माह में की गयी। इन पौधों पर नवम्बर माह में बैशाखी 1989-90 फसल के लिए बीहन लाख लगाया गया।

एफ० स्ट्रिक्टा को सिर्फ कतकी एवं एफ० एस्ट्रोबिलिफेरा को कतकी और अगहनी लाख की दोनों फसलों के लिए मूल्यांकन किया गया जिसका परिणाम उत्साहवर्धक प्राप्त हुआ।

2.2.8 पलास पर गूटी बांधने के लिए किए गए प्रयोगों से ज्ञात हुआ कि मई माह में गूटी बांधने से सर्वाधिक जड़ निकलने की प्रतिक्रिया आरम्भ होती है। हारमोन के प्रयोग से सर्वाधिक शत प्रतिशत गूटियों में जड़ निकलने की प्रक्रिया पाई गयी। बिना हारमोनों के प्रयोग से भी 70 प्रतिशत से भी अधिक गूटियों में जड़ निकलते पाये गये।

रसायन विभाग

सम्पूरित अनुसंधान

3.1.12 चपड़ा, जलांशित लाख तथा उनके अवयवी अम्लों पर नाइट्रिक अम्ल के ऑक्सीकरण प्रतिक्रिया से प्राप्त अपघटित पदार्थो, पाँच यौगिक पृथक किए गए।

3.2.11 पाइमेलिक, सुवेरिक, सिवासीक, एजेलिक, हेक्साडीकेन-1, 16-डाइओइक तथा अन्डेक-2-इन-1, 11-डाइओइक अम्लों से ट्रायजोल, आक्सीडाइजोल, थाइडाइजोल और उनके सोडियम लवण तैयार किए गए।

3.4.5 मोम रहित चपड़ा और भट्टा चपड़ा प्रत्येक से तीसी तेल (डबल वायॅल्ड) के साथ रासायनिक अभिक्रिया करके प्रारंभिक संयोजन बनाये गये और इनके सतह लेपण गुणों का अध्ययन किया गया। ये दोनों संयोजन लौह-धातु सतह पर चिकने, एकरूप एवं उच्च आसंजनशील फिल्म बनाते हैं। हवा में सुखाये गये या भर्जित, दोनों फिल्में लचीलापन, खरोंचरोधी तथा जल, अम्ल एवं क्षार प्रतिरोध परीक्षाओं में सभी सही पाये गये। संक्षारण प्रतिरोध परीक्षा करने पर भर्जित फिल्मों में भी जंग लगने के स्पष्ट चिह्न दिखाई दिये। दोनों संयोजनों का प्रदर्शन लगभग एक जैसा ही पाया गया। संक्षारण निरोधक को प्रारंभक संयोजनो में मिलाने पर भी फिल्म के प्रदर्शन में पर्याप्त स्तर तक सुधार नहीं पाया गया।

चपड़ा-तीसी तेल (डबल बॉयल्ड) — पोलीआइसोसायनेट एवं चपड़ा-तीसी तेल (डबल वॉयल्ड) — एपोक्सी रेज़िन से बने वार्निश, जिनका प्रारंभक बनाने के लिए वाहन के रूप में उपयोग हुआ, का भी अध्ययन किया गया। इन प्रारंभकों से बने हवा में सूखाये अथवा भर्जित दोनों फिल्में लचीलापन, खरोंचरोधी तथा जल प्रतिरोध परीक्षाओं में सही पाये गये। परन्तु संक्षारण प्रतिरोध जाँच करने पर केवल भर्जित फिल्में ही परीक्षण में संतोषजनक पाये गये। अतः लौह धातु सतह को रंगने के लिए इन दोनों प्रारंभकों का उपयोग किया जा सकता है।

3.4.6 विभिन्न अनुपातों में स्टाईरीन और लाख-अलसी तेल संयुक्त पदार्थ को लेकर प्रतिक्रिया कराया गया तथा प्रतिफलित पदार्थ के रासायनिक सहिष्णुता एवं खरोंच-कठोरता गुणों के अध्ययन से ज्ञात हुआ कि साधारण लाख की अपेक्षा मोमरहित लाख से प्राप्त प्रतिफलित पदार्थ के गुण अच्छे हैं।

3.5.5 लाख-यूरिया का एक संयोजन, जिनमें यूरिया की मात्रा लाख रॉल के भार का 31.5 प्रतिशत तक था, चूर्ण के रूप में बनाया गया और उसमें धीमी गति से मुक्त होने की विशेषताएँ पाई गई। धीमी गति से मुक्त होने वाले लाख संपुटित यूरिया के दाने भी बनाये गये जिसमें पैराफीन मोम का सीलेन्ट के रूप में प्रयोग किया गया।

3.6.3 चपड़ा और एपोक्सी रेजिन के संमिश्रण (70:30) का घोल की अवस्था में संसाधन करके हवा में सूखनेवाला एक वार्निश बनाया गया जिसको विद्युत प्रतिरोधन वार्निश की तरह उपयोग में लाया जा सकता है। ऐसा देखा गया कि रोधन सूचक का मान फिल्म के तापीय सहिष्णुता पर निर्भर नहीं करता है।

क्रियमाण अनुसंधान

3.1.9 चौरी लाख और उससे बने बहुलकों के अंतरंग-श्यानता मान ज्ञात किये गये।

3.2.10 एजेलिक अल्डीहाइड, जो एल्यूरिटिक अम्ल पर आयोडेट द्वारा आक्सीकरण से प्राप्त प्रतिफलित पदार्थों में एक है, का उपयोग करके कीट-लिंग फीरोमोन जैसे मीथाइल 9 (जेड)- टेट्राडेसीनोएट, 9 (जेड)-टेट्राडेसीन-1- ओल और इसका एसीटेट तथा 9 (जेड)-टेट्राडेसीन-1- एल संश्लेषित किये गये। जुवेनाइल हारमोन सक्रियता के लिए कुछ संभावित यौगिकों को फिर से तैयार किया गया।

3.2.12 सी-15 लैक्टोन डाइ अम्ल प्राप्त करने के लिए शैलोलिक अम्ल के एस्टरीकरण से प्राप्त डाइमिथाइल शैलोलेट (द्रवणांक 152-153 से०) में कास्टिक पोटाश मिलाकर संगलित किया गया।

3.2.13 एजेलिक सेमी अल्डीहाइड के मिथाइल एस्टर से हाफ एस्टर बनाते हुए लैक्टोन का संश्लेषण किया गया।

3.2.14 कार्बनिक नाइट्रेट बनाने के लिए एल्यूरिटिक अम्ल का मिथाइल एस्टर बनाकर इसे असंतृप्त अम्ल में परिवर्तित किया गया।

3.3.11 यह देखा गया कि चपड़ा को इथाइल सेल्युलोज और डाइब्यूटाइल थैलेट से रूपान्तरित करने पर इसका अम्ल मान एवं हाइड्राक्सील मान घटकर क्रमशः 35.7 तथा 70.9 रह जाता है।

3.3.12 "लैक मड" से प्राप्त मोम को यूरिया की अलग-अलग मात्रा से अभिक्रिया कराया गया।

3.4.7 लसलसा जलांशित लाख (कारखाने का कचड़ा) से बनाये गये वार्निश के सतह-लेपन गुणों का अध्ययन किया गया।

3.4.8 यूरिथेन पेन्ट बनाने के लिए चपड़ा, इथीलीन ग्लाइकोल और टेरथैलीक अम्ल के उपयोग से प्राप्त पोलीएस्टर को विभिन्न डेस्मोडूर से प्रतिक्रिया कराया गया। डेस्मोडूर "एन" का उपयोग करने से सबसे अच्छा परिणाम पाया गया । चपड़ा का उपयोग करके पहले बनाये गये यूरिथेन पेन्ट का मौसम सहिष्णुता अध्ययन भी किया गया।

3.6.4 चपड़ा, एपोक्सी-रेजीन और डबल बॉयल्ड अलसी तेल के प्रतिक्रिया से प्राप्त प्रतिफलित पदार्थ से एक समुन्नत, भर्जित किस्म का विद्युत रोधन वार्निश तैयार किया गया। वार्निश से प्राप्त फिल्म में जल्द सुखाने के अच्छे गुण, पर्याप्त परावैद्युत शक्ति और 200 से० तक तापीय सहिष्णुता पाये गये।

3.8.1 कुसुम की छाल से पेट्रोलियम ईथर और मिथानोल द्वारा निकाले गये अर्क से दो शुद्ध अवयवों को अलग किया गया।

प्रौद्योगिकी अनुभाग

सम्पूरित अनुसंधान

4.1.6 (ii) मोमरहित रंगहीन लाख का उत्पादन करने के लिए एक विधि मानकीकृत की गयी है जो भा० मा०—16-1956 (डी० ग्रेड) और भा० मा० स०/आर— 1956(ई) के अनुरुप है।

4.6.1 चपड़ा पर गंधकाम्ल, ओलियम (20 प्रतिशत) तथा क्लोरोसल्फोनिक अम्ल के अलग-अलग प्रतिक्रिया से धनायन विनिमयक रॉल तैयार किया गया और उसकी घनायन विनिमयक क्षमता क्रमशः 1.0, 4.1 और 5.84 अणु-समतुल्य/ग्राम पायी गयी।

क्रियमाण अनुसंधान

4.2.3 फीलर-युक्त प्राकृतिक रबड़ में चपड़ा तथा रोजिन से अलग-अलग समावेशन कराकर उसके यांत्रिक गुणों में परिवर्तन का तुलनात्मक अध्ययन किया गया और यह पाया गया कि रोजिन की अपेक्षा चपड़ा अच्छा कार्य करता है।

4.5.1 एल्फीड बनाने वाले रासायनिक पदार्थों से लाख को परिवर्तित कर मुद्रण स्याही (काला रंग) तैयार की गयी।

प्रसार विभाग

क्रियमाण अनुसंधान

5.5 संक्रियात्मक अनुसंधान क्षेत्र में रंगीनी लाख की खेती का परीक्षण सह-प्रदर्शन किया गया, परिणामतः लाख की उपज में वृद्धि हुई। गैर परंपरागत लाख पोषकों को लोकप्रिय बनाने के लिए विशेष उपाय किए गए। इसके अतिरिक्त अन्य संगठनों के सहयोग से कृषि एवं बागवानी फसलों इत्यादि का प्रदर्शन किया गया।

5.6 लाख की उपज के सह संबंध एवं लाख कीट से संबंधित कुछ मानक एवं परिपालक पर प्रारंभिक अनुसंधान से संकेत मिला है कि कुछ खोजे गए मानक और लाह उपज के बीज महत्त्वपूर्ण सह संबंध है। बैशाखी 1987-88 और कतकी-88 के फसलों के दौरान अपनाए गए पैरामीटर के आधार पर लाख उत्पादन में क्रमशः लगभग 30 से 38 और 21 से 46 प्रतिशत भिन्नता की व्याख्या की जा सकती है।

हिन्दी दिवस एवं हिन्दी सप्ताह के आयोजन

संस्थान में 14 सितम्बर, 1989 को हिंदी दिवस का आयोजन

हिन्दी दिवस समारोह के अवसर पर श्री श्रवण कुमार निदेशक महोदय द्वारा मुख्य अतिथि डा० रामखेलावन पांडेय का स्वागत करते हुए.

हिन्दी समारोह दिवस का एक दृश्य

किया गया तथा 14 से 20 सितम्बर तक की अवधि को हिन्दी सप्ताह के रूप में मनाया गया। समारोह के मुख्य अतिथि के पद से बोलते हुए डा० रामखेलावन पाण्डेय, पूर्व विभागाध्यक्ष हिन्दी स्नातकोत्तर विभाग, राँची विश्वविद्यालय, राँची, ने कहा कि राजभाषा विभाग द्वारा नियम व अधिनियम बनाए गए हैं परंतु वे हिन्दी की प्रगति के लिए पर्याप्त नहीं है। देश के लोगों को आगे आना होगा और अपने राष्ट्र और राष्ट्रभाषा के लिए तन-मन से तत्पर होना होगा। राजभाषा हिन्दी की महत्ता पर प्रकाश डालते हुए उन्होंने कहा कि 1801 से पहले जितनी भी आधुनिक भारतीय भाषाएँ थीं उनका गद्य तो था ही नहीं। हिंदी ने ही गद्य का श्रीगणेश किया। उन्होंने स्मरण दिलाया कि बंकिम चन्द्र चटर्जी ने कहा था कि हिन्दी के माध्यम से ही राष्ट्रीय एकता आ सकती है।

संस्थान में निदेशक श्री श्रवण कुमार ने मुख्य अतिथि के स्वागत के साथ संस्थान में हिन्दी प्रयोग के गौरवमय अतीत को दुहराते हुए अधिक-से-अधिक कार्य हिन्दी में करने की अपील की और कहा कि "हिन्दी राष्ट्रीय एकता का प्रतीक है "। पूरे देश में यही एक भाषा है जो अधिकांश लोगों द्वारा बोली और समझी जाती है। यह एक सहज भाषा है जिसके लिए अहिन्दी भाषी लोगों को भी बोलने और समझने में मामूली प्रयास करना पड़ता है। उन्होंने कहा कि संस्थान के हिन्दी प्रेमियों के प्रयास वैज्ञानिक अनुसंधान टिप्पणियाँ एवं पुस्तकें भी हिन्दी में प्रकाशित की गई हैं।

उक्त अवसर पर हिन्दी टिप्पण/प्रारुपण एवं हिन्दी निबंध प्रतियोगिता का आयोजन किया गया तथा प्रथम, द्वितीय एवं तृतीय स्थान प्राप्त करने वाले सदस्यों को प्रमाण-पत्र एवं पुरस्कार प्रदान किया गया। राजभाषा संबंधी प्रचार सामग्री जिनमें शब्दावलियाँ, संस्थान एवं परिषद् के हिन्दी प्रकाशन तथा संदर्भ साहित्य की एक प्रदर्शनी का भी आयोजन किया गया। पिछले वर्ष हिन्दी में अधिकाधिक कार्य करने वाले 18 कर्म-चारियों को प्रशस्ति पत्र से सम्मानित किया गया। संस्थान में हिन्दी की प्रगति का प्रतिवेदन श्री सत्यानन्द शर्मा, प्रशासकीय अधिकारी तथा धन्यवाद ज्ञापन श्री श्रीकृष्णमणि त्रिपाठी, प्रभारी हिन्दी कार्यक्रम एवं अध्यक्ष हिन्दी दिवस समारोह समिति ने किया।