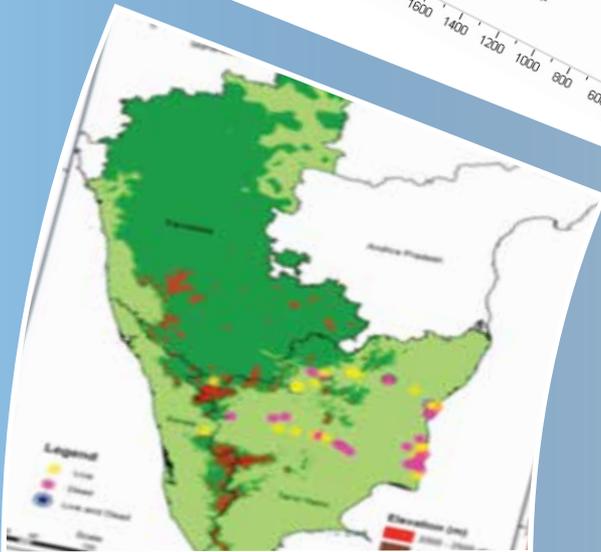
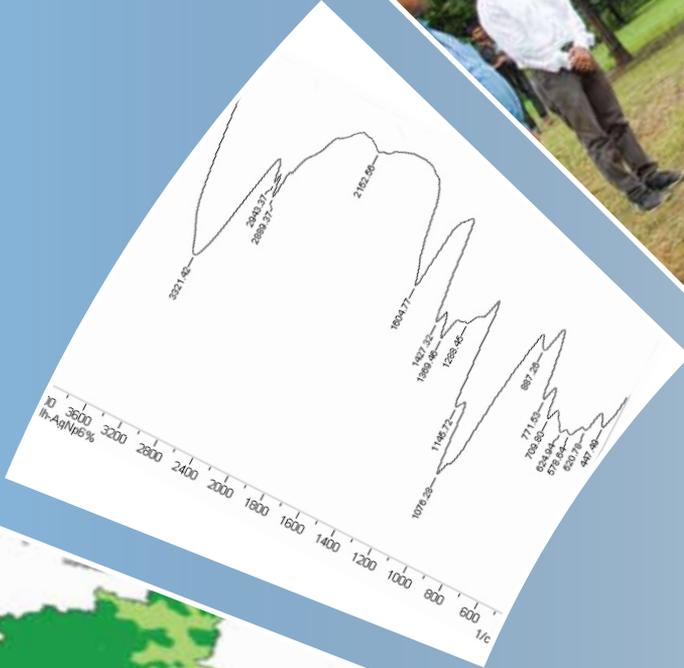




# वार्षिक प्रतिवेदन Annual Report 2017-18



भाकृअनुप-भारतीय प्राकृतिक राल एवं गोंद संस्थान  
ICAR-Indian Institute of Natural Resins and Gums

नामकुम, राँची - 834 010 (झारखण्ड)  
Namkum, Ranchi - 834 010 (Jharkhand)

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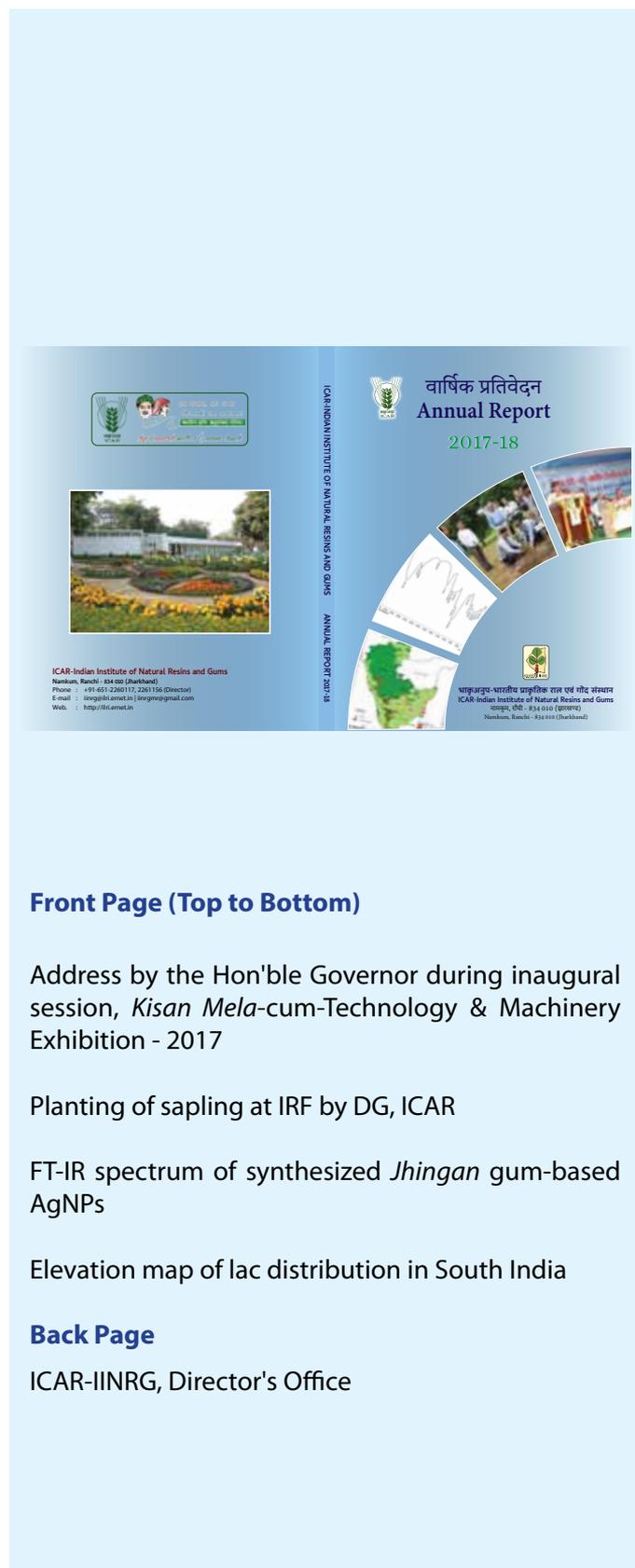
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Planting of sapling at IRF by DG, ICAR

FT-IR spectrum of synthesized *Jhingan* gum-based AgNPs

Elevation map of lac distribution in South India

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ICAR-IINRG, Director's Office



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## Preface

The eastern region of India, comprising Bihar, Chhattisgarh, Eastern UP, Jharkhand, Odisha and West Bengal is lagging in agriculture and is home to more than 50 % of India's poor and food insecure population. Agriculture is the main stay for the 80% of rural population of the Jharkhand. The CAGR of farmers' nominal incomes between 2002-03 and 2012-13 was 11.8 % at an all-India level and Jharkhand was listed among the bottom (8.6%). Lac cultivation is an important vocation for inhabitants of 45 out of 150 disadvantaged districts of India. Jharkhand - the leading state in lac production (60% of National production). 25-32% of total farm income in major lac growing areas comes from lac cultivation. It is a major source of livelihood and income generation especially for tribal farmers in rain-fed areas. About one million man-days are generated in the existing lac processing units alone.

Lac cultivation, if integrated with agriculture has potential to contribute significantly in doubling farmers' income. Evaluation of Lac Integrated Cropping System has clearly established an increase of more than 20% income in comparison to sole vegetables cultivation. Similarly, profit earned from lac culture on fruit varieties of *ber* is significantly higher than the fruit production. *Katha* variety of *ber* excelled in broodlac yield followed by *Bagwadi* and CAZRI Gola. Quick growing lac-hosts play a significant role if lac is to be introduced in newer areas or integrated with existing cropping systems to diversify land use for enhanced income per unit land. Persistent endeavor in this direction has led to identification of *Calliandra calothyrsus* as a potential host for lac cultivation. To reap the maximum benefit, continuous improvement in management practices of lac cultivation is necessary. Irrigation alone increased broodlac yield by 31% in summer *rangeeni* lac crop on pigeon-pea; application of potash gave additional increase of 17.6%. Studies of lac predators with volatiles extracted from the lac insects have given clues about their behavior that would be important in their management. A new *in-situ* cage has been developed for assessing the population of parasitoids under field conditions which is superior to the existing caging method. Relative abundance of parasitic population during various cropping seasons using newly developed *in-situ* caging method revealed different emergence profile of pest populations.

Natural resins and gums are export oriented commodities and mostly exported in raw form. It is essential to process and add value to these for enhanced domestic consumption and also to create employment opportunities for the local populace. The Institute developed super absorbent hydrogels from *guar* gum which was evaluated for agricultural application as conditioner and as matrix for controlled release of Phosphorus (P) and Boron (B) in soil as well as water with encouraging results. Moisture retention capacity of soil increased 1.5 times even at a dose as low as 0.3 % and improved porosity of soil by 9%. Nutrient loaded hydrogel could maintain concentration of P & B up to 60 days in pot culture experiments as compared to commercial fertilizer. Lac based paper coating formulations developed in aqueous and solvent systems for application on paper packaging materials were found flexible and scratch resistant; strength of the paper also increased significantly. In order to develop value added products, Total Dietary Fibre in partially hydrolysed *guar* gum was characterized and found to be in the range of 85-88% by weight.

Dissemination of the developed technologies to the stakeholders is as important as developing them. 13 Farmers' training programmes on Scientific lac cultivation, processing and utilization (365 farmers); three educational programmes on production, processing and uses of natural resins and gums for 89 UG/PG students; 22 on-farm training programmes (2570 stakeholders); 67 in-campus orientation programme (3174 stakeholders) and four lac based product demonstration programmes benefitting 87 self-sponsored stakeholders were organized.

The Institute won laurels during the year for its commendable contribution in improving the livelihood options for the farmers and bagged ASSOCHAM Leadership Award 2017 for Leadership Project in Agriculture. The Annual Report of the Institute also got the Best Annual Report Award 2016-17 under Small Institute Category.

Congratulations TEAM IINRG! Keep it up!

October, 2018  
Namkum, Ranchi

(KK Sharma)  
Director



# Introduction

## Mandate

- ❖ Research on lac production technologies and processing and value addition of natural resins (including lac), gums and gum-resins.
- ❖ Information dissemination, training and technology transfer to farmers, processors and entrepreneurs and tribal people on lac, gums and gum-resins for sustainable livelihood.

## Historical Perspectives

India is one of the largest producers of natural resins, gums and gum-resins (NRGs) along with China, Indonesia, Russia and Brazil. Our country is the world leader in production of *guar*, *karaya* and *psyllium* gums as well as lac. Total production of NRG has been increased from 1160314 tons in 2013-14 to 1196308 tons in 2014-15, thus an increase of about 3.1% over the previous year. *Guar* holds the largest share of NRGs produced in India. NRGs are an important source of subsidiary income to farmers in around 70 disadvantaged districts, identified by the Planning Commission. With growing interest in safe and natural material for consumption in various areas, the demand is expected to grow steadily in future. Export quantity of NRGs from India is increased but the value of export has declined as the continuous decline of the price in international market. In case of import scenario, it has increased over the period. The exported quantity of the lac and lac based products has decreased by 5.58% during 2016-17 over the previous year and it was valued about Rs. 20689.92 lakh.

ICAR-Indian Institute of Natural Resins and Gums (ICAR-IINRG) fills in the gap of a national R&D Institution to the NRG sector, which is quite important from social, export and ecological angles. The Institute provides holistic support in research to the NRG sector under one roof, from production of lac-processing-value addition-application development and related areas like quality control, capacity building, to strengthen the sector in the country. The origin of the Institute dates back to 1920s during the British era, when the need for establishment of an R&D organization for lac, a natural resin of insect origin, was felt.

Realizing the strategic importance of this commodity, the then Imperial Government of India constituted the Lindsay-Harlow Committee in 1920 to look into all aspects of the country's lac trade and its development. On the suggestions of this committee, lac merchants organized themselves into the Indian Lac Association for Research, under the aegis of which, the foundation stone of the Indian Lac Research Institute (ILRI) was laid on September 20, 1924 at Ranchi. Subsequently, on the recommendations of the Royal Commission on Agriculture, the Indian Lac Cess Committee (ILCC) was constituted, which took over the reins of the ILRI in 1931. As a result of reorganization of agricultural research and education in the country after independence, the ICAR took over the administrative control of the ILRI in April 1966. This Institute is thus, one of the oldest institutions within the ICAR system, having completed more than 92 years of existence. It has contributed immensely towards all-round development of lac maintaining India's leadership in production, installed processing capacity and export of the commodity.

Recognizing the importance of other natural resins and gums, which are cultivated and collected in the Indian sub-continent, and are of tremendous industrial importance in divergent industries and export markets, the ICAR revised the mandate of ILRI and renamed it as IINRG. All natural gums and resins were brought under its scope, under the revised research mandate of the Institute w.e.f. September 20, 2007. Subsequently, the ICAR also sanctioned a new Network Project on Conservation of Lac Insect Genetic Resources launched in August, 2014 with eight centres besides the existing Network Project on Harvesting, Processing and Value Addition of NRGs with increased strength. Since November 29, 2009 the Institute is recognized as National Lac Insect Germplasm Centre (NATLIGEC). On May 30, 2015, the Institute was certified as ISO 9001:2008 organization.



## Location and Agro-Climat

The Institute is located 9 km south-east of Ranchi city, on the Ranchi-Jamshedpur highway (NH33) at an altitude of 650 m above mean sea level, 23°23" N latitude and 85°23" E longitude. The soil of the experimental farm is of lateritic



type. The area experienced mild salubrious climate, with rather good rainfall of about 1064 mm, of which about 75 per cent (795 mm) was during the monsoon season.

## Organizational Structure

ICAR-IINRG has responded to the globalization of industries and agricultural enterprises of the country as well as functional reorganization of ICAR. The Institute also has undergone structural changes and the priorities have been redefined. In 1995-1996, the erstwhile Divisions and Sections were abolished and the scientific manpower divided into three divisions, viz. Lac Production, Processing and Product Development and Transfer of Technology. The NATLIGEC maintains Lac-Insect and Lac-Host Plant Field Gene Banks. The Institute is headed by Director.

## Staff

The Institute has a sanctioned strength of 1 RMP, 47 scientific, 72 technical, 33 administrative and 84 supporting grade staff with a total of 237 sanctioned posts, out of which 29 scientific including RMP, 36 technical, 19 administrative and 46 supporting posts with a total of 130 staff are in position as on December 31, 2017.

## Infrastructure

Manned by a team of dedicated scientists from various disciplines including Agricultural Entomology, Plant Sciences, Agricultural Chemicals, Engineering, Biotechnology etc., the Institute has about 130 staff in scientific, technical, administrative and supporting categories. The Institute has a number of prestigious labs, like Biotechnology, Bio-control Laboratory, Instrumentation Laboratory, Quality Evaluation Laboratory etc. The Institute shoulders the responsibility of collection and maintenance of germplasm of lac insect lines as well as lac host trees. NATLIGEC. Similarly, the Lac-Host Plant Field Gene Bank of the Institute has ninety collections of 12 genera and 55 lac-host species comprising trees, medium and bushy types of lac host plants collected from different agro climatic regions of the country.

There are several well-organized and equipped service sections to support research activities of the Institute. The administrative wing comprises Director's Office, Administrative Section, Audit and Accounts Section, Purchase and Central Stores. The sections providing technical support are Library; Prioritization, Monitoring and Evaluation Cell; Institute Research Farm and Maintenance & Workshop unit. The Auxiliary units are Hindi Cell, Security, Medical and Estate Maintenance services.

The Institute Research Farm (IRF) spread over 36 ha, has all conventional land cultivated lac host plants. Presently, it has approx. 1550 host trees of *Schleichera oleosa* (Kusum), 2480 trees of *Butea monosperma* (palas), 1351 trees of *Ziziphus mauritiana* (ber) and 8700 minor host plants. The IRF also maintains a nursery of host plants for meeting the demand from other institutions as well as farmers. More than 1800 cultures of 72 lac insect lines are being conserved lives on potted plants of *bhalia* (*F. macrophylla*) under protected conditions in the Field Gene Bank of National Lac Insect Germplasm Centre (NATLIGEC).

The ICAR-IINRG Library has a holding of more than 35,000 volumes of scientific journals, 2000 rare books, including back volumes of research periodicals in the field of resins and gums including lac and surface coatings. Since the holdings of back volumes of certain journals date back to circa 1868, the library is also a partner of the Consortium for e-Resources in Agriculture (CeRA), of ICAR. Besides catering to the learning needs of scientists and the staff of the Institute, the library also attracts researchers from neighboring educational and research institutions, including Birla Institute of Technology, Ranchi University, Birsa Agricultural University and ICAR-Research Complex for Eastern Region, Ranchi; Indian Institute of Technology, Kharagpur; Rajendra Agricultural University, Samastipur; Patna University, Patna; National Institute of Technology, Jamshedpur etc.

The Quality Evaluation Laboratory of the Institute, caters to the quality control needs of the lac processing/lac product industries as well as exporters of lac/lac products. The lab has facilities for carrying out testing of lac/lac products as per BIS requirements.

The PME Cell provides access to internet and e-mail facilities for communication and information retrieval to the scientists. The Institute website at: <http://ilri.ernet.in/~iinrg/> is a valuable source of information in the Institute.



## Executive Summary

### Lac Production Technology

- ❖ Evaluation of *K. lacca* was carried out during *rangeeni* (*baisakhi*) and *kusmi* (*aghani*) crop period 2016-17 on *Calliandra calothyrsus*, *C. surinamensis*, *Dalbergia assamica* and *Malvaviscus penduliflorus*. *C. calothyrsus* was found to be a good bushy lac host for lac cultivation for both the strains with broodlac ratio of 4.75, 4.18 during *baisakhi* and *aghani*, respectively.
- ❖ Pruning response in *swadi palas* for winter *kusmi* lac production was assessed at farmers' field. Higher broodlac yield was recorded in February and January pruning and it was significantly higher than farmers' practice of pruning in December. About 18-21% yield advancement was recorded than farmers practice.
- ❖ Pigeon pea germplasm was evaluated for summer *rangeeni* crop. Irrigation had significant role in broodlac production and raised broodlac yield by 31%. Additional dose of potash also played significant role in lac production with additional increase in lac yield by 17.6%.
- ❖ Twenty four fruit *ber* varieties were evaluated for *rangeeni* lac production potential over year. *Katha* excelled in broodlac yield with output ratio of 7.6 followed by *Bagwadi* (7.3), CAZRI Gola (7.3) and Seb x Gola F1 (7.0). *Katha* and CAZRI Gola had also higher scraped lac per cent.
- ❖ The per cent of lac insects that died during each age interval/apparent mortality (100qx) was found to be maximum in the 2<sup>nd</sup> instar for *bhalia* and *semialata* plants which was 16.44% and 45.77% respectively and in the 3<sup>rd</sup> instar for *arhar* plants which was 25.08%. The average resin yield was the highest for *bhalia* (3.14 gm) followed by *arhar* (2.087 gm) and *semialata* (0.851 gm). All these attributes make *bhalia* the best preferred host for *katki* crop.
- ❖ *Semialata* + Brinjal + Tomato yielded an income of Rs. 1,85,712/acre while *semialata* + Brinjal gave income of Rs. 1,55,712/acre and sole brinjal crop generated an income of Rs. 1,40,000/acre in the farmer's field.
- ❖ Liming reduced seedling mortality significantly registering zero mortality in 20g/tubule application rate as compared to 13 per cent in control. Inoculation of azotobacter increased basal diameter 58% compared to 37% in uninoculated plants only in young plantation. Phosphobacterin inoculation affected plant height only, where inoculated plants witnessed 53% increase and uninoculated ones had increased 35% only.
- ❖ Demonstration of winter season *kusmi* lac production technology for improved lac yield using recommended doses of chemical fertilizer was conducted in three villages of Ranchi and one village of Khunti district. Lac yield ratio under fertilizer applied trees ranged in between 2.5 to 7.5 depending upon level of adoption of crop sanitation. Lac yield ratio in no fertilizer applied trees was in between 2.0 to 6.0. Yield ratio was found to increase from 124 to 186 per cent due to application recommended doses of fertilizer.

### Morpho-Physico-Biotechnological Characterization

- ❖ SSR-PCRs were carried out for 27 pigeon pea genotypes with 63 primers to identify potential of germplasm for lac/lac + seed purpose. Genetic relationship among the pigeon pea genotypes was deciphered based on the dendrogram.
- ❖ Partial geranyl pyrophosphate synthase, one of the key genes involved in sesquiterpene synthesis was cloned from the Indian lac insect, *Kerria lacca* (Kerr) using transcriptome data following PCR based techniques. One Suppression Subtraction Library (SSH) was constructed to identify the differential gene expression in female lac insects compared to crawlers. qPCR experiments have been done to validate the up regulation of 10 genes in adult female insects compared to crawlers.
- ❖ 94 *kusum* (*Schleichera oleosa*) plants in Ranchi region were studied for their morpho-physiological





characteristics. Observation illustrated that maximum trees (40) lie in low range (up to 50 cm) followed by medium (24), large (22) and very large range (8). Mean of petiole number/branch was observed higher in large and very large range (3.4) whereas mean leaflet number/petiole was observed higher in medium and large range and it ranged from 5.8-6.8. Mean leaflet area was found higher in large range (500.6) followed by low (488.9), medium (481.5) and very large range (468.1).

- ❖ Climatic condition of the year was characterized by meagre rainfall in the month of May. It not only promoted fruit drop, but also affected seed germination of the set fruits drastically. Germination per cent of seed sown in early July proved to perform two times better than that of early June and mid June sowing.

## Pest Management

- ❖ The adults of lac insect predators, *Eublemma amabilis* and *Pseudohypatopa pulverea* showed typical electrophysiological response to extracts of lac insect and its associated products. Among both the predators, *Eublemma amabilis* has stronger EAG responses to different extracts of lac insect associated products (LIAPs) than *P. pulverea*.
- ❖ Behavioral studies of predator populations with the extracted volatiles from lac insect whole body were done using “Y” tube olfactometer. It was found that, out of 40 *Eublemma amabilis*, 6 numbers each moved towards the lac insect whole body extract and the solvent (Hexane). Similarly in *P. pulverea*, it was found that out of 11 *P. pulverea* 9 and 2 numbers moved towards the lac insect whole body extract and the solvent (Hexane), respectively.
- ❖ Relative abundance and emergence profile of parasitoids and predators associated with lac insect were recorded during summer season (*baisakhi* 2017) and rainy season (*katki* 2017) crops of *rangeeni* strain. The information generated revealed that, three parasitoids (*Aprostocetus purpureus*, *Tachardiaephagus tachardiae* and *Parechthrodryinus clavicornis*) and one predator *Eublemma amabilis* were abundant during the crop seasons.
- ❖ Level of parasitization recorded was lesser in *katki* (2017) compared to *baisakhi* (2017) on *ber* and *palas*. The maximum level of parasitization was during sexual maturity period during *baisakhi* (2017) whereas in *katki* (2017), maximum level of parasitization was recorded during crop maturity period.
- ❖ Emergence profile of lac associated fauna was compared between different caging methods viz., in situ caging and lab caging during *baisakhi* (2017) and *katki* (2017). Higher numbers of parasitoids were recorded in in situ method of caging compared to lab caging. Relative abundance of lac associated fauna was also compared under two different conditions viz., spray with (Fipronil + Chlorothalonil) and with Chlorothalonil only which revealed, *A. purpureus*, *P. clavicornis* and *E. amabilis* were more in number when sprayed with Chlorothalonil only but *T. tachardiae* was more when sprayed with Fipronil + Chlorothalonil except *ber* during *baisakhi*, 2017.

## Tapping, Processing and Characterization of NRGs

- ❖ Novel super absorbent hydrogels were synthesized from *guar* gum, characterized and standardized to get maximum water absorption, up to 800 ml distilled water per gram dry weight. Biodegradation studies confirmed that highly porous structure of hydrogels is almost completely biodegradable within 6 months under soil.
- ❖ Different coating formulations were developed in aqueous and solvent systems and applied on paper packaging materials. The formulations were found smooth, uniform and glossy. Films of the formulations were found flexible and resistant to scratch and impact. Studying mechanical properties, it was observed that strength of the paper increased significantly after coating. Analysis of barrier properties revealed very good improvement in barrier to oxygen and water vapour transmission as compared to control.
- ❖ The synthesized *acacia* gum-based silver nanoparticles (AgNPs) were characterized by Inductively Coupled Plasma Optical Emission Spectrometry (ICP-OES) and TEM whereas *jhingan* gum-based AgNPs by FT-IR Spectroscopy, Zeta Potential and Scanning Electron Microscopy (SEM).



## Application and Product Development

- ❖ Hydrogels were synthesized from *guar* gum (GG-g-PHEMA-cl-NN'-mba) by varying cross-linker concentration using ceric ammonium nitrate as a free radical initiator.
- ❖ The Total Dietary Fibre (TDF) content in partially hydrolyzed *guar* gum (PHGG) was in the range of 88-85% and characterized by various physicochemical and spectroscopic methods.
- ❖ The synthesized hydrogel was evaluated for agricultural applications as soil conditioners and as matrix for controlled release of phosphorus (P) and boron (B) in soil as well as water. The water absorbing hydrogel after addition to soil as fine powder could improve its moisture retention up to 1.5 times at minor dose of 0.3% as also could retain the marginally higher moisture percentage even up to higher matric suction of 15 bars. Also incorporation of fine powder of hydrogel up to 0.3% in the soil improved its porosity up to 9% of its original. Controlled nutrient release studies in soil revealed that, the nutrient loaded hydrogel could maintain optimum concentration of P & B up to 60 days in pot culture experiments as compared to commercial fertilizer.

## Capacity Building and Training

- ❖ A total of 13 Farmers' Training Programmes on 'Scientific lac cultivation, processing and utilization' were organized for 365 farmers from four States viz., Jharkhand, Chhattisgarh and Meghalaya.
- ❖ Three Educational programme on 'Production, processing and uses of natural resins and gums' were conducted for 89 UG/PG students from institutions namely Sam Higginbottom Institute of Agriculture Science & Technology, Allahabad; Institute of Agriculture Science, Banaras Hindu University, Varanasi (U.P.) and Department of Zoology, PK Roy Memorial College, Dhanbad ( Jharkhand).
- ❖ 22 on-farm training programmes were organized for 2570 stakeholders of Jharkhand and Madhya Pradesh states. 771 participants from various districts of Jharkhand state benefitted from on-farm motivational / supplementary training programme.
- ❖ 67 in-campus one day orientation programmes on natural resins and gums were organized; 3174 stakeholders visited the Institute. Two short term training programs were organized in which 57 persons participated from various organizations of Jharkhand state.
- ❖ Four short term lac based product demonstration training programmes were organized for 87 self sponsored stakeholders of different states on lac processing and product development.

## Field Demonstration, Technical Advisory and Extension Activities

- ❖ To showcase the latest technologies of the Institute, experts participated in eight Exhibition / *Kisan Melas* wherein around 27790 visitors were acquainted with the different activities of Institute. Also participated in 4 *Kisan gosthi* organized in different districts of Jharkhand that benefitted about 788 participants.
- ❖ Five field demonstrations on scientific lac cultivation technologies and gum tapping were carried out at various places in Jharkhand and Rajasthan.
- ❖ A sum of Rs. 15.46 lakh was generated through training charges, consultancy project and sale of literature during the period.
- ❖ An ICT enabled One to One Programme (OTOP), Market Oriented Technical Advisory Services (MOTAS), diagnostic and crop monitoring visits benefited more than 100 farmers, processors, industrialists, lac businessmen and lac handicraft entrepreneurs from 16 states.

## Technology Adoption, Impact Assessment and Market Research Activities

- ❖ Due to low international market price for *guar* gum during 2016-17, total production of NRGs has decreased from 844646.00 tons in 2015-16 to 566230.00 tons in 2016-17. A decline of about 33 % in the production of NRGs was observed over the previous year. Total production of lac was observed around 12.77% lower than the previous year and 10.3% decrease in lac production was recorded in Jharkhand.





- ❖ Export quantity of NRGs from India increased but the value of export declined due to continuous decline of the price in international market. The exported quantity of the lac and lac based products has decreased by 5.58% during 2016-17 over the previous year and it was valued about Rs. 20689.92 lakh.

### KVK Khunti

- ❖ 75 CFLD under NFSM having area of 10 ha were conducted on Green gram, Pigeon pea and Chick pea covering 129 farmers and 5 FLD on Paddy variety 'Sahbhagi' having area of 2 ha covering 7 farmers were conducted. Six Off Campus training of farmers on cultivation of Green gram, Pigeon pea, Chick pea and soil sampling techniques were conducted for the 125 farmers. 4 *Kisan gosthis* were organized that benefitted about 720 participants.



## कार्यकारी सारांश

### लाख उत्पादन प्रौद्योगिकी

- ❖ वर्ष 2016-17 के रंगीनी (बैसाखी) एवं कुसमी (अगहनी) फसल अवधि में *केरिया लैका* का *कैलिएन्डा कैलोथीरसस*, *सी. सुरीनामेन्सिस*, *उलबर्जिया असमिका* एवं *माल्वावीस्कस पेन्डुलीपलोरस* पर मूल्यांकन किया गया। *सी. कैलोथीरसस* लाख खेती के दोनो प्रभेदों के लिए अच्छा झाड़ीदार परिपालक पाया गया, जिसका बैसाखी एवं अगहनी में क्रमशः बीहनलाख अनुपात 4.75 एवं 4.18 रहा।
- ❖ शरदकालीन कुसमी लाख के उत्पादन के लिए स्वादी पलास पर काट-छांट के प्रभाव का मूल्यांकन किसान के खेत पर किया गया। फरवरी एवं जनवरी में की गई छांट से बीहनलाख का उच्चतर उपज रिकार्ड किया गया एवं यह दिसम्बर में किसानों द्वारा किये जाने वाले काट-छांट से उल्लेखनीय रूप से उच्चतर था।
- ❖ ग्रीष्मकालीन रंगीनी फसल के लिए अरहर के जननद्रव का मूल्यांकन किया गया। बीहनलाख उत्पादन में सिंचाई की भूमिका महत्वपूर्ण थी तथा इससे बीहनलाख का उत्पादन 31% बढ़ गया। पोटेश के अतिरिक्त डोज ने महत्वपूर्ण भूमिका निभाई तथा लाख की उपज में 17.6% की अतिरिक्त वृद्धि हुई।
- ❖ रंगीनी लाख के उत्पादन क्षमता के लिए चौबीस फलदार बेर किस्मों का मूल्यांकन वर्ष भर किया गया। 7.6 के बीहनलाख उत्पादन अनुपात के साथ कथा ऊपर रहा तथा उसके बाद बागवाडी (7.3), काजरी गोला (7.3) एवं सेब X गोला F. (7.0) का स्थान रहा। कथा एवं काजरी गोला का छिली लाख प्रतिशत भी उच्चतर था।
- ❖ प्रत्येक उम्र अंतराल/स्पष्ट मरणशीलता (100 क्यूएक्स) में लाख कीट की मृत्यु का प्रतिशत भालिया एवं सेमियालता के द्वितीय निरूप में अधिकतम पाया गया जो क्रमशः 16.44% एवं 45.77% था, तथा अरहर के पौधे के तृतीय निरूप का 25.08% था। राल का औसत उच्चतर उत्पादन भालिया पर 3.14 ग्रा. था उसके बाद अरहर (2.087 ग्रा.) तथा सेमियालता (0.851)। इन सभी गुणों के कारण भालिया कतकी फसल के लिए सबसे अच्छा परिपालक पाया गया।
- ❖ किसान के खेत में सेमियालता + बैंगन + टमाटर से रु.1,85,712/एकड़ उपज हुई, जबकि सेमियालता + बैंगन से रु. 1,55,712/एकड़ आय हुई तथा अकेले बैंगन की फसल से रु. 1,40,000/एकड़ की आय हुई।
- ❖ नियंत्रण के 13 प्रतिशत की तुलना में 20 ग्रा./ट्यूबल प्रयोग दर में चूना के प्रयोग से विचड़ों में शून्य मरणशीलता देखी गयी। नये बागान में अजोटोबैक्टर के संचालन से आधार व्यास 58% तक बढ़ा, जबकि गैर संचारित पौधों में यह 37% रहा। फौस्फोबैक्टेरिन के संचारण से केवल पौधे की वृद्धि प्रभावित होती है, जहाँ संचारित पौधों में 53% वृद्धि होती है तथा गैरसंचारित में केवल 35% वृद्धि हुई।
- ❖ राँची के तीन ग्रामों एवं खूंटी जिले के एक गाँव में रासायनिक उर्वरक के अनुशंसित डोज का प्रयोग कर लाख की उन्नत उपज के लिए भारदकालीन कुसमी लाख उत्पादन प्रौद्योगिकी का प्रदर्शन किया गया। उर्वरक प्रयोग किये गए वृक्षों पर लाख उपज का अनुपात फसल स्वच्छता के स्तर के अनुरूप 2.5 से 7.5 रहा। उर्वरक उपयोग नहीं किए गए वृक्षों का लाख उत्पादन 2.0 से 6.0 के बीच रहा। उर्वरक के अनुशंसित डोज के प्रयोग से उपज अनुपात में 124 से 186 प्रतिशत की वृद्धि हुई।

### आकारिकी-शारीरिक-जैवप्रौद्योगिकीय अभिलक्षण वर्णन

- ❖ लाख/लाख + बीज के उद्देश्य के लिए आशाजनक जननद्रव की पहचान के लिए 27 अरहर जीनोटाइप का 63 प्रारंभकों के साथ एस एस आर – पी सी आर किया गया। डेन्डोग्राम के आधार पर अरहर के तीन प्रारूपों के बीच आनुवंशिक संबंध का अर्थ निकाला गया।



- ❖ पी जी आर आधारित तकनीक के अनुरूप ट्रांसक्रिप्टोम आंकड़े का उपयोग करते हुए भारतीय लाख कीट, *केरिया लैका* (केरे) से सेस्क्वीटैरपीन संश्लेशन में संलग्न एक महत्वपूर्ण जीन पार्सियल जेरानिल पाइरोफॉस्फेट का क्लोन बनाया गया। रेंगने वाले कीट की तुलना में मादा लाख कीट के भिन्न जीन अभिव्यक्तिकरण की पहचान के लिए एक सप्रेसन सबट्रैक्शन लाइब्रेरी (एस एस एच) का निर्माण किया गया। रेंगने वाले कीट की तुलना में वयस्क मादा कीट के 10 जीनों के नियमन के सत्यापन के लिए क्यू पी सी आर प्रयोग किया गया।
- ❖ राँची क्षेत्र के 94 कुसुम (*लीचेरा ओलिओसा*) पेड़ों के आकारिक-शारीरिक अभिलक्षण वर्णन का अध्ययन किया गया। पर्यवेक्षण से पता चला कि ज्यादातर पेड़ (40) निचले स्तर में (50 से.मी. तक) में तथा मध्यम (24), बड़े (22) तथा बहुत बड़े (8) स्तर में आते हैं। औसत पत्रक संख्या/पर्णवृत्त मध्यम एवं बड़े स्तर में पाये गए जो 5.8-6.8 तक थे। औसत पत्रक क्षेत्र बड़े स्तर (500.6) में उच्चतर पाये गए, उसके बाद निम्न (488.9), मध्यम (481.5) एवं बहुत बड़े (468.1) स्तर का स्थान रहा।
- ❖ इस वर्ष जलवायु स्थिति के अंतर्गत मई महीने में बरसात बहुत कम हुई। इससे न केवल फल गिरने लगे वल्कि फलों के बीजों का अंकुरण बुरी तरह प्रभावित हुआ। जून के शुरुआत एवं मध्य जून में बोए गए बीजों की तुलना में जुलाई के आरम्भ में की गई बुआई में बीजों का अंकुरण प्रतिशत दोगुना बेहतर था।

### नाशीकीट प्रबंधन

- ❖ लाख कीट परभक्षी यूब्लीमा एमाविलिस एवं स्यूडोहाइपाटोपा पल्वेरिया के वयस्कों ने लाख कीटों एवं इससे जुड़े उत्पादों के सार के प्रति विशिष्ट इलेक्ट्रोफिजियोलॉजिकल प्रतिक्रिया प्रदर्शित की। दोनो परभक्षियों में लाख कीटों एवं संबद्ध उत्पादों (एल आइ ए पी एस) के सार के प्रति पी. पल्वेरिया की तुलना में इ. एमाविलिस की इ ए जी प्रतिक्रिया ज्यादा स त्कत है।
- ❖ 'वाइ' नलिका ओल्फैक्टोमीटर का उपयोग कर लाख कीट के संपूर्ण भारीर के वाष्पशील सार के साथ परभक्षी आबादी का व्यवहार अध्ययन किया गया। यह देखा गया कि 40 ई. एमाविलिस में से प्रत्येक 6 की संख्या लाख कीट संपूर्ण भारीर सार एवं विलायक (हेक्सेन) की ओर गए। इसी तरह पी. पल्वेरिया में से क्रमशः 9 एवं 2 की संख्या में लाख कीट सम्पूर्ण भारीर सार एवं विलायक (हेक्सेन) की तरफ गए।
- ❖ ग्रीष्म ऋतु (बैसाखी 2017) एवं वर्षा ऋतु (कतकी 2017) के रंगीनी प्रजाति के फसलों की अवधि में लाख कीट से जुड़े परभक्षियों एवं परजीवियों के सापेक्ष प्रचुरता एवं प्रादूर्भाव विवरण को रिकार्ड किया गया। प्राप्त जानकारी से पता चलता है कि फसल सीजन की अवधि में तीन परजीवी (एप्रोस्टोसिटस परप्यूरियस, टैकार्डीफेगस टैकार्डी एवं पैरेक्थोड्राइनस क्लैविकॉर्निस) तथा एक परभक्षी यूब्लीमा एमाविलिस की बहुलता थी।
- ❖ बेर एवं पलास पर बैसाखी (2017) की तुलना में कतकी (2017) पर परजीवीकरण का स्तर कम था। बैसाखी (2017) में लैंगिक परिपक्वता के समय परजीवीकरण का स्तर अधिकतम था, जबकि कतकी (2017) में परजीवीकरण का अधिकतम स्तर फसल की परिपक्वता के समय था।
- ❖ बैसाखी (2017) एवं कतकी (2017) फसल अवधि में विभिन्न केजिंग विधि जैसे प्रतिस्थाने केजिंग एवं प्रयोग ाला में केजिंग के दौरान लाख से जुड़े जन्तुओं के प्रादूर्भाव विवरण की तुलना की गई। प्रयोगशाला में किये गए केजिंग की तुलना प्रतिस्थाने केजिंग में ज्यादा संख्या में परजीवी रिकार्ड किए गए। लाख से जुड़े जन्तुओं की सापेक्ष प्रचूरता, दो अलग-अलग स्थितियों में जैसे फिप्रोनील, क्लोरोथैलोनील तथा केवल क्लोरोथैलोनील के साथ स्प्रे की तुलना की गई, जिससे पता चला कि बैसाखी 2017 की अवधि में बेर के अतिरिक्त जब केवल क्लोरोथैलोनील का छिड़काव किया गया तो ए. परप्यूरियस, पी. क्लैविकॉर्निस एवं इ. एमाविलिस की संख्या ज्यादा थी, लेकिन फिप्रोनील, क्लोरोथैलोनील के छिड़काव में टी. टैकार्डी की संख्या ज्यादा थी।



## प्राकृतिक राल एवं गोंद का निष्कर्षण, प्रसंस्करण एवं अभिलक्षण वर्णन

- ❖ ग्वार गोंद से एक अनूठा उत्कृष्ट अवशोषक हाइड्रोजेल का संश्लेषण व अभिलक्षण वर्णन किया गया तथा प्रति ग्राम शुष्क वजन में 800 मि.ली. तक आसवित अवशोषित कर अधिकतम जल अवशोषण के लिए मानकीकृत किया गया। जैवअवक्रमण अध्ययनों से पुष्टि होती है कि हाइड्रोजेल की अत्यधिक छिद्रदार संरचना मिट्टी के अन्दर छः महीने में लगभग पूर्ण रूप से जैवअक्रमणीय है।
- ❖ जलीय एवं विलायक पद्धति में विभिन्न लेपन सामग्री विकसित की गई एवं कागज की पैकिंग सामग्री पर प्रयोग की गई। यह सुत्रण चिकना, एक समान तथा चमकदार पाया गया। सुत्रण की फिल्में लचीली तथा खरोंच एवं प्रभाव प्रतिरोधी पाई गई। यांत्रिक गुणों के अध्ययन से यह पता चला कि लेपन के बाद कागज के सामर्थ्य में उल्लेखनीय वृद्धि हुई है। बाधा गुणों के विलेपण से पता चलता है कि नियंत्रण की तुलना में ऑक्सीजन एवं जल वाष्प संचरण के रोक में बहुत अच्छा सुधार हुआ है।
- ❖ संश्लेषित अकेशिया गोंद आधारित सिल्वर सूक्ष्म कणों (ए जी एन पी एस) का इंडक्टिवली कपल्ड प्लाज्मा ऑप्टिकल इमिशन स्पेक्ट्रोमेट्री (आइ सी पी – ओ इ एस) एवं टी इ एम द्वारा अभिलक्षण वर्णन किया गया, जबकि झींगन आधारित ए जी एन पी एस का एफ टी – आई आर स्पेक्ट्रोस्कोपी, जीटा पोटेंसियल एवं स्कैनिंग इलेक्ट्रॉन माइक्रोस्कोपी (एस इ एम) द्वारा किया गया।

## प्रयोग एवं उत्पाद विकास

- ❖ सेरिक अमोनियम नाइट्रेट का मुक्त रेडिकल इनिशिएटर के रूप में उपयोग कर अलग-अलग क्रॉसलिंग सांद्रण द्वारा ग्वार गोंद (जी जी जी – पी एच इ एम ए – सी एल – एन एन – एम बी ए) से हाइड्रोजेल का संश्लेषण किया गया।
- ❖ आंशिक रूप से जल अपघटित ग्वार गोंद (पी एच जी जी) में कुल खाद्य रेशा (टी डी एफ) अंश 88–85: था तथा विभिन्न भौतिक रासायनिक एवं स्पेक्ट्रोस्कोपिक विधि से इसका अभिलक्षण वर्णन किया गया।
- ❖ संश्लेषित हाइड्रोजेल का मिट्टी के साथ-साथ पानी में मृदा अनुकूलक के रूप में कृषि संबंधी उपयोग एवं फॉस्फोरस (पी) एवं बोरॉन (बी) के नियंत्रित मुक्ति के सांचे के रूप में मूल्यांकन किया गया। मिट्टी में महीन पाउडर के रूप में मिलाने के बाद जल अवशोषक हाइड्रोजेल 0.3: के निम्न डोज से भी नमी धारण क्षमता 1.5 गुणा बढ़ जाती है तथा 15 बारों के उच्चतर मैट्रिक सक्शन तक थोड़ा ज्यादा नमी प्रतिशत को बनाए रख सकता है। मिट्टी में 0.3: हाइड्रोजेल के बारिक पावडर के मिलाने से मिट्टी की छिद्रता 9: तक बढ़ जाती है। मिट्टी में पोशक तत्वों की नियंत्रित मुक्ति से पता चलता है कि वाणिज्यिक उर्वरकों की तुलना में गमला में संवर्धन में संपोशक सहित हाइड्रोजेल से 60 दिन तक अनुकूलतम सघनता बनी रहती है।

## क्षमता निर्माण एवं प्रशिक्षण

- ❖ झारखंड, छत्तीसगढ़ एवं मेघालय के 365 किसानों के लिए लाख की वैज्ञानिक खेती, प्रसंस्करण एवं उपयोग पर कुल 13 कृषक प्रशिक्षण कार्यक्रम आयोजित किए गये।
- ❖ सैम हिगीनबॉटम कृषि विज्ञान एवं प्रौद्योगिकी संस्थान, इलाहाबाद; कृषि विज्ञान संस्थान, बनारस हिन्दू विश्वविद्यालय, बनारस एवं प्राणिविज्ञान विभाग, पी के राय मेमोरियल महाविद्यालय, धनबाद के स्नातकोत्तर/स्नातक के 89 छात्र/छात्राओं के लिए प्राकृतिक राल एवं गोंद के उत्पादन, प्रसंस्करण एवं उपयोग पर तीन शैक्षणिक कार्यक्रम आयोजित किये गए।
- ❖ झारखंड एवं मध्यप्रदेश राज्यों के 2570 पणधारियों के लिए 22 प्रक्षेत्र प्रशिक्षण कार्यक्रम आयोजित किये गए। झारखंड राज्य के विभिन्न जिलों के 771 प्रतिभागियों को प्रक्षेत्र प्रोत्साहन/पूरक प्रशिक्षण दिया गया।





- ❖ प्राकृतिक राल एवं गोंद का 67 एक दिवसीय अभिविन्यास कार्यक्रम आयोजित किया गया, जिसमें 3174 प्रणधारियों ने संस्थान का भ्रमण किया। झारखंड राज्य के विभिन्न संस्थानों के लोगों के लिए दो अल्पावधि प्रशिक्षण कार्यक्रम आयोजित किया गया।
- ❖ विभिन्न राज्यों के 87 स्वप्रायोजित हितधारकों के लिए लाख प्रसंस्करण एवं उत्पाद विकास पर चार लाख आधारित अल्पावधि उत्पाद प्रदर्शन प्रशिक्षण कार्यक्रम आयोजित किए गए।

### प्रक्षेत्र प्रदर्शन, तकनीकी परामर्श एवं प्रसार गतिविधियां

- ❖ संस्थान की नवीनतम प्रौद्योगिकियों को दिखाने के लिए विशेषज्ञों ने आठ प्रदर्शनी/किसान मेला में भाग लिया, जहाँ 27,790 आगंतुकों ने संस्थान की विभिन्न गतिविधियों से परिचय प्राप्त किया। झारखंड के विभिन्न जिलों के 4 किसान गोष्ठियों में भी आयोजित की गयी, जिससे 788 प्रतिभागियों को लाभ पहुँचाया गया।
- ❖ झारखंड एवं राजस्थान के विभिन्न स्थानों में लाख की वैज्ञानिक खेती प्रौद्योगिकी एवं गोंद निष्कर्षण पर पाँच प्रक्षेत्र प्रदर्शन आयोजित किए गए।
- ❖ इस अवधि में प्रशिक्षण शुल्क, परामर्शी परियोजना एवं प्रशिक्षण भुल्क द्वारा रू. 15.46 लाख की आय अर्जित की गई।
- ❖ आई सी टी समर्थित एक को एक कार्यक्रम (ओ टी ओ पी), बाजार आधारित तकनीकी परामर्श सेवा (एम ओ टी ए एस), आंकलन एवं फसल निरीक्षण दौरे से 16 राज्यों के 100 से अधिक किसानों, प्रसंस्करणकर्त्ताओं, उद्यमियों, लाख व्यापारियों एवं लाख हस्तशिल्प उद्यमियों को लाभ पहुँचाया गया।

### प्रौद्योगिकी अंगीकरण, प्रभाव मूल्यांकन एवं बाजार अनुसंधान गतिविधियां

- ❖ वर्ष 2016-17 में ग्वार गोंद के अन्तर्राष्ट्रीय बाजार मूल्य में कमी के कारण प्राकृतिक गोंद राल का कुल उत्पादन कम होकर 2015-16 के 8,44,646.00 टन से 2016-17 में 5,66,230.00 टन हो गया। गत वर्ष की तुलना में प्राकृतिक राल एवं गोंद के उत्पादन में लगभग 33% गिरावट दर्ज की गई। लाख के कुल उत्पादन में गत वर्ष की तुलना में 12.77% गिरावट दर्ज की गई एवं झारखंड में लाख उत्पादन में 10.3% कमी रिकार्ड की गई।
- ❖ भारत से प्राकृतिक राल एवं गोंद के निर्यात की मात्रा बढ़ी है, लेकिन अन्तर्राष्ट्रीय बाजार में लगातार भाव गिरने के कारण कुल मूल्य में गिरावट आई। गत वर्ष की तुलना में वर्ष 2016-17 में लाख एवं लाख आधारित उत्पादों के निर्यात में 5.58% गिरावट आई, जिसका मूल्य लगभग रू. 20,689.92 लाख था।

### कृषि विज्ञान केन्द्र, खूंटी

- ❖ एन एफ एस एम के अन्तर्गत 10 हे. क्षेत्र में मूंग, अरहर एवं चना पर 75 सी एफ एल डी आयोजित किया गया जिसमें 129 किसानों को शामिल किया गया तथा 2 हे. क्षेत्र में 7 किसानों को शामिल कर धान की किस्म "सहभागी" पर 5 प्रक्षेत्र प्रदर्शन किए गए। मूंग, अरहर एवं चना की खेती एवं मिट्टी का नमूना लेने की तकनीक पर 125 किसानों के लिए परिसर के बाहर छः प्रशिक्षण कार्यक्रम आयोजित किए गए। चार किसान गोष्ठियां भी आयोजित की गई, जिसमें 720 प्रतिभागियों को लाभ पहुँचाया गया।



## Awards Conferred on ICAR-IINRG

### Best Annual Report Award for Small Institutes Category

ICAR-IINRG, Ranchi has been conferred Best Annual Report (2016-17) Award for Small Institutes Category. Dr. KK Sharma, Director, received the coveted Trophy and the Certificate for the Best Annual Report (2016-17) Award for Small Institutes Category from Hon'ble Sri Radha Mohan Singh, Union Minister for Agriculture & Farmers' Welfare during ICAR Directors and Vice-Chancellors Conference at New Delhi on 8<sup>th</sup> March, 2018.



Dr. KK Sharma, Director receiving the coveted Trophy and Certificate for the Best Annual Report (2016-17)

### Leadership Award (ASSOCHAM)

ICAR-IINRG, Ranchi has been conferred Leadership Award (ASSOCHAM) in agriculture. Dr. KK Sharma, Director received the Leadership Award from Her Excellency Smt. Droupadi Murmu, Hon'ble Governor of Jharkhand during National Summit on Leadership-cum-Award 2017 on 31<sup>st</sup> October at Hotel BNR Chanakya, Ranchi.



Dr. KK Sharma, Director receiving Leadership Award from Her Excellency Smt. Droupadi Murmu, Hon'ble Governor of Jharkhand



Dr. KK Sharma, Director with the Chairperson & Members of Institute's Publication Committee along with the Coveted Trophy & the Certificate





# Research Accomplishments

## Lac Production

### 1. Productivity and Quality Improvement

#### 1.1 Collection, conservation, characterization and documentation of lac insect and host plant bio-diversity and potentiality trials

##### Relative abundance of the stress tolerance factor in selected line of *F. semialata*

The study was conducted to investigate the influence of lac insect feeding induced stress on physiology of *Flemingia semialata*. Significant variation in total sugar, total protein, starch, free phenols and proline content was observed among the morning and evening sample studied under inoculated (stress condition) and control condition and their interaction was also significant (Table 1).

##### Total Sugar

The morning inoculated leaves showed 5.52 % increase in total sugar content whereas evening inoculated leaves showed decreased content (-25%) compared to control.

##### Starch

The morning inoculated leaves showed decrease (-19.03 %) in starch content whereas evening inoculated leaves also showed decrease (-25%) compared to control.

##### Protein

The morning inoculated leaves showed 23.80 % increase in total protein content whereas evening inoculated leaves showed decrease trend (-39.88%) as compared to control.

##### Free Phenol

The morning inoculated leaves showed 28.35 % increase in free phenol content whereas evening inoculated leaves showed decrease trend (-40.5%) as compared to control.

##### Proline

The morning inoculated leaves showed 91.35 % increase in proline content compared to control. Continuous feeding on host plants and profuse honey dew secretion by lac insect creates moisture stress inside the plants

leading to accumulation of proline in the leaves. Thus high proline content shows that water content in the plant is highly influenced by sap sucking insects.

**Table 1: Diurnal changes in the leaf biochemical constituents of lac host plant *F. semialata* vis-à-vis lac insect feeding**

Parameters	% increase/decrease				
	Total Sugar	Starch	Protein	Free Phenol	Proline
Leaf (Morning)	5.52	-19.03	23.80	28.35	91.35
Leaf (Evening)	-25.99	-19.16	-39.88	-40.50	--
Bark (Morning)	5.73	41.70	14.70	24.25	--

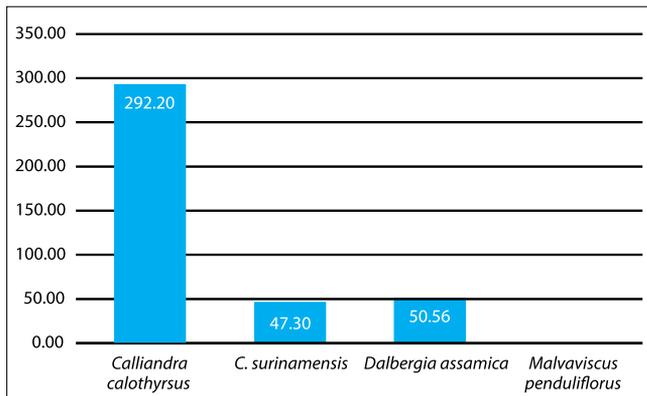
##### Potentiality trials of *K. chinensis* on new lac host plants

Evaluation of *K. lacca* (*kusmi* and *rangeeni*) was carried out during *baisakhi* and *aghani* crop cycles of 2016-2017. Broodlac was inoculated and biological attributes, viz., pre-harvest and post-harvest parameters were recorded on *Callindra calothyrsus*, *C. surinamensis*, *Dalbergia assamica* and *Malvaviscus penduliflorus*.

##### Evaluation of *K. lacca* (*rangeeni*) during summer (*baisakhi*) crop 2016-17

Settlement density of *K. lacca* (*rangeeni*) was more (76.33 per sq cm) with less initial mortality (9.9 per cent) on *C. calothyrsus* than other hosts. Sex ratio was more than optimum ranged 64 to 70 per cent in three host plants. Lac insect mortality was observed before sexual maturity on *M. penduliflorus*. Average fecundity (292.20 nos) was more on *C. calothyrsus* than other hosts (Fig. 1). Cell weight (14.39 and 15.24 mg) and resin weight (12.02 and 12.53 mg) were at par with each other on *C. calothyrsus* and *C. surinamensis*, respectively. Yield attributes, viz., broodlac, rejected lac, scraped lac and broodlac ratio were obtained more on *C. calothyrsus* (1.57 kg, 940 gram, 101 gram and 4.75 per plant) than *C. surinamensis* (1.58 kg, 0.0 gram, 29 gram and 4.21 per plant) and *D. assamica* (112 gram, 0.0 gram, 2.4 gram and 0.47 per plant).

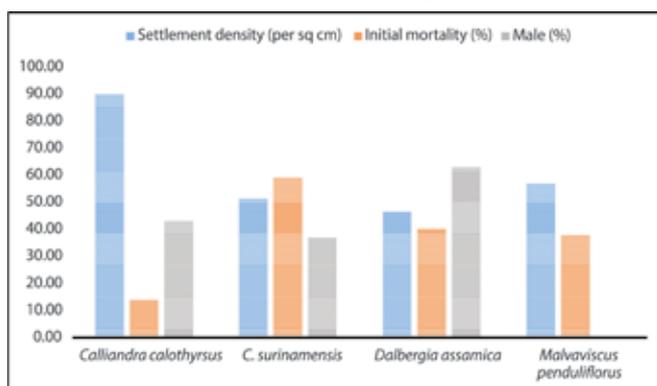




**Fig. 1:** Fecundity of *K. lacca (rangeeni)* during *baisakhi* 2016-17

### Evaluation of *K. lacca (kusmi)* during winter (*aghani*) crop 2016-17

Settlement density of *K. lacca (kusmi)* was more (89.93 per sq cm) on *C. calothyrsus* followed by *C. surinamensis* and *D. assamica*. Initial mortality was less 13.5 per cent on *C. calothyrsus* than other two hosts. Optimum sex ratio (43 and 38 per cent) was recorded on *C. calothyrsus* and *C. surinamensis*, respectively. Lac insect mortality was observed before sexual maturity on *M. penduliflorus* (Fig. 2). Average fecundity (205 nos), cell and resin weight (26.5 and 23.7 mg) were recorded only from *C. calothyrsus*. Yield attributes, viz., broodlac, broodlac per meter lac encrustation, rejected lac, scraped lac and broodlac ratio were obtained on *C. calothyrsus* (1.93 kg, 92 g, 179 g, 678 g and 4.18 per plant). However, only rejected and scraped lac were obtained from *C. surinamensis* and *D. assamica* during *aghani* 2016-17.

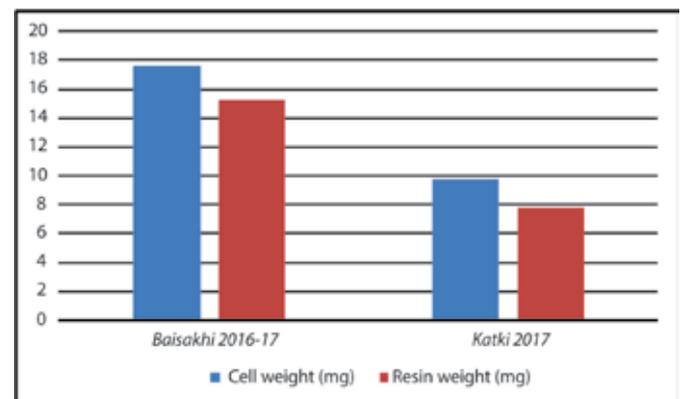


**Fig. 2:** Pre harvest parameters of *K. lacca (kusmi)* during *aghani* 2016-17

### Evaluation of lac insect on rain tree

Average initial settlement density (70.73 and 16.33 per sq cm), initial mortality (19.51 and 53.47 per cent), sex ratio (26 and 18 per cent), fecundity (84.36 and 85.86 nos.), cell weight (17.59 and 9.76 mg), resin weight

(15.22 and 7.80 mg), survival at maturity (5 and 7.8 nos.), broodlac per meter shoot (137.5 and 130 gram) and broodlac ratio (1.05 and 1.36) were recorded on rain tree during *baisakhi* 2016-17 and *katki*, 2017 respectively. Initial settlement density and cell and resin weight were more during *baisakhi* 2016-17 than *katki*, 2017 (Fig. 3) whereas broodlac ratio was more in *katki*, 2017 compare to *baisakhi*, 2016-17.



**Fig. 3:** Cell and resin weight of *K. lacca (rangeeni)* on rain tree

### Barcoding of *Kusum (Schleichera oleosa)* and *ber (Ziziphus mauritiana)*

Genomic DNA was isolated from *kusum* and *ber* plants following CTAB method. The isolated DNA was purified using commercially available kit and used for PCR reactions. PCR conditions were standardized for universal bar-coding primers viz., *rbcl*, *psbA-trnH* and *atpF-atpH*. Bar-coding PCRs were carried out and the PCR products were sequenced. The sequences were found to be matching with the respective genes.

### Conservation of Lac Insects/Host Plants Biodiversity

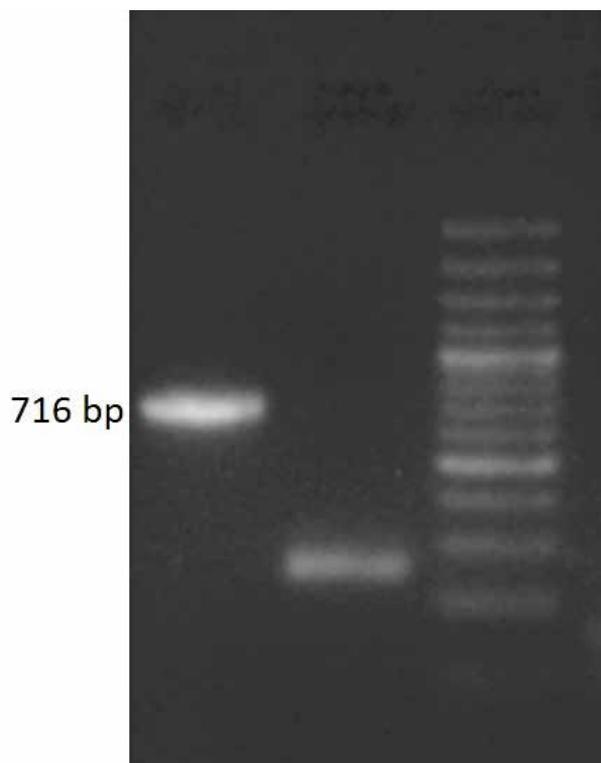
- ❖ 89 collections of 55 species are being conserved in the lac host field gene bank.
- ❖ 1290 cultures of 56 lac insect lines are being conserved in National Lac Insect Germplasm Centre (NATLIGEC).
- ❖ *Swadi palas* plantations consisting of 75 plants are being conserved in a separate plot.

### 1.2 Identification and cloning of putative key genes involved in terpene biosynthesis of the Indian lac insect, *Kerria lacca* (Kerr)

One of the prenyltransferases, geranyl geranyl pyrophosphate synthase was cloned by using gene specific primers available from transcriptome data (Fig.



4). The cloned gene was sequenced and blast analysis was done to identify the cloned gene. It was found to match with GGPS (Geranyl geranyl pyrophosphate synthase) of aphids. The expression of geranyl geranyl pyrophosphate synthase gene in different developmental stages of lac insects was also studied by performing quantitative PCR. Higher expression of the geranyl geranyl pyrophosphate synthase gene was observed in settled nymphal stage and fertilized female lac insects as compared to crawlers of the Indian lac insect. This result implies that the cloned geranyl geranyl pyrophosphate synthase gene might be involved in development and/or rein biosynthesis.

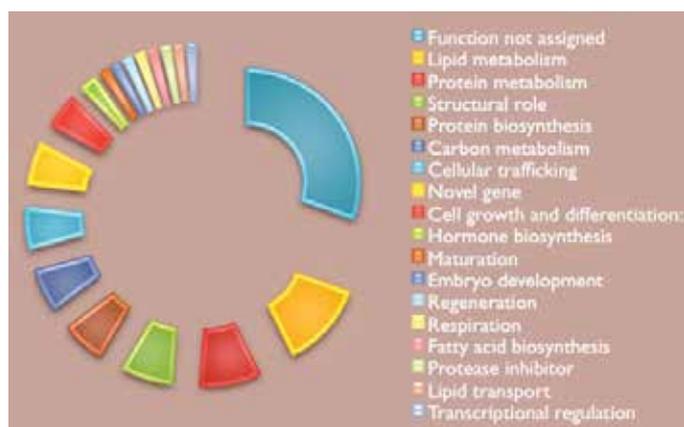


**Fig. 4:** Cloning of partial GGPS gene from *Kerria lacca*

### Construction of SSH library

One SSH library (Suppression Subtraction Hybridization Library) using crawler cDNA as driver and adult female lac insect cDNA as tester was constructed using commercially available kit. The resultant cDNA after subtraction was cloned in *Escherichia coli*. The plasmids from the positive clones were isolated from the constructed library and sequenced using vector specific primers. The sequences were analyzed using BLAST option in NCBI database. The results revealed the presence of some differentially expressing genes in adult female lac insects compared to crawlers. Differentially expressing genes in the adult female

lac insects belong to different categories including lipid metabolism, amino acid metabolism, hormone biosynthesis, maturation, respiration, protein synthesis, cell growth and differentiation, carbon metabolism, intracellular trafficking and few hypothetical genes for which functions are not known. The share of resultant differentially expressing genes in adult female lac insects compared to crawlers has been depicted in the pie chart (Fig. 5). qPCR was carried out to validate the up regulation of expression of 10 genes in adult females compared to crawlers.



**Fig. 5:** Representation of differentially expressing genes from SSH library

### 1.3 Identification, cloning and characterization of genes involved in pigment biosynthesis of the Indian lac insect, *Kerria lacca* (Kerr)

Putative enzymes involved in the pigment biosynthesis pathway have been deduced from the available literature. The different pigment related genes associated with the pathway were successfully amplified by PCR from cDNA of crimson and yellow lac insects. The specific primer pairs of genes N-acetyl transferase (*cnt*), deaminase (*da*), yellow N-acetyl transferase (*ynt*), tyrosine monooxygenase (*tymo*), acyl transferase (*at*), demethylase (*dm*) were obtained from the transcriptome data. The gene sequences were amplified and cloned via TA cloning and sequenced. The length of sequences obtained for *cnt*, *da*, *ynt*, *tymo*, *at*, *dm* were of 975 bp, 1695 bp, 1303 bp, 1695 bp, 1617 bp and 1585 bp, respectively. Using the partial cDNA sequences of the following genes, the specific primers pairs for 3' and 5' rapid amplification of cDNA ends (RACE) were designed. The full length cDNA cloning of deaminase (*da*) gene has been done by 3' and 5' Rapid Amplification of cDNA Ends (RACE). The sequences of 5' and 3' RACE products of *da* have been assembled to get the complete cDNA sequence of 2477 bp.



#### 1.4 Integrated nutrient management for quick establishment of *kusum* (*Schleichera oleosa*) plantation germination per cent of *kusum* seeds and seedling mortality affected by different factors

Climatic condition of the year was characterized by very meager rainfall in the month of May. It not only promoted fruit drop, but also affected seed germination of the set fruits drastically. Germination per cent of seed sown on early July proved to perform two times better in seed germination than that of early June and mid june sowing. Unlike new seeds, old seeds reacted adversely to heat treatment and germination per cent decreased significantly *i.e.* from 55 to 37 per cent. Azotobacter inoculation responded positively, but no interaction was found to be significant. Liming reduced seedling mortality significantly registering zero mortality in 20 g/ tube application rate (Fig. 6).

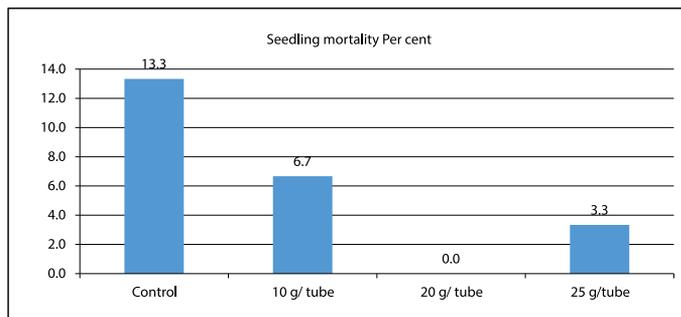


Fig. 6: Seedling mortality per cent affected by lime application

#### Growth of *kusum* plants affected by chemical fertilizer and PGPR inoculation

Azotobacter inoculation found to effect on plant height and basal diameter of plants significantly in one year old plantation but it failed to do so in 3 year old. Its inoculation increased basal diameter 58% and uninoculated plants increased 37% only in young plantation. Phosphobacterin inoculation affected plant height only, where inoculated plants witnessed 53% increase and uninoculated one had increased 35%. However, old plantation showed remarkable effect of application of fertilizer, phosphobacterin and VAM (Fig. 7).

New plantation of *kusum* seedlings with plastic mulching and current season's seedlings showed that fertilizer and VAM application uniformly affected plant growth positively, but difference was not significant. Termite attack was found to be significantly low.

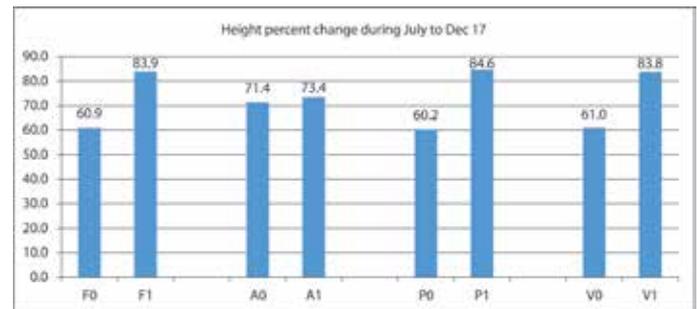


Fig. 7: Growth of *kusum* plants affected by fertilizers and PGPR application

#### Effect of mulching on establishment of *kusum* seedlings

Two sets of *kusum* seedlings were planted - with and without plastic mulching in September 2016 and July 2017 respectively. Observation on basal diameter at the age of 1.5 years has been presented in Fig 8. Basal diameter attained with mulching is at par to that of without mulching even though the former experienced only one rainy season when majority of growth takes place. Besides, plants with mulching suffered only 2 percent mortality due to termite attack, while plants without mulching suffered 29 per cent plant mortality.

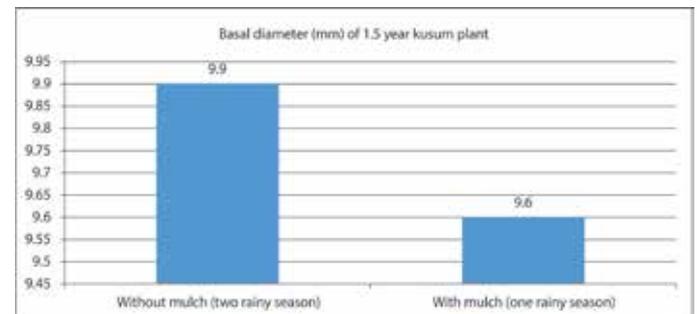


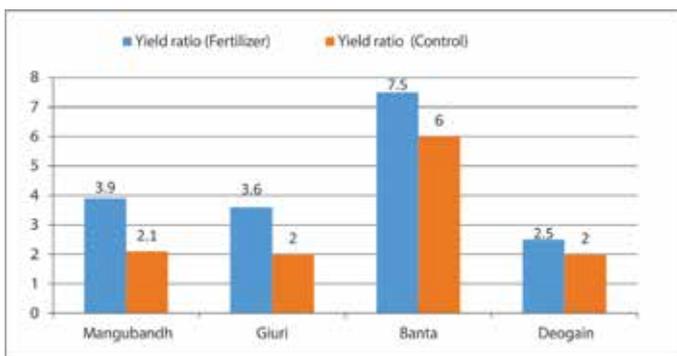
Fig. 8: Effect of mulching on *kusum* plant growth

#### Transfer of Technology Activity

1. Demonstration of increasing *rangeeni* lac yield by the use of chemical fertilizer at farmers' field at Hurda, Namkum, Ranchi registered 10.5% increase in scraped lac yield per metre broodlac. Values were 32.5 and 29 g scraped lac per 100 cm long broodlac.
2. Winter season *kusmi* lac yield ratio under fertilizer application and under no fertilization in farmers' field at different villages of Ranchi and Khunti districts.
3. Demonstration of winter season *kusmi* lac production technology for improved lac yield using recommended doses of chemical fertilizer



was conducted in three villages of Ranchi and one village of Khunti district. Lac yield ratio under fertilizer applied trees ranged in between 2.5 to 7.5 depending upon level of adoption of crop sanitation. Lac yield ratio in no fertilizer applied trees was in between 2.0 to 6.0. Yield ratio was found to increase from 124 to 186 per cent due to application of recommended doses of fertilizer. Sample of winter season *kusmi* lac stick was drawn from fertilized and unfertilized trees at Giuri and Mangubandh villages of khunti and Ranchi districts. Count for caterpillar indicated that there was no significant difference in fertilizer application and no application. However, count was almost two times higher in Mangubandh than Giuri. Sticklac weight from 100 cm lac stick was recorded to be 275 and 152 per cent higher in fertilizer application trees over no application in two villages. Further, encrustation thickness was found to be 16 percent higher in fertilized trees (Fig. 9).



**Fig. 9:** Lac yield attributes recorded in fertilized and unfertilized trees at farmers' field

### 1.5 Development and evaluation of lac production practices for *swadi palas* for productivity and two bushy hosts- *arhar* and *semialala* for summer sustainability

#### (i) Pruning response in *swadi palas* for winter *kusmi* lac production at farmer's field

Forty trees of *swadi palas* was pruned (ten trees each in December 15, January 16, February 16 and March 16) and *kusmi* broodlac was inoculated in July 16. Winter *kusmi* broodlac was harvested in February 2017. Higher broodlac yield was recorded in February and January pruning and it was significantly higher than traditional practice of pruning in December. About 18-21 % yield advancement was recorded than traditional practice. Output in March pruned trees was low rather lowest

in our experiment. Thus pruning of trees of *swadi palas* must be advocated in January and February (Fig. 10).



**Fig. 10:** Pruning response in *swadi palas* for lac cultivation

While calculating three years performance on impact of pruning time for tree vigour of *swadi palas* (*Butea monosperma*) and lac productivity it was observed that inoculable new shoots length was significantly higher in early February and late January pruning as compared to traditional practice of pruning in December. Length and width of new shoots had significant and positive correlation with broodlac yield (0.673 and 0.498, respectively) whereas its correlation with number of shoots was significantly negative (-0.344) (Table 2).

**Table 2: Correlation of broodlac production with growth parameters**

Correlation	Broodlac yield ratio	Number of new shoots	Length of new shoots
Broodlac yield ratio	1.000	-	-
Number of new shoots	-0.344*	1.000	-
Length of new shoots	0.673**	0.221 <sup>NS</sup>	1.000
Width of new shoots	0.498**	-0.276 <sup>NS</sup>	0.577**

#### (ii) Pigeon pea germplasm for summer *rangeni* crop 2016-17

For developing package on *rangeni* lac production on pigeonpea, selected germplasm were evaluated for response of fertilizer and irrigation on lac productivity. Two level of irrigation: I<sub>1</sub> at critical stages *i.e.*, crawler settlement, sex differentiation and maturity, I<sub>2</sub> at 15 days interval. Two level of chemical fertilizer: F<sub>1</sub> as recommended for grain *i.e.*, N: P: K= 25: 50: 25 kg/ha, F<sub>2</sub> as recommended in F<sub>1</sub> + 50% more potash. All three factors and their interaction were significant. Irrigation had significant role in broodlac production and raised broodlac yield by 31%. Additional dose of potash also



played significant role in lac production with additional increase in lac yield by 17.6%.

(iii) Sixty three polymorphic EST microsatellite markers were assayed across the twenty seven pigeon pea genotypes collected from Jharkhand, Bihar, Assam, Manipur, Uttar Pradesh and West Bengal (Birsa Arhar 1, Birsa Arhar 2, Bahar, Assam Local 1, Assam Local 2, Assam Local 3, Acc No.- 591139, RCMP 2, RCMP 3, RCMP 4, RCMP 5, S-RCMP 5, RCMP 8, RCMP 11, IPA 8-2, S-IPA 8-2, IPA 9-1, KA 9-2, MA 6, MA 13, MA 31, KBA 40-1, NDA 1, ICPR 2671, ICPL 87119, ICP 13092 and P-291). Markers used in the study amplified a total of 352 alleles with an average high polymorphic information content value of 0.75. The average number of alleles per locus was 5.58, indicating a greater magnitude of diversity among the plant materials included in this investigation. Analysis of molecular variance showed a significant amount of differentiation (63.37%) among the genotypes. Individuals within the groups or genotypes contributed 36.63% of total variability. According to the dendrogram based on Nei's analysis the whole population was divided into two major clusters. First cluster comprised of sixteen local germplasm responsible for high yielding brood lac and second cluster contained rest of the eleven high grain yielding varieties. Different sub clusters showed a correlation between genotypes and geographic origin (Fig. 11).

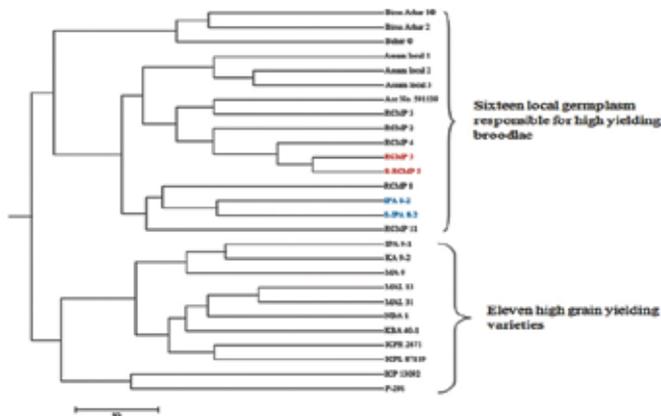


Fig. 11 : Clustering of geno types of pigeon pea

#### (iv) Potential of fruit *ber* varieties for *katki* crop (July-November) over year

Twenty four fruit *ber* varieties were evaluated for *rangeeni* lac production potential over year. *Katha* excelled in broodlac yield with output ratio of 7.6 followed by *Bagwadi* (7.3), *CAZRI Gola* (7.3) and *Seb x Gola F<sub>1</sub>* (7.0). *Katha* and *CAZRI Gola* had also higher scraped lac per cent (Fig. 12).

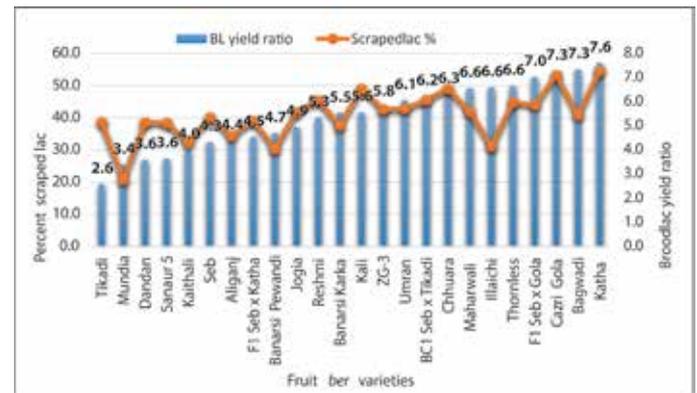


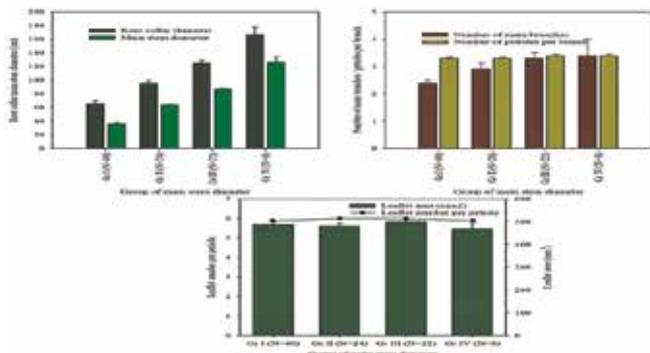
Fig. 12 : *Rangeeni* lac production potential of fruit *ber* varieties

### 1.6 Morpho-physiological characterization *vis-à-vis* strategies to augment quality and storability of seeds of *Schleichera oleosa* under ambient condition

#### Morpho-physiological study of the *kusum* plants

Altogether, 94 *kusum* plants in Ranchi region were studied for their morpho-physiological characteristics *viz.*, root collar diameter, main stem diameter and main branch diameter, petiole number/branch, leaflet number/petiole and leaflet area. In the present study, *kusum* tree was categorized on the basis of main stem diameter in four group *viz.*, Group I : small (up to 50 cm), Group II : medium (51-75 cm), Group III : large (76-100 cm) and Group IV: very large (< 101 cm). Data as shown in Fig. 13 illustrated that maximum trees (40) lie in low range (up to 50 cm) followed by medium (24), large (22) and very large range (8). The mean root collar diameter, main stem diameter and main branch number was observed maximum in very large range (<101 cm) of main stem collar diameter. Mean of petiole number/branch was observed higher in large and very large range (3.4) but the differences among them was non-significant whereas mean leaflet number/petiole was observed higher in medium and large range and it ranged from 5.8-6.8. Mean leaflet area was observed higher in large range (500.6) followed by low (488.9), medium (481.5) and very large range (468.1). The differences among root collar diameter, main stem diameter and main branch diameter, leaflet number/petiole and Leaflet area were observed to be significant. Observations revealed a significant amount of variation for their morpho-physiological characteristics. The plants have shown measurable growth responses, such variation among different populations may be due to different intensities of natural selection acting upon the traits in their natural habitat. Results of this study are

important for the conservation of the genetic variation of the species and for future improvement schemes.



**Fig. 13 :** Morpho-physiological study of the *kusum* plants

## 1.7 Comparative analysis of life table and population parameters of both *kusmi* and *rangeeni* strains of lac insect, *Kerria lacca* on three bushy host plants

Stage specific and cohort life table was constructed for *katki* (*rangeeni*) strain of lac insect in three host plants viz. *Flemingia semialata*, *F. macrophylla* and *Cajanus cajan*. The per cent of individuals that died during each age interval/apparent mortality (100qx) was found to be maximum in the 2<sup>nd</sup> instar for *bhalia* and *semialata* plants which was 16.44 and 45.77 respectively and in the 3<sup>rd</sup> instar for arhar plants which was 25.08. Survivorship curves were constructed for three host plants which showed that in *semialata* plants there was an abrupt increase in pre-settlement mortality in the 1<sup>st</sup> instar itself. Instar differentiation was found to be improper in *semialata* plants as even after 28<sup>th</sup> day of inoculation some were found to be in 1<sup>st</sup> nymphal stage and others were in 2<sup>nd</sup>. Gross reproductive rate was found to be 683, 574, 487 for *bhalia*, arhar and *semialata* respectively. Net reproductive rate was calculated to be 479.1, 313.4, 168.7 for *bhalia*, arhar and *semialata* respectively. Bioclimatic index was estimated to be 0.06, 0.04, 0.055 for *bhalia*, *semialata* and arhar respectively. The male % age was found to be 29.96%, 11.5% and 21.44% in *bhalia*, *semialata* and arhar respectively. The average resin yield was highest for *bhalia* (3.14 gm) followed by arhar (2.087 gm) and *semialata* (0.851 gm). All these attributes make *bhalia* the best preferred host for *katki* crop.

## 2. Crop Production System Management

### 2.1 Lac Integrated Farming System (LIFS)-II

Evaluation of LIFS model Brinjal + Tomato + Bittergourd

+ Cowpea was taken up in the summer of 2017. Each crop was planted in an area of 55m<sup>2</sup> (22m×2.5m). The yield was 2.16 quintals, 56.5 kg, 23.5 kg and 32 kg for brinjal, bittergourd, cowpea and tomato respectively. The overall B:C ratio was found to be 2.2:1. In winter of 2017, Brinjal-Tomato-Cowpea model was taken for evaluation. 300 each plants of brinjal, tomato and cowpea were planted in area of 55 m<sup>2</sup>, 55 m<sup>2</sup> and 110 m<sup>2</sup> area respectively.

LIFS was popularized among 2 farmers viz. Madan Das, Bimal Linda in Gosaitoli and Kochatoli respectively.

*Semialata* + Brinjal + Tomato yielded an income of Rs. 1,85,712/acre while *semialata* + Brinjal gave income of 1,55,712/acre and sole brinjal crop generated an income of Rs. 1,40,000/acre in the farmer's field. Bimal Linda was provided with 300 seedlings each of Brinjal and tomato.

## 2.2 Tritrophic interaction in lac ecosystem

### Tritrophic interaction in lac ecosystem: A semiochemical approach

The electroantennogram (EAG) responses were recorded from 2-3 days old predators viz., *Eublemma amabilis* and *Pseudohypatopa pulverea* with using minimum of five different excised antennae constituting three replicates using EAG instrument (M/s Syntech Hilversum, The Netherlands). Predators response to volatile chemicals from lac insect whole body extracts were investigated with a dual- choice Y-tube olfactometer. Adult predators were introduced into the Y-tube olfactometer at the entrance of the stem and allowed to move freely and observations were taken for their behavior/response.

### Electroantennography and behavioural studies of predator populations

The adults of lac insect predators, *E. amabilis* and *P. pulverea* showed typical electrophysiological response to extracts of lac insect and its associated products (Fig. 14). Among both the predators, *E. amabilis* has stronger EAG responses to different extracts of LIAPs than *P. pulverea*. Different extracts of lac insect and its associated products tested under EAG for *E. amabilis* and *P. pulverea* exhibited high level of sensitivity to extract of adult female (2.265-mV) and lac insect whole body (1.187-mV), respectively and significantly better response than hexane and other extracts (Table 3). Different major semiochemicals viz., Decane, Eicosane Hexadecane, Nonadecane (10 per cent) already identified using GC-MS along with lac insect whole body tested under EAG for *E. amabilis* and *P. pulverea*. *E. amabilis*, exhibited high



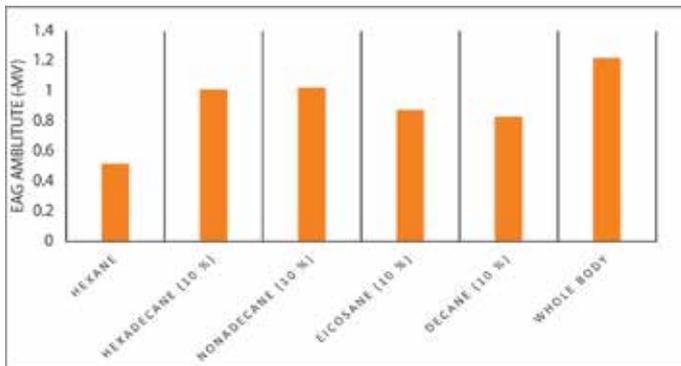
level of sensitivity to lac insect whole body (1.216-mV) followed by Hexadecane, Nonadecane, Eicosane and Decane. Similarly, *P. pulverea* also exhibited high level of sensitivity to lac insect whole body (0.987-mV) followed by Decane, Hexadecane Eicosane, and Nonadecane significantly better response than hexane (Fig. 15 & 16).



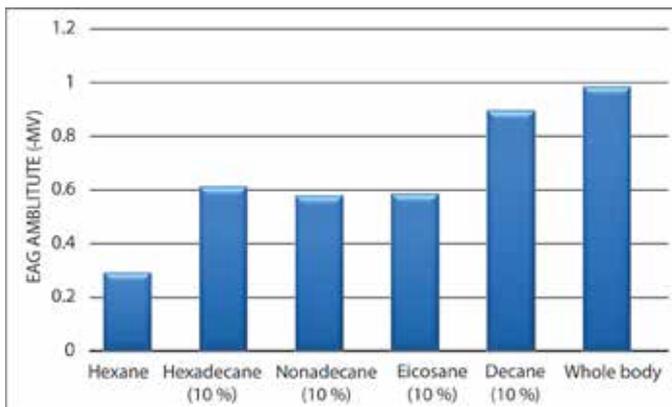
**Fig. 14 :** Electrophysiological response of predators to lac insect and associated products extracts

**Table 3 : Electroantennogram response of predators to lac insect and associated products extracts**

Lac insect and associated products extracts	Hexane	Crawler	Adult female	Wax	Resin	Whole body	SEd	CD(.05)
Response (-mV) of <i>E. amabilis</i> adults	0.551 <sup>c</sup>	1.099 <sup>bc</sup>	2.265 <sup>a</sup>	1.468 <sup>b</sup>	1.365 <sup>b</sup>	1.080 <sup>bc</sup>	0.332	0.687
Response (-mV) of <i>P. pulverea</i> adults	0.570 <sup>c</sup>	0.634 <sup>c</sup>	1.138 <sup>ab</sup>	0.985 <sup>ab</sup>	0.926 <sup>b</sup>	1.187 <sup>a</sup>	0.114	0.234



**Fig. 15 :** EAG responses of *E. amabilis* against different semiochemicals

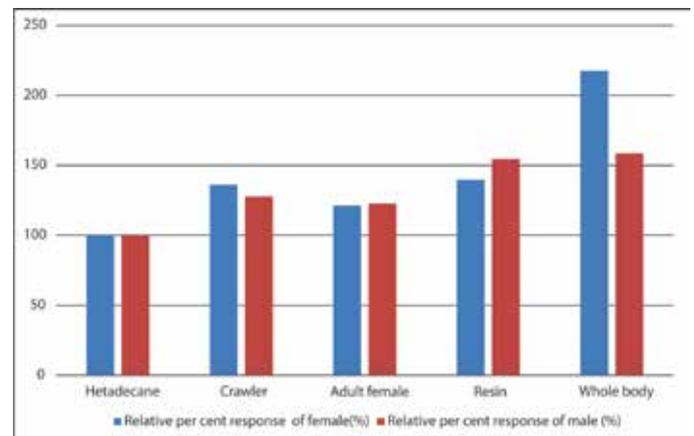


**Fig. 16 :** EAG responses of *P. pulverea* against different semiochemicals

### Relative EAG responses of *E. amabilis*

EAG response to the individual samples were combined as pooled and averaged. Relative responses are expressed as per cent of response to standard stimulus (Heptadecane in hexane). Relative per cent response

of *E. amabilis* to lac insect samples extracted in hexane viz. crawler (136 and 128 %), adult female (121 and 123 %), resin (140 and 155 %) and whole body (218 and 159 %) were recorded from female and male of *E. amabilis*, respectively. EAG responses of *E. amabilis* female as well as male were higher to the extracts of lac insect whole body followed by lac resin, crawler and adult female (Fig. 17).

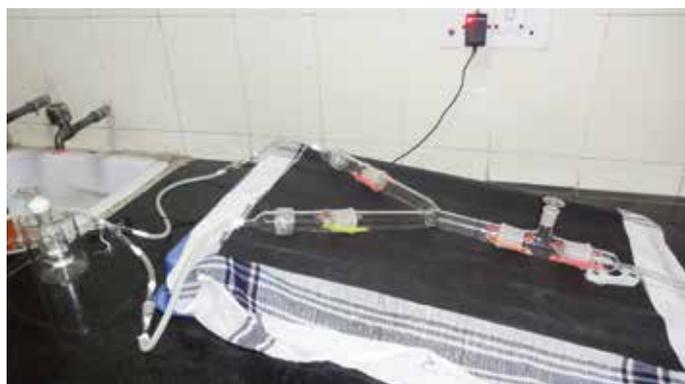


**Fig. 17:** Relative EAG responses of *E. amabilis* to lac insect and associated products extracts

Behavioural studies of predator populations with the extracted volatiles from lac insect whole body were done using "Y" tube olfactometer. *E. amabilis* and *P. pulverea* collected and released in to "Y" tube olfactometer to test the attraction towards extract of lac insect whole body kept in one arm of olfactometer and hexane as control in other arm. It was found that, out of 40 *E. amabilis* 6 numbers each were moved towards lac insect whole body extract and solvent (Hexane). Remaining 28 did not move anywhere. Similar study was also tried with *P.*

*pulverea*. It was found that out of 11 *P. pulverea*, 9 and 2 numbers moved towards lac insect whole body extract

and solvent (Hexane), respectively (Fig. 18).



**Fig. 18 :** Predators moved towards lac insect whole body extracts in 'Y' tube olfactometer

### 2.3 Effect of abiotic factors on lac associated fauna in rangeeni crops

#### Relative abundance of lac associated fauna during rangeeni lac crops

Relative abundance and emergence profile of parasitoids and predators associated with lac insect were recorded at Institute Research Farm, Namkum, Ranchi, Jharkhand during *baisakhi* (2017) and *katki* (2017) crops under two different conditions viz., Fipronil + Chlorothalonil and Chlorothalonil only. The information generated revealed that three parasitoids

(*Astocetus purpureus*, *Tachardiaephagus tachardiae*, *Parechthrodryinus clavicornis*) and one predator *Eublemma amabilis* were abundant in *baisakhi* and *katki*, 2017. Population lac associated fauna was recorded more on sprayed with Chlorothalonil only compared to Fipronil + Chlorothalonil on *ber* and *palas* during both *baisakhi* and *katki*, 2017. Among lac associated fauna, *Aprostocetus purpureus* was recorded more numbers sprayed with Chlorothalonil only compared to Fipronil + Chlorothalonil on *ber* and *palas* during *baisakhi* and *katki*, 2017. (Table 4 & 5).

**Table 4 :** Relative abundance of lac associated fauna during *Baisakhi* 2017

Lac associated fauna	Chlorothalonil only (Numbers per meter lac encrustation)		Fipronil + Chlorothalonil (Numbers per meter lac encrustation)	
	<i>Ber</i>	<i>Palas</i>	<i>Ber</i>	<i>Palas</i>
<i>Tachardiaephagus tachardiae</i>	19.00	26.33	6.00	3.67
<i>Aprostocetus purpureus</i>	64.67	31.33	14.00	4.67
<i>Parechthrodryinus clavicornis</i>	0.33	3.67	2.00	1.00
<i>Eublemma amabilis</i>	13.00	32.33	3.33	11.00
Total	97.00	93.67	25.33	20.33

**Table 5 :** Relative abundance of lac associated fauna during *Katki* 2017

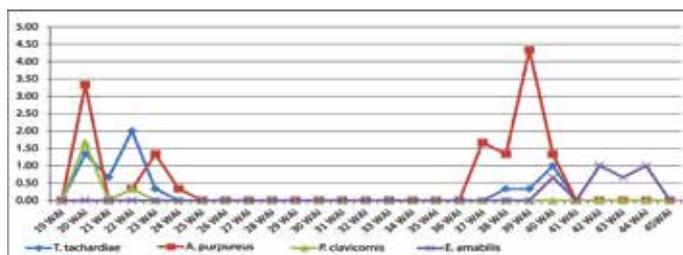
Lac associated fauna	Chlorothalonil only (Numbers per meter lac encrustation)		Fipronil + Chlorothalonil (Numbers per meter lac encrustation)	
	<i>Ber</i>	<i>Palas</i>	<i>Ber</i>	<i>Palas</i>
<i>Tachardiaephagus tachardiae</i>	18.00	9.33	14.00	9.33
<i>Aprostocetus purpureus</i>	171.00	87.67	53.33	67.67
<i>Parechthrodryinus clavicornis</i>	2.67	4.67	1.00	0.33
<i>Eublemma amabilis</i>	11.33	21.33	7.33	9.00
Total	203.00	123.00	75.67	86.33



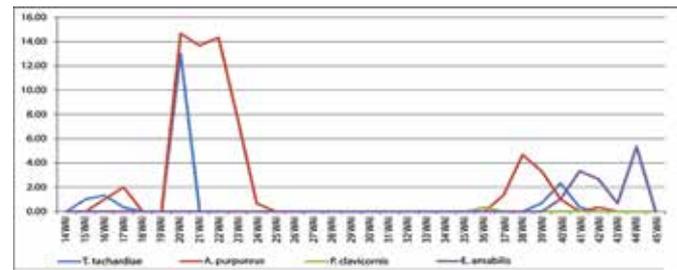
### Emergence profile of lac associated fauna during *rangeeni* lac crops

Study on weekly emergence profile of lac associated fauna showed maximum population of *A. purpureus* in those samples which were collected 20 WAI during sexual maturity period in Chlorothalonil only (14.67) on *ber* whereas in *palas*, maximum population of *Tachardiaephagus tachardiae* (15.33) and *E. amabilis* (10.00) during 38 WAI and 44 WAI, respectively as compared to Fipronil + Chlorothalonil when caged during *baisakhi* 2017 (Fig. 19 to 22). In *Katki*, 2017 the maximum emergence of *A. purpureus* (47.67, 29.67) during 17 WAI and 16WAI when raised on *ber* and *palas* respectively, in Chlorothalonil only compared to Fipronil + Chlorothalonil. (Fig. 23 to 26)

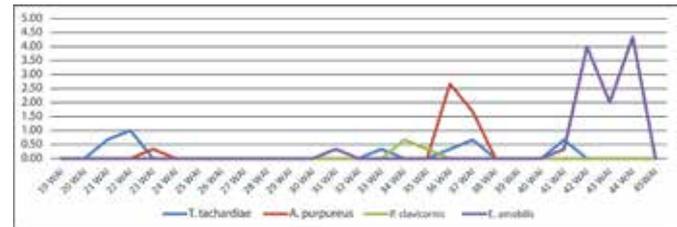
In addition, emergence profile of lac associated fauna was compared between different caging methods viz., *in situ* caging and lab caging during *baisakhi* 2017 and *katki*, 2017. Higher number of parasitoids was recorded in *in situ* method of caging compared to lab caging. *A. purpureus*, *P. clavicornis* and *T. tachardiae* were more in number sprayed with Chlorothalonil only in *in situ* method of caging on *ber* (Fig. 27). Whereas, in *palas* *A. purpureus*, *P. clavicornis* and *E. amabilis* were more in number sprayed with Chlorothalonil only whereas *T. tachardiae* more in sprayed with Fipronil + Chlorothalonil in *insitu* method of caging during *baisakhi* 2017 (Fig. 28). Fipronil spray may be effective against *A. purpureus*, *P. clavicornis* and *E. amabilis* but less effective against *T. tachardiae*. Similar trend was observed during *katki*, 2017 (Fig. 29 & 30). Interestingly, un-emerged *E. amabilis* (immature stages viz., larva and pupa) were also recorded while pricking/scraping of lac encrustation sample on both the host and methods of caging during *baisakhi*, 2017 and *katki*, 2017.



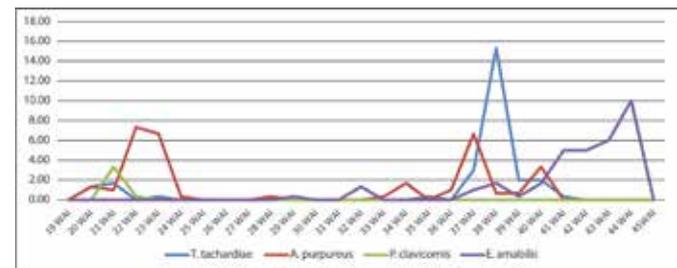
**Fig. 19 :** Emergence profile of lac associated fauna on *ber* during *Baisakhi* 2017(Fipronil+ Chlorothalonil)



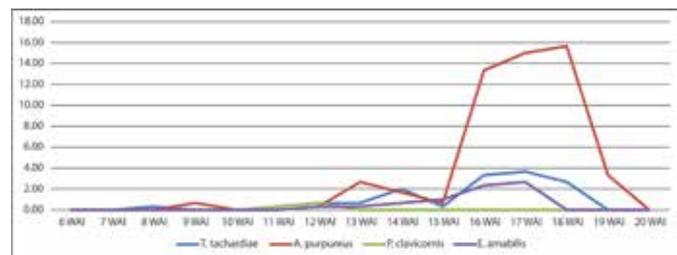
**Fig. 20:** Emergence profile of lac associated fauna on *ber* during *Baisakhi* 2017(Chlorothalonil only)



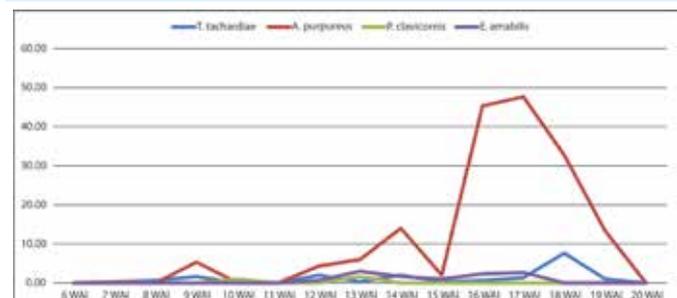
**Fig. 21:** Emergence profile of lac associated fauna on *palas* during *Baisakhi* 2017(Fipronil+ Chlorothalonil)



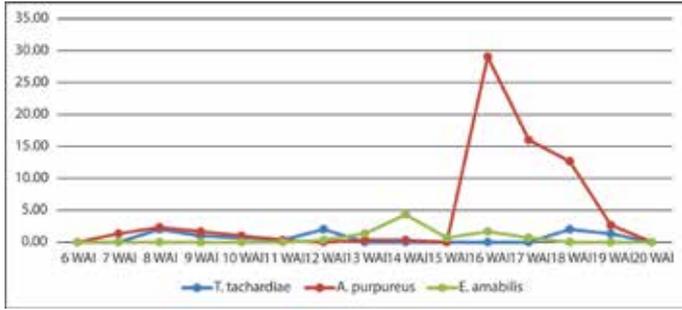
**Fig. 22:** Emergence profile of lac associated fauna on *palas* during *Baisakhi* 2017(Chlorothalonil only)



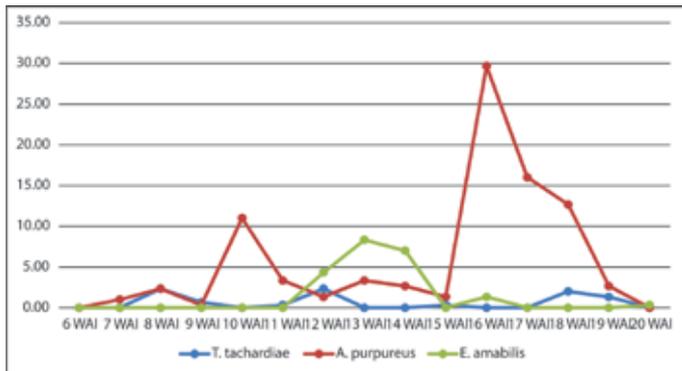
**Fig. 23:** Emergence profile of lac associated fauna on *ber* during *katki* 2017 (Fipronil+ Chlorothalonil)



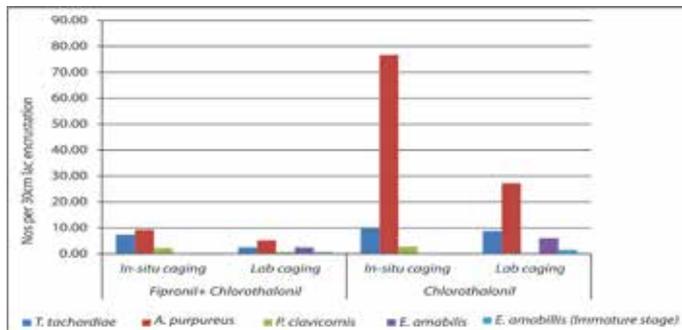
**Fig. 24:** Emergence profile of lac associated fauna on *ber* during *katki* 2017 (Chlorothalonil only)



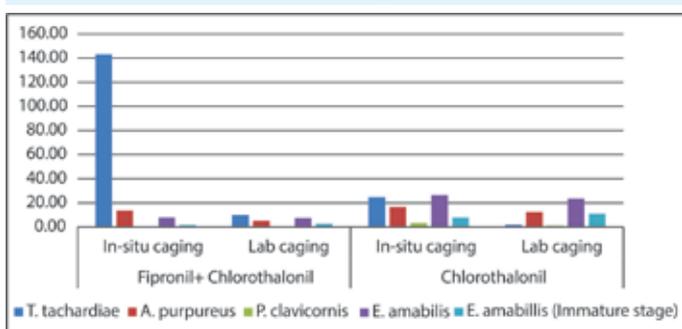
**Fig. 25:** Emergence profile of lac associated fauna on *palas* during *katki* 2017(Fipronil+ Chlorothalonil)



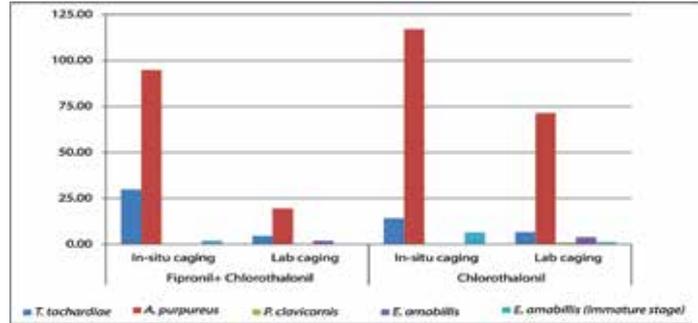
**Fig. 26:** Emergence profile of lac associated fauna on *palas* during *katki* 2017 (Chlorothalonil only)



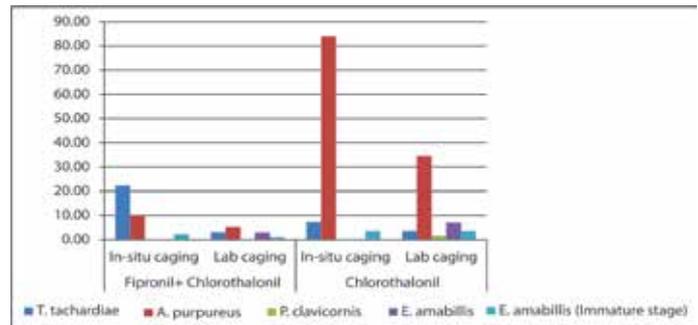
**Fig. 27:** Emergence profile of lac associated fauna from different methods on *ber* during *Baisakhi* 2017



**Fig. 28:** Emergence profile of lac associated fauna from different methods on *palas* during *Baisakhi* 2017



**Fig. 29:** Emergence profile of lac associated fauna from different methods on *ber* during *katki* 2017



**Fig. 30:** Emergence profile of lac associated fauna from different methods on *palas* during *katki* 2017

### Assessment of parasitization during *rangeeni* lac crops

Lac insect cells were collected during critical period 17<sup>th</sup> to 22<sup>th</sup> week after inoculation and 10 to 14 WAI from field during summer season *rangeeni* (*baisakhi*) and rainy season (*katki*) crop 2017 and examined under microscope by pricking the cells to assess the level of parasitization. Lac insect cells 333 and 446 were pricked on *ber* and *palas*, respectively. There were per cent parasitization in live (1.8, 2.02) and dead (49.76, 62.3) lac insect cells on *ber* and *palas*, respectively. Similarly, in *katki*, 2017, lac insect cells 294 and 383 were pricked on *ber* and *palas*, respectively. There were per cent parasitization in live (6.4, 6.5) and dead (28.2, 53.8) lac insect cells on *ber* and *palas*, respectively. Level of parasitization was recorded less in *katki* 2017 as compared to *baisakhi* 2017 on *ber* and *palas*. The maximum level of parasitization was recorded at the time of sexual maturity period on *ber* and *palas* during *baisakhi* (2017) whereas in *katki* (2017), maximum level of parasitization during crop maturity period on *ber* and *palas*.



## 2.4 Externally Funded Projects

### DBT Bio-CARe Project

#### Identification, cloning and characterization of genes involved in pigment biosynthesis of the Indian lac insect, *Kerria lacca* (Kerr)

Putative enzymes involved in the pigment biosynthesis pathway have been deduced from the available literature. The different pigment related genes associated with the pathway were successfully amplified by PCR from cDNA of crimson and yellow lac insects. The specific primer pairs of genes N-acetyl transferase (cnt), deaminase (da), yellow N-acetyl transferase (ynt), tyrosine monooxygenase (tymo), acyl transferase (at), demethylase (dm) were obtained from the transcriptome data. The gene sequences were amplified and cloned via TA cloning and sequenced. The length of sequences obtained for cnt, da, ynt, tymo, at, dm were of 975 bp, 1695 bp, 1303 bp, 1695 bp, 1617 bp and 1585 bp, respectively. Using the partial cDNA sequences of the following genes, the specific primers pairs for 3' and 5' rapid amplification of cDNA ends (RACE) were designed. The full-length cDNA cloning of deaminase (da) gene has been done by 3' and 5' Rapid Amplification of cDNA Ends (RACE). The sequences of 5' and 3' RACE products of da have been assembled to get the complete cDNA sequence of 2477 bp.

### ICAR - ICRAF Project

#### Enabling tribal communities to improve their livelihood through agro forestry systems on a sustainable basis

The work under the project has been started since October, 2017 at ICAR - IINRG, Ranchi. The site selection for base line survey and selection of villages, tribal farmer's beneficiary for adoption of LIFS under this collaborative project has carried out. For implementation of the project team visited Ichagarh block of Seraikela Kharsawan district on 24 November 2018. A *Kishan Gosthi* was organized and problems on lac cultivation was discussed among 72 farmers present in this *Gosthi*. Two tribal farmers were selected under this project.



*Kisan Gosthi at Panchayat Bhawan, Melan Chowk*



Proposed LIFS field at Ichagarh



Proposed LIFS field at Choti Chunchunia

Visited Jaipur village of Rania block, Khunti on 28 Nov 2018 to select farmers for the same. Majority of palas (a major lac host) plant in tribal areas are not being used for lac cultivation. One tribal farmers selected in Jaipur village for adoption of LIFS model.



Proposed LIFS field at Jaipur, Rania block of Khunti district



Team visited Beniyajara, Angara block of Ranchi district on 7 Dec 2017 and selected farmers. *Semialata* with vegetables have been proposed for adoption of LIFS model under this project.



Field view for proposed LIFS in Beniyajara

### Field view for proposed LIFS in Beniyajara

#### List of selected farmers under ICRAF project

Name of farmers	Name of Villages	Sub Districts	District
Mr Kishun Mahto	Beniyajara	Angara	Ranchi
Mr Xavior Kendulana	Jaipur	Rania	Khunti
Mr Umesh Singh Munda	Milan	Ichagarh	Seraikela Kharsawan
Mr Krishna Singh Munda	Bada Chunchunia	Ichagarh	Seraikela Kharsawan



## Processing and Product Development

### 3. Processing, Storage and Quality Management

#### 3.1 Establishment of pilot plant of dewaxed decolourised lac (DDL) for training, demonstration and process refinement

##### Study on DDL preparation and use of alternate solvent in process

Some more trials of dewaxed and decolourised lac (DDL) were carried out for DDL preparation in both ethanol and 2-Propanol. A total 10 nos. fresh trial carried in lac-

solvent ratio 1:6 for DDL preparation which includes 4 nos. trial in alternate solvent 2-Propanol in place of spirit (ethanol). The initial colour value of seedlac used for these trials was 12. For colour removal of lac in solution 20% fresh charcoal was used during refluxing of lac solution in solvent. Time duration for charcoal treatment in refluxing was kept 0.5, 1, 1.5 and 2 hrs. Wax removals were carried out in thick jeans cloth in place of filter paper of lab process suitable for up-scaling. Hot filtration of charcoal was also carried out in thick cloth in place of filter paper of lab process so that process can be up-scaled (Table 6).

**Table 6 : Process validation and optimization for up-scaling the process**

Sl. No.	Colour of seedlac	Charcoal (%)	Lac-solvent ratio (w/v)	Yield of DDL (%)	Colour of DDL	Wax (%)	Impurity (%)	Acid value	Flow (mm)	Life (min.)
1	12	20	1:6	77	2.4	0.33	0.046	66.58	60	31
2	12	20	1:6	60	2.6	0.27	0.050	76.66	40	26
3	12	20	1:6	63	2.6	0.43	0.052	78.71	50	19
4	12	20	1:6	61	2.0	0.27	0.938	70.68	62	17
5	12	20	1:6	67	1.0	0.28	42.156	49.42	Nil	Nil
6	12	20	1:6	71	2.6	0.34	0.834	75.00	75	21
7	12	20	1:6*	65	1.8	0.98	1.218	77.58	72	23
8	12	20	1:6*	68	2.0	1.17	1.116	77.69	62	37
9	13	20	1:6*	62	4.0	0.08	0.416	76.18	55	34
10	13	20	1:6*	53	4.0	0.31	0.418	76.23	35	20

\* Solvent 2-Propanol



**Fig. 31a** : DDL sample prepared in spirit solvent



**Fig. 31b** : DDL sample prepared in 2-Propanol solvent



In the first 06 no. trials carried out in spirit (ethanol), yield of DDL were 60 to 77% by weight of seedlac and in 04 no. trials carried out in 2-Propanol, yield of DDL were 53 to 68% by weight of seedlac. Reduction in colour value of lac (seedlac colour value 12) in DDL were 2.6 to 1 and in 2-propanol trial these were 1.8 to 4. During these trials maximum yield upto 77% by wt. of seedlac was obtained and colour reduction maximum lower to 1 value from 12 colour value of seedlac was achieved. Slight issue of dissolution of seedlac in 2-Propanol was observed while DDL preparation compared to use of spirit as solvent for DDL preparation. Flow of DDL sample upto 75mm and life of sample upto 37 minutes were obtained. Wax, impurity content and acid value of DDL samples were within limit. DDL samples prepared in 2-Propanol were of reduced colour and similar quality parameters compared to samples prepared in spirit indicates use of this alternate solvent in case of restricted/non availability of spirit for DDL preparation (Fig. 31a & b).

### 3.2 Biodegradation studies on lac resin using soil burial method

The lac samples (sticklac, seedlac and shellac) buried in farm pit and pot soil were drawn after interval of one year of its burial. The samples were washed thoroughly to remove the soil stick to the samples and dried weights were recorded for their weight loss. Sticklac lac and seedlac showed 16-27% and 7-9% weight loss respectively. The samples buried in farm pit soil recorded higher decrease in weight as compared to the samples buried in pot. Shellac recorded very less decrease in weight after one year of its burial test (Fig. 32 a & b).

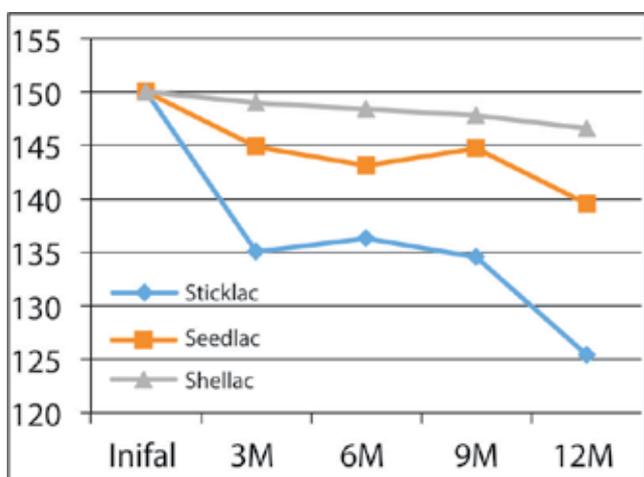


Fig. 32a : Weight loss of samples buried in pot soil

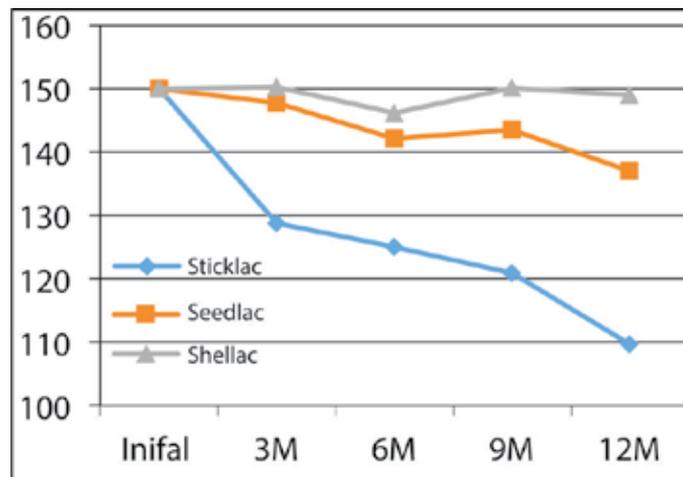


Fig. 32b : Weight loss of samples buried in pit soil

Physico-chemical properties such as flow, life under heat, cold alcohol insoluble % and color index of the samples were determined. Significant change was observed in flow of sticklac and seedlac samples. Flow (fluidity) of sticklac and seedlac buried in pit and pot became nil while control samples showed flow of 20mm and 43mm respectively (Fig. 33 a & b). Life under heat of buried lac samples decreased higher as compared to that of control samples. No significant change was observed in cold alcohol insoluble % and colour index of the samples.

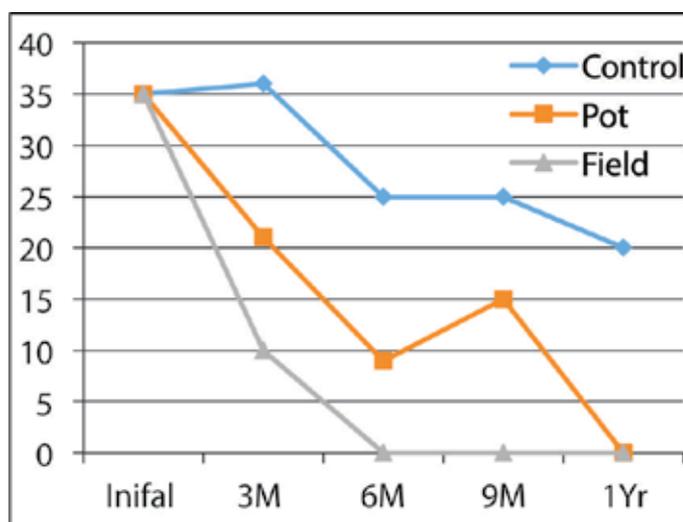
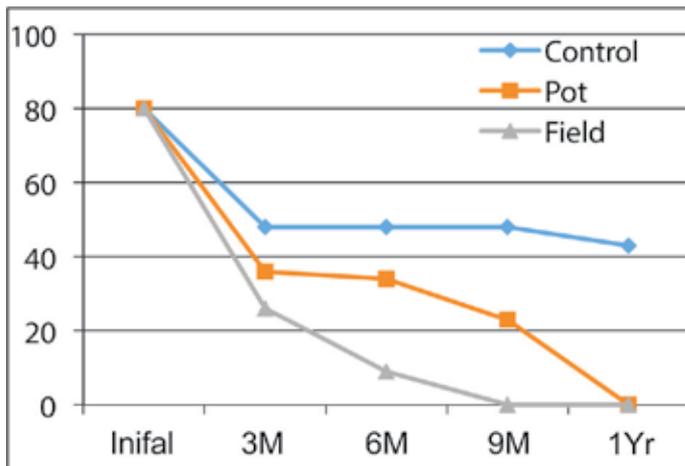


Fig. 33 a : Flow of sticklac samples



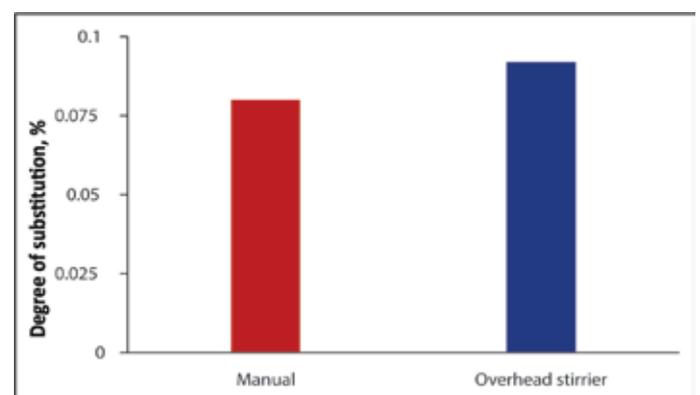
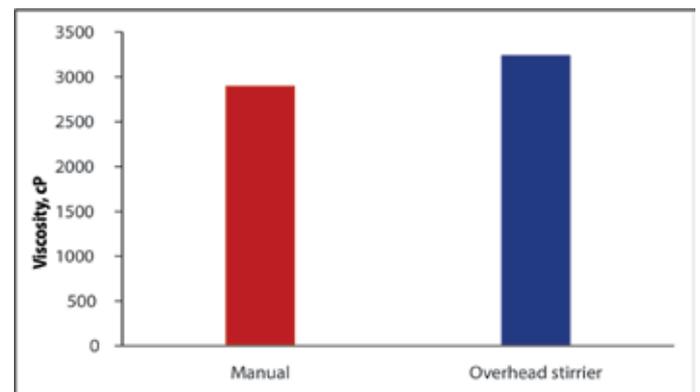
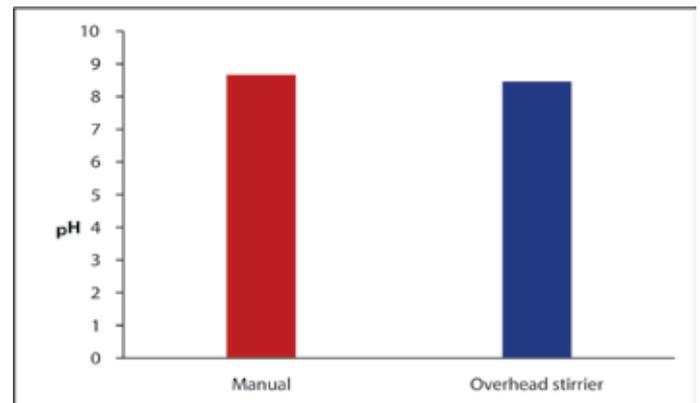


**Fig. 33b :** Flow of seedlac samples after one year of interval

### 3.3 Development of pilot plant of *guar* gum derivative for training and demonstration

Carboxy methyl *guar* gum derivative prepared on bench scale to observe the requirement of mechanisms for pilot plant and machineries based on process of carboxy methyl *guar* gum derivative preparation. Total 28 trials of carboxy methyl *guar* gum derivative preparation carried out during the experimentation. Out of total experiments, 21 experiments were conducted manually and rest 07 experiments were conducted using overhead stirrer. Mean pH, viscosity and degree of substitution of manually prepared carboxy methyl *guar* gum derivative on bench scale were evaluated and determined to be 8.67, 2892.72 cP and 0.08% with minimum and maximum values as 7.42 and 9.89, 16.5 and 4889 cP and 0.00 and 0.12%, respectively whereas the same were 8.46, 3241.88 cP and 0.092% with minimum and maximum values as 7.30 and 9.17, 16.50 and 5199 cP and 0.07 and 0.12%, respectively for carboxy methyl *guar* gum derivative prepared using overhead stirrer. Mean values quality parameters (pH, viscosity and degree of substitution) of carboxy methyl *guar* gum derivative prepared manually and using overhead stirrer were found to be almost similar (Fig. 34).

Carboxy methyl *guar* gum derivative was also prepared manually with 5 kg *guar* gum powder (Fig. 35 and 36) and quality parameters of same were evaluated. Mean quality parameters (viscosity and degree of substitution) of the carboxy methyl *guar* gum derivative prepared manually with 5 kg *guar* gum powder were determined to be very less (9.07cP and 0.06%) with minimum and maximum mean values as 5.45 and 14.25 cP and 0.05 and 0.07%, respectively.



**Fig. 34 :** Mean quality parameters of carboxy methyl *guar* gum derivative prepared manually and using overhead stirrer

During the process of carboxy methyl *guar* gum derivative preparation with 5 kg *guar* gum sample, it was observed that volume of the prepared carboxy methyl *guar* gum derivative increases up to 2.5 times compared to the raw material (*guar* gum powder) volume.

Again trials of carboxy methyl *guar* gum derivative preparation were conducted manually with 1 kg *guar* gum powder and quality parameters (viscosity and degree of substitution) determined. Mean viscosity and degree of substitution of carboxy methyl *guar* gum derivative prepared with 1 kg *guar* gum powder were determined as 1685.47 cP and 0.078% with minimum



and maximum value as 11.35 and 3149 cP and 0.06 and 0.10%, respectively. On the basis of experimental trials of carboxy methyl *guar* gum derivative preparation from *guar* gum powder, equipments and machineries requirement for pilot plant development finalized based on method of preparation.



Fig. 35 : Carboxy methyl *guar* gum derivative



Fig. 36 : Prepared carboxy methyl *guar* gum derivative

#### 4. Value Addition, Application Development and Product Diversification

##### 4.1 Synthesis and evaluation of cross-linked *guar* gum hydrogels for application in bio-remediation and in agriculture

Novel super absorbent hydrogels were synthesized by grafting *guar* gum with acrylic acid and cross-linking with ethylene-glycol dimethacrylic acid (GG-AA-EGDMA). Synthesized hydrogels were characterized by <sup>13</sup>C NMR, FT-IR, SEM, thermal stability, swelling and biodegradation studies (Fig. 37 & 38).

The synthesized hydrogels were evaluated for agricultural applications as soil conditioners and as matrix for controlled release of phosphorus (P) and boron (B) in soil as well as water. For this, same hydrogels

were synthesized by *insitu* loading of  $\text{KH}_2\text{PO}_4$  and  $\text{H}_3\text{BO}_3$  as a nutrient source for P and B respectively. The release pattern of fertilizer loaded hydrogels (FLH) in acid soil was compared with the commercial fertilizer, boronated single super phosphate (bSSP) along with soil alone as a control. The powdered hydrogel showed tremendous capacity to absorb water (up to 800 g/g for distilled water) and modestly faster decay in soil with half-life of about 77 days. This hydrogel after addition to soil as fine powder could improve its moisture retention significantly at minor dose of 0.1 to 0.3%. Water holding capacity of soil increased to up to 1.5 times and soil could retain the marginally higher moisture percentage even up to higher matric suction of 15 bars. Also incorporation of fine powder of hydrogel up to 0.3% in the soil improved its porosity up to 9% of its original (Fig 39).



Fig. 37 : Hydrogel appearance (Dried and swollen)

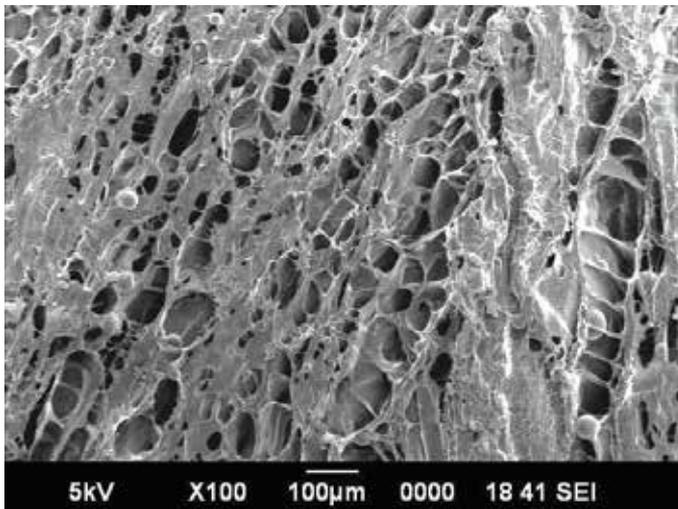
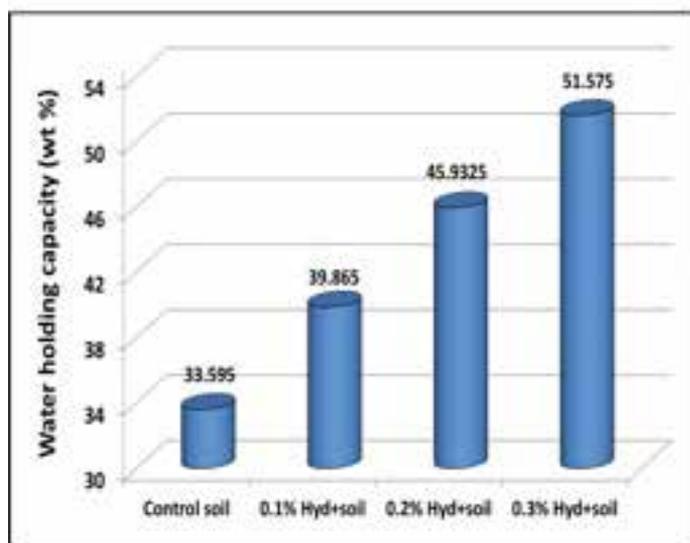


Fig. 38 : Morphological study (SEM)





**Fig. 39 :** Maximum Water Holding Capacity of Soil

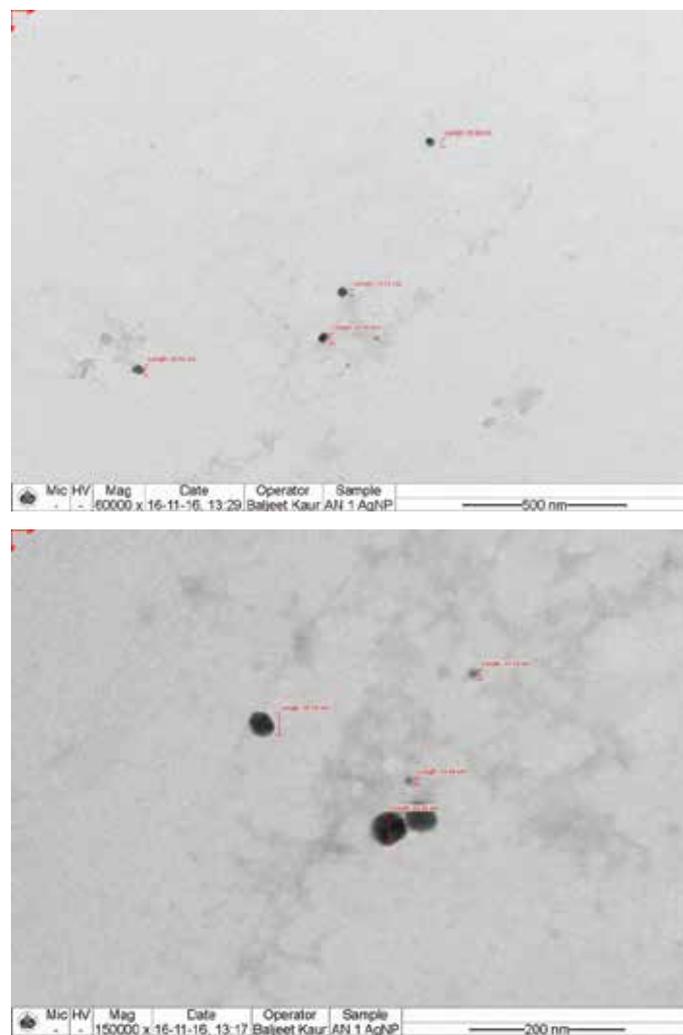
Controlled release studies for P and B in soil was done by pot culture experiment. The nutrient loaded hydrogel could maintain optimum concentration of P & B up to 60 days whereas; in case of commercial fertilizer, boronated single super phosphate, burst release of nutrient at early stage resulted in fixation of nutrient in to plant unavailable form. Nutrient release kinetics studies through GG-AA-EGDMA revealed that, the hydrogel followed 'Fickian' mechanism for release of P and B in water and also best fit curves for the release in soil were calculated. The synthesized hydrogel are expected to have wide potential applications in agriculture and horticulture, particularly in acidic soils. Overall, the synthesized cross-linked *guar* gum hydrogels were found to be promising materials for environmental and agricultural applications.

#### 4.2 Green synthesis of silver nanoparticles capped in *Acacia* and *Jhingan* gum for bactericidal application

##### Characterization of *Acacia nilotica* gum-based silver nanoparticles (AgNPs)

Inductively Coupled Plasma Optical Emission Spectrometry (ICP-OES) method for detecting the presence of heavy metals in the synthesized *Acacia nilotica* gum-based silver nanoparticles (AgNPs) exhibited that Ag was 40.46 mg/litre and Pb, Cd &

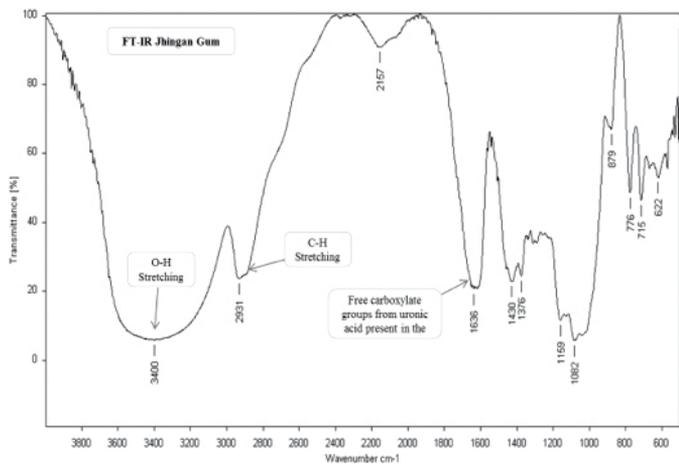
As were below detectable limits. TEM images of the synthesized *Acacia nilotica* gum-based AgNPs with 2.0 % gum concentration showed particles size ranging from 10.89 nm to 53.04 nm under different magnifications from 60,000 to 1,50,000 (Fig. 40).



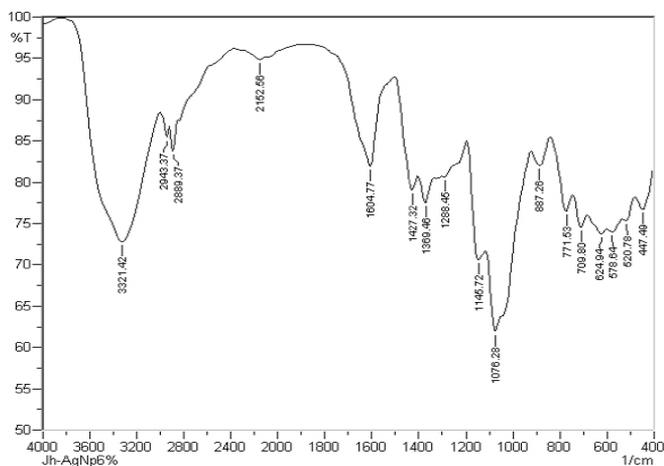
**Fig. 40 :** TEM images of synthesized *Acacia nilotica* gum-based AgNPs

##### Characterization of *Jhingan* gum-based silver nanoparticles (AgNPs)

FT-IR spectra of synthesized *jhingan* gum-based AgNPs showed shifts in the absorbance peaks from 3400 to 3321  $\text{cm}^{-1}$  (due to stretching vibrations of O-H groups), 1636 to 1604  $\text{cm}^{-1}$  ((due to characteristic asymmetrical stretch of carboxylate groups) and 1376 to 1369  $\text{cm}^{-1}$  (due to symmetrical stretch of carboxylate groups) with decreased band intensity is suggestive of the binding of silver ions with hydroxyl and carboxylate groups of gum, respectively (Fig. 41a & b).

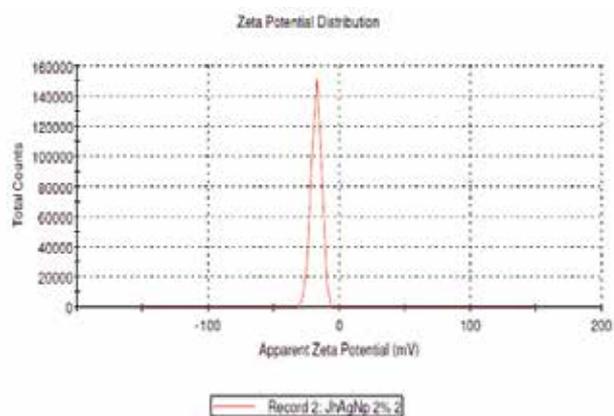


(a)

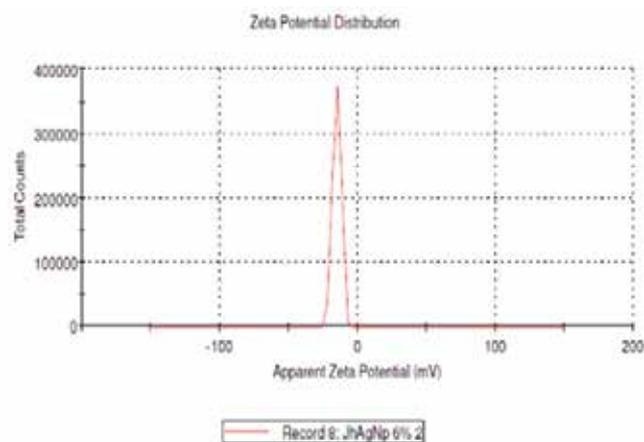


**Fig. 41 :** FT-IR spectrum of (a) *Jhingan* gum (b) synthesized *Jhingan* gum-based AgNPs

The synthesized *jhingan* gum-based AgNPs with 2% gum concentration showed zeta potential value -17.7 mV whereas with 6.0 % gum concentration, it was -15.0 mV. This data showed that synthesized *jhingan* gum-based AgNPs are fairly stable (Fig. 42 a & b).



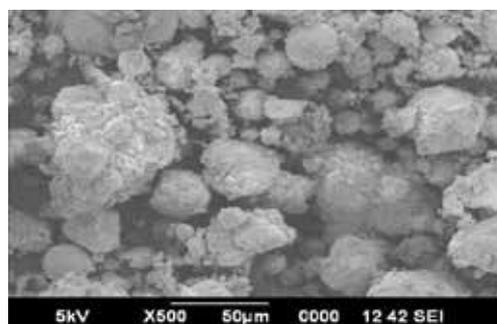
(a)



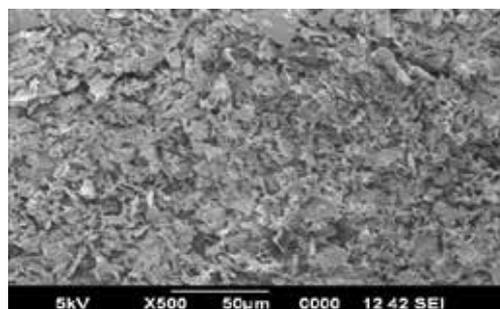
(b)

**Fig. 42 :** Zeta potential of synthesized *Jhingan* gum-based AgNPs (a) 2% *Jhingan* gum (b) 6% *Jhingan* gum

Morphological features of the *jhingan* gum and its synthesized AgNPs were studied with a JEOL JSM-6390 LV Scanning Electron Microscope. The images were taken at an accelerating voltage of 5 kV and at different magnifications. The most meaningful information was obtained at X500 magnification and 50 μm scale and found that the gum has distinct, irregular, macro/ large particles. On the contrary, the *jhingan* gum-based AgNPs surface morphology showed compact micro inter-woven particles like structure (Fig. 43 a & b).



(a)



(b)

**Fig. 43 :** SEM Images of (a) *Jhingan* gum (b) synthesized *Jhingan* gum-based AgNPs



### 4.3 Development of coating formulation for paper packaging materials

Different coating formulations were developed for paper packaging material in aqueous and solvent systems. The formulations were homogeneous in nature. Films were developed on tin panels and glass plates and studied. FT-IR spectra showed intensity of carboxyl group of shellac decreased on reaction with reactants, indicating interaction of shellac with molecules of reactants. Thermal behaviour of the films of the formulations was studied with Differential Scanning Calorimetry (DSC). DSC thermograms revealed thermal stability of the two samples up to 200 °C, with little softening around 80 °C. Films of the formulations were observed to be flexible and showed resistance to impact.

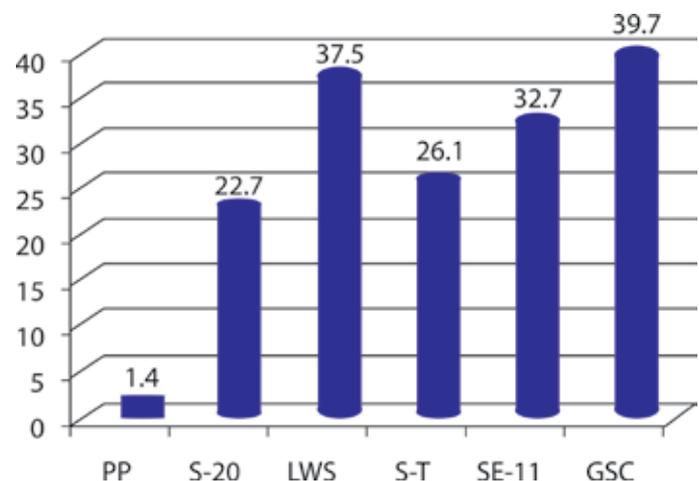
The formulations were applied on the packaging papers. The formulations were found to be smooth, uniform and glossy (Fig. 44 a & b). The coated papers were studied for mechanical properties such as tensile strength, tensile modulus, elongation% and toughness with UTM. Improvement in mechanical properties was observed after coating the papers. Tensile strength and tensile modulus increased by 76% and 90% respectively as compared to control. Elastic modulus was calculated 3 times increase as compared to that of control. The formulations showed glossiness (59% as compared to standard black 57%) (Fig. 45).



**Fig. 44 a :** Control packaging paper

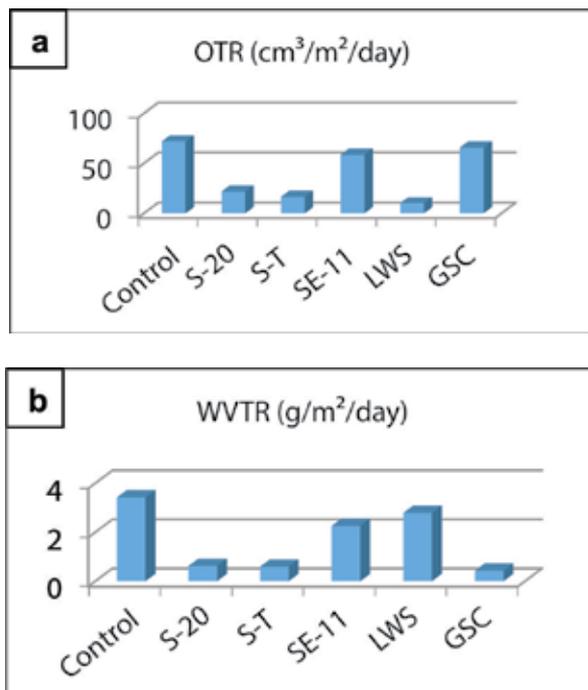


**Fig. 44 b :** Packaging paper coated with one of the formulations



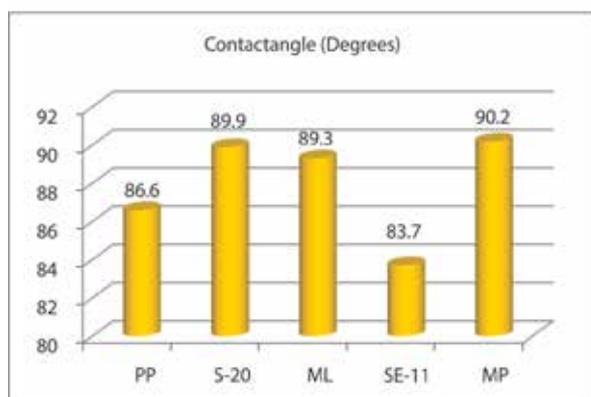
**Fig. 45 :** Gloss of the packaging papers coated with different formulations

Barrier properties such as oxygen and water vapour permeability tests of paper packaging materials coated with the developed coating formulations were evaluated from ICAR-CIPHET, Ludhiana. Six samples of coated packaging papers including control sample were successfully evaluated for their oxygen transmission rate (OTR) and water vapour transmission rate (WVTR). Thickness of the packaging papers was 447-579 $\mu$ , while film thickness of the formulations was 20-132 $\mu$ . OTR and WVTR of the samples tested were found in the range of 10.1–71.871 cm<sup>3</sup>/cm<sup>2</sup>.24hr and 0.424-3.417 g/cm<sup>2</sup>.day respectively (Fig. 46 a & b).

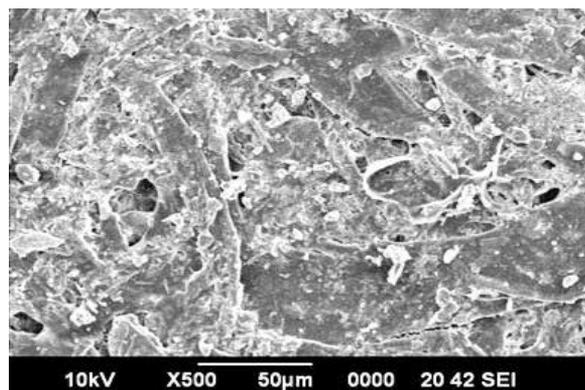


**Fig. 46 :** (a) OTR of the packaging papers coated with the different formulations, (b) WVTR of the packaging papers coated with the different formulations

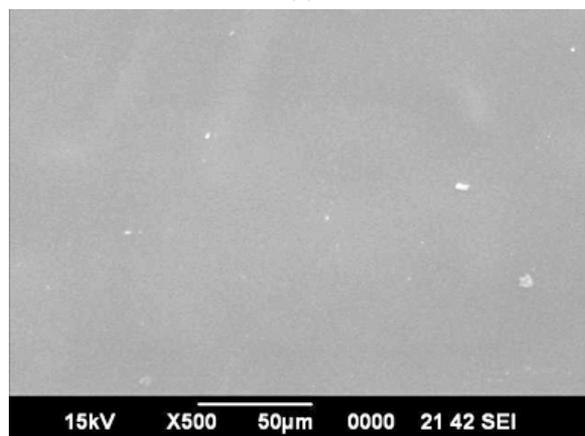
Contact angle measurement on the coated packaging papers were carried out against water to see behaviour of the coating formulations with water. It was observed that hydrophobicity of the packaging paper increased after coating the papers with the formulations (Fig. 47). Scanning electron microscopic (SEM) analysis of the coated packaging papers was carried out to analyze surface morphology of the packaging papers. The analysis indicated that pores of the paper were blocked with coating of the formulations. Surface of the paper got smoothed and surface evenness was observed after coating the packaging papers with the formulations (Fig. 48).



**Fig. 47 :** Contact angle on the packaging papers coated with different formulations against water



(a)



(b)

**Fig. 48 :** SEM image of (a) Control packaging paper and (b) packaging paper coated with one of the formulation

#### 4.4 Modification of guar and arabic gum for potential use as dietary fibre

Partially hydrolyzed guar gum (PHGG) is reported as a source of water soluble dietary fiber showing physiological benefits like increase in defecating frequency and reduction in serum cholesterol, free fatty acid and glucose concentration. Enzymatic hydrolysis of guar gum can be achieved through endo-β-mannanase enzyme. They catalyze the hydrolysis of 1,4-α-D-mannosidic linkages in galactomannan polymers. Their ability to degrade these substrates depends both on the degree of polymerization and galactose substitution levels.

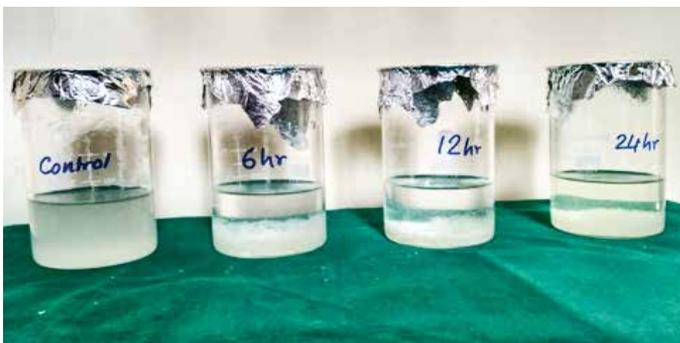
Partial hydrolysis of guar gum was carried out using enzyme endo-β-mannanase under different reaction parameters (conc. of substrate, time and pH). The reaction condition of the enzymatic degradation was standardized. It was observed that at pH 6.0, 40 °C



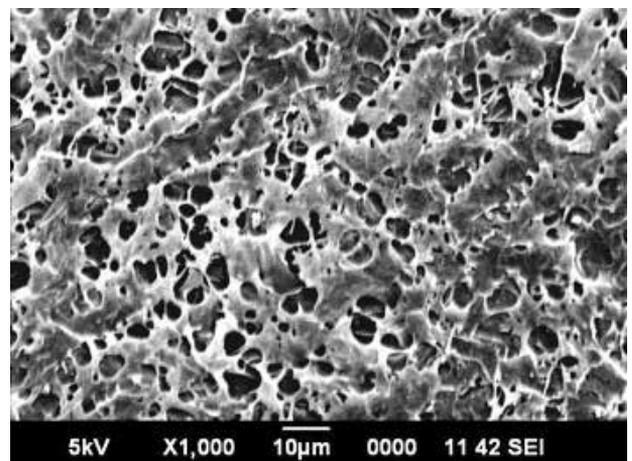
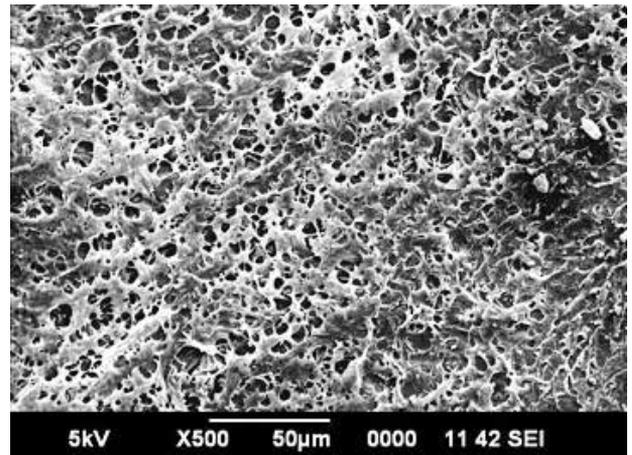
temperature and 3 hr reaction time was found optimum for enzymatic hydrolysis of *guar* gum. The yield of the isolated fibre was 55-60%. Estimation of Total Dietary Fibre (TDF) content of isolated sample was carried out AOAC using enzymatic-gravimetric method. The TDF content of the product was estimated in the range of 88-85%. The viscosity of the enzymatically hydrolysed *guar* gum was estimated using suspended level viscometer. The molecular weight of the enzymatically degraded *guar* was estimated using the intrinsic viscosity of the product and found  $2.067 \times 10^4$  whereas the native *guar* gum having molecular weight in the range of  $8.52 \times 10^5$ . The study shows the polymeric chain length of the hydrolyzed product has been reduced to one-tenth the original molecular length of native *guar* gum which could be ascertained through comparison of molecular weight of both the samples. In addition to the reduction in viscosity, the solution clarity was also significantly increased in the hydrolysed product (Fig. 49). The isolated fibre was also characterized through FT-IR, XRD, DSC and (SEM) (Fig. 50) confirms the formation of dietary fibre.

Dietary fibre from gum *arabic* was isolated using chemical method. The dietary fibre was extracted through solvent precipitation method. Tannins were also removed from the dietary fibre samples. The yield of the isolated fibre was 60-77%.

Estimation of TDF content of isolated sample was carried out using enzymatic-gravimetric method. The TDF content of the isolated product was recorded in the range of 70-72% and estimated dietary fibre are in the form of soluble dietary fibre.



**Fig. 49 :** Enhanced solution clarity of the enzyme hydrolyzed *guar* gum



**Fig. 50 :** Scanning Electron Micrograph (SEM) images of partially hydrolyzed *guar* gum

#### 4.5 Natural gum based adsorbents for removal of heavy metals from water

Novel polymers in the form of a thiolated, aminated and oxygenated derivatives of natural exudates gums were synthesized as adsorbents for the removal of heavy metals.

Adsorption studied of the modified gums for the adsorption of Cr and Cd was carried out at constant concentration of heavy metals (2 ppm) and adsorbent dose (50 mg) at variable time (10,30,60,90 and 120 minute).

Among different modified gum oxidized gum *arabic* shows highest adsorption of 93.6% of Cr at 60 min. and 90% of Cd at 90 min. Thiolated gum *Karaya* shows highest adsorption of 93.05% of Cr at 60 min. and 98% of Cd at 90 min.

## 4.6 Synthesis of natural gum based nanocomposite hydrogel for wound healing and water treatment

### Synthesis of *guar* gum based hydrogel

Hydrogel was prepared by the graft copolymerization of purified natural *guar* gum (GG) with acrylic acid derivative using ceric ammonium nitrate (CAN) as initiator and N,N'-methylene bisacrylamide (MBA) as crosslinker. Synthesized hydrogel was characterized by (FT-IR) analysis, SEM and TGA.

### Characterization of *guar* gum based hydrogel

#### FT-IR Analysis

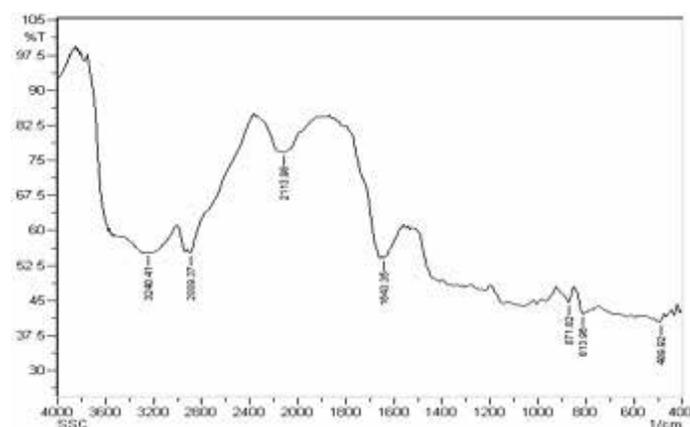


Fig. 51 a : Pure *guar* gum

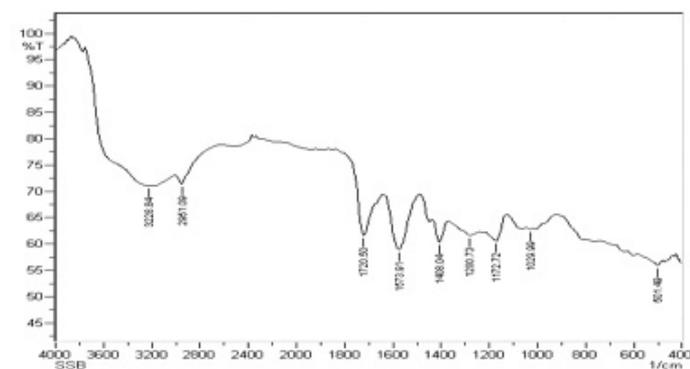


Fig. 51 b : Acrylate based hydrogel (II)

It can be observed from (Fig. 51 a & b) that the absorption bands of *guar* gum at  $1643\text{ cm}^{-1}$  (H-O-H bending) and at  $1439\text{ cm}^{-1}$  (C-OH bending vibration) disappeared after reaction and the new bands at  $1720\text{ cm}^{-1}$  (C=O stretching of -COOH groups),  $1573\text{ cm}^{-1}$  (asymmetric stretching of -COO- groups) and  $1450$  and  $1408\text{ cm}^{-1}$  (symmetric stretching of -COO- groups) appeared in the spectrum of *guar* gum grafted acrylate which were close to the characteristic absorption of acrylic acid derivative. The bands at  $1029\text{ cm}^{-1}$  (C-O stretching),

$1077\text{ cm}^{-1}$  (C-OH stretching) and  $1168\text{ cm}^{-1}$  (C-O-C stretching) for GG were also observed in the spectrum of *guar* gum grafted acrylate with weakened intensity. This information gives direct evidence that the acrylic acid derivative has grafted onto *guar* gum macromolecular chains, and the -COOH and -COO- groups coexist in the grafting copolymer.

#### SEM studies (Fig. 52 a & b)

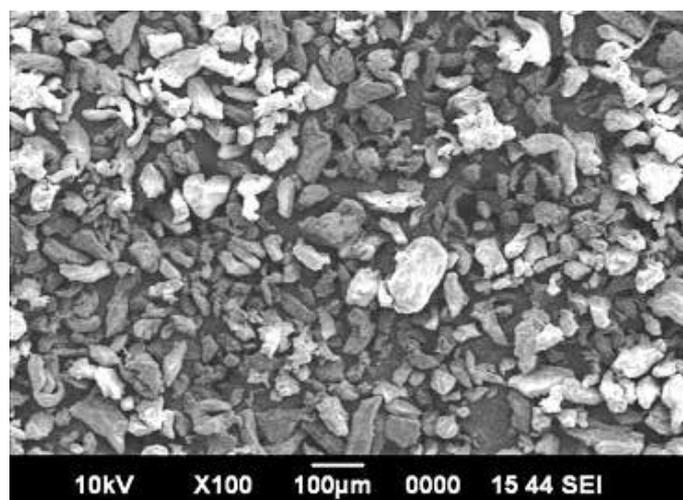


Fig. 52 a : *Guar* gum

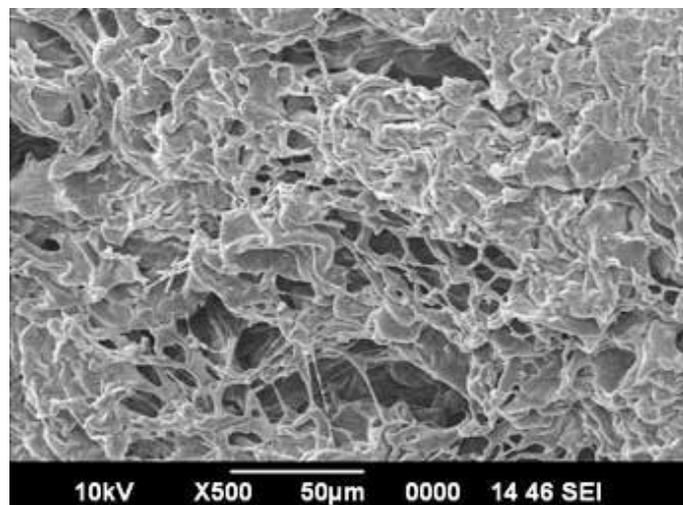


Fig. 52 b : Acrylate based hydrogel

It can be observed in the SEM image which shows structures with a great penetration of the medium into the system with pores that form connections (channels) with the interior of the structure. The capillary channels with greater porosity were clearly observed from SEM images in acrylic acid derivative based hydrogel whereas *guar* gum in absence of crosslinkage shows lower porosity (Fig. 52 a & b).



## Synthesis of zinc oxide nanoparticles

The zinc acetate dehydrate, sodium hydroxide, (E. Merck Ltd., Mumbai) and all other reagents used of analytical purity grade. For synthesizing zinc oxide nanoparticle, zinc acetate dihydrate (20 mM) solution of 50 ml was prepared and placed on magnetic stirrer for 20 minutes for mixing. Sodium hydroxide (1M) solution was added drop wise to this solution until pH become 10.5. Then, solution was stirred at 800-1000 rpm for 2 hours. During this time, white colored precipitate of zinc hydroxide was developed. Precipitate was then centrifuged at 5000 rpm for 10 minutes followed by repeated washing with distilled water and ethanol to remove trace impurities. Final precipitate was dried at 60 °C in hot air oven overnight for obtaining ZnO nanoparticles.

## Characterization of zinc oxide nanoparticles

### UV-Visible spectroscopic analysis:

Synthesized zinc oxide nanoparticles were characterized by UV-Visible spectrophotometer (CECIL CE 7200, UK) at 200 nm to 700 nm range (Fig. 53).

Fourier transform infrared spectroscopy(FT-IR) analysis: To evaluate the potential functional groups associated in biosynthetic methods, FT-IR analysis was conducted in IR-Prestige 21, Shimadzu Japan, in the range of 400-4000  $\text{cm}^{-1}$  at a resolution of 4  $\text{cm}^{-1}$ . Small amount of zinc oxide nano powder was taken to make KBr pellete and thereafter processed for FT-IR study and analyzed through inbuilt software (Fig. 54).

### XRD analysis:

X-ray diffraction (XRD) was performed using a Smart Lab 9 kW Rigaku, Japan X-ray Diffractometer. In built software program was used for the assignment of reflections and analysis of the XRD patterns (Fig. 55).

### DLS and zeta sizer analysis:

Synthesized zinc oxide nano formulations were diluted with Milli-Q water and particle size was determined using particle size analyzer (Malvern Instruments, UK, Nano ZS) and stability was detected with zeta sizer (Fig. 56 & 57).

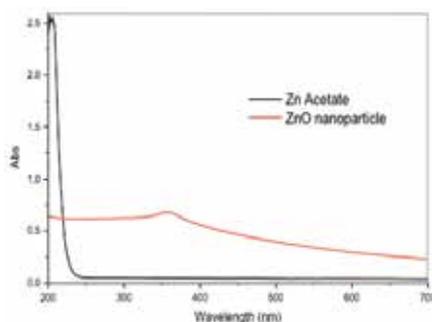


Fig. 53 : UV-Vis Spectra of ZnO nano

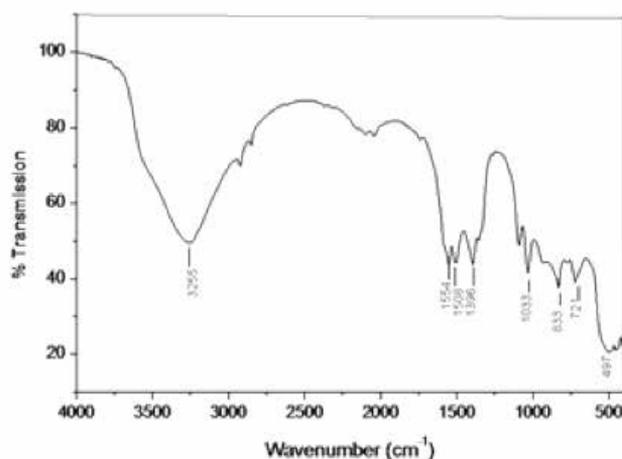


Fig. 54 : FT-IR spectra of ZnO nano

In the present study, zinc oxide nanoparticles were synthesized through chemical precipitation method. UV-Visible spectra exhibited peak near 340 nm conforming to plasmon-resonance absorption in zinc oxide nanoparticles (Fig. 53). FT-IR data analysis also showed peaks at 509  $\text{cm}^{-1}$  and 763  $\text{cm}^{-1}$  for Zn-O absorption band and confirmed the variation in banding pattern during synthesis of zinc oxide nanoparticle (Fig. 54).

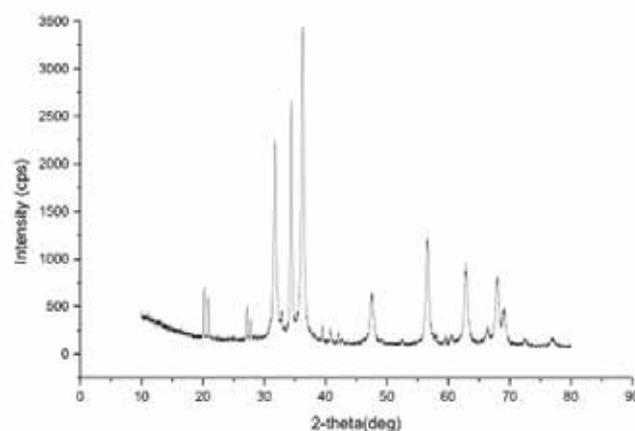


Fig. 55 : XRD pattern of ZnO nano

JCDPS data of XRD analysis also substantiated the synthesis of zinc oxide nanoparticles (Fig. 55)



Fig. 56 : DLS image of ZnO nano



Average particle size of the formulation was detected as 148 nm by DLS (Fig. 56). Zeta potential of synthesized ZnO nanoparticle was found 11.0 mv which indicates that moderate stability of the ZnO nanoparticle in the aqueous suspension (Fig. 57).

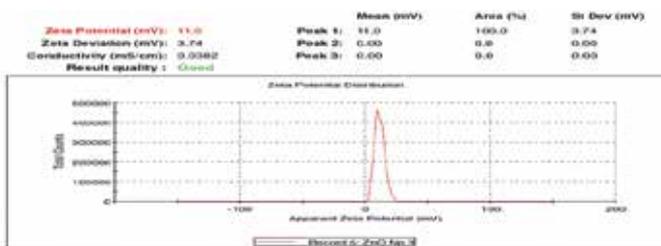


Fig. 57 : Zeta potential of ZnO nano

### Extraction of *palas* tannin

Extraction of tannin from the *palas* gum is carried out by dissolving the gum in boiling water and cold filtrate was treated with saturated brine solution and precipitated tannin was filtered, washed with brine solution and dried. Dried solid was powdered and extracted with alcohol and treated with ether. The tannin was purified by repeated precipitation with ether and yield recorded was 42% which is further verified through estimation of tannin as Tannic Acid Equivalent (TAE) by Folin-Ciocalteu method using UV-VIS spectrophotometer. The estimated TAE of the purified tannin was found to be 412.5 mg / g dry powder (Fig. 58).

### Synthesis of *palas* tannin based silver nanoparticle

Different concentrations of *palas* tannin were prepared by slightly heating the solution to 50-60 °C. The *palas* tannin was reacted with 1mM silver nitrate solution under constant stirring. The pH of the reactant solution was raised to 10 with 1M aqueous sodium hydroxide solution. The colour of the reaction was turned to light brown to deep brownish which indicated the formation of silver nanoparticles. The reaction mixture was centrifuged and supernatant was separated and stored for further characterization (Fig. 59).



Fig. 58 : *Palas* gum & *palas* tannin



Fig. 59 : *Palas* tannin solution & synthesized PT-AgNPs

### Characterization of *palas* silver nanoparticles

The synthesized tannin based silver nanoparticle were characterized using UV-Vis spectrophotometer and particle size analyzer. The UV-Vis spectra of silver nanoparticle showed peak at 425 nm due to Surface Plasmon Resonance (SPR). The particle size of the synthesized silver nanoparticle was recorded 129 nm as hydrodynamic diameter (Fig. 60 & 61).

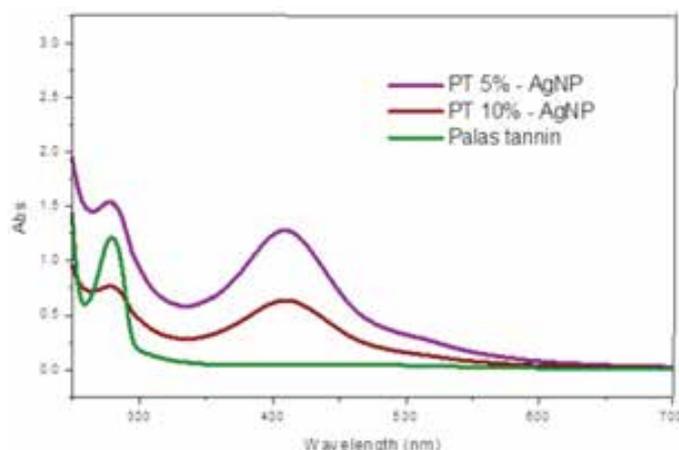


Fig. 60 : UV-Vis spectra of PT-AgNPs

Z-Average (d.nm)	Size (d.nm)	% Intensity	St Dev (d.nm)
129.0	Peak 1: 177.7	94.1	72.49
Pdi: 0.255	Peak 2: 30.20	5.9	6.589
Intercept: 0.922	Peak 3: 0.000	0.0	0.000
Result quality: Good			

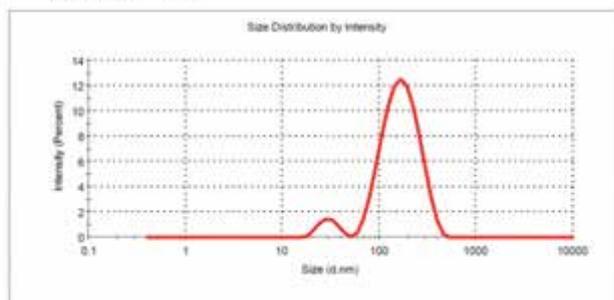


Fig. 61 : Particle size analysis of synthesized AgNPs



## Synthesis of tannin-silver nanoparticle-hydrogel nanocomposite

The silver nanoparticle was incorporated into the matrix of hydrogel through diffusion and adsorption techniques. The different gradient of the tannin and nanosilver formulation was prepared and concentration based diffusion and adsorption efficacy was determined (Fig. 62 a & b).



**Fig. 62 a :** Hydrogel incorporated with different conc. of AgNPs



**Fig. 62 b :** Silver nanocomposite hydrogel 20%

## 4.7 Synthesis of guar gum hydrogel-nanoparticle hybrid scaffold

Hydrogels were synthesized from *guar* gum (GG-g-PHEMA-cl-NN'-mba) by varying cross-linker concentration using ceric ammonium nitrate as a free radical initiator. The optimized grade has been determined by its higher percentage grafting as well as higher cross-linking values. It was observed that the grafting percentage increases as the concentration of monomer was increasing. Silver nanoparticles were synthesized in the solution containing polyvinyl pyrrolidone (PVP), silver nitrate was reduced by the glucose, and silver particles were generated. Sodium hydroxide was used to enhance the reaction velocity. When the mole ratio of NaOH to AgNO<sub>3</sub> was ranged from 1.4 to 1.6, the colloid kept stable. The hydrogels were swollen and stirred by a magnetic bar in AgNP solution for 4 h. The material was washed with water and then air dried for 24 h and vacuum dried for another day.





## Transfer of Technology

### 5. Capacity Building of Farmers and Entrepreneurship Development

#### 5.1 Learning, capacity building, extension education and information services on NRGs

The Institute has conducted different types of training programme pertaining to scientific lac cultivation, processing and utilization under capacity building and

entrepreneurship development programme (Table 7). It continuously assessing the needs of stakeholders and modified the programmes accordingly. Beside many In-campus programmes, field out-reach activities in terms of training, technical guidance, lac crop monitoring etc. were also undertaken. A total of 34980 stakeholders were benefited under various capacity building and skill development programs.

**Table 7 : Details of capacity building and entrepreneurship development programme**

Sl. No.	Name of programme	No. Of batch/campus	No. Of beneficiaries
1	Farmers training programme on Scientific lac cultivation, processing and utilization	13	365
2	Educational programme - Summer/Winter Workshop on Natural Resins and Gums (10 days)	03	89
3	Short term training program (3 days) - Refresher Course on Forecast Technique of Larval Emergence	01	01
4	Short term training program (3 days) - <i>Rangeeni</i> lac cultivation, Processing and Utilization	03	85
5	On-farm training programme on Scientific lac cultivation	22	2570
6	On-farm Motivational/ Supplementary training programme on lac cultivation	09	771
7	In-campus one-day Orientation programme on lac cultivation	67	3174
8	Participation in Exhibition / <i>Kisan Mela</i>	09	27790
9	Lac based product demonstration training	22	49
10	Advisory Services provided	86	86
<b>Total</b>		<b>235</b>	<b>34980</b>

#### Farmers training programme on Scientific lac cultivation, processing and utilization

The programme entitled Scientific lac cultivation processing and utilization is for one week and it constitutes lac cultivation, processing at farm level and its uses. A total of 365 farmers from different districts of four states viz., Jharkhand, Chhattisgarh and Meghalaya participated in the programme. The participants were sponsored by various organizations and details are given in Annexure-1.

#### Educational programme on production, processing and uses of natural resins and gums

Different educational institutions namely Sam Higginbottom Institute of Agriculture Science & Technology, Allahabad (Formerly Allahabad Agriculture Institute, Allahabad), Institute of Agriculture Sciences, Banaras Hindu University, Varanasi (Uttar Pradesh) and Department of Zoology, P.K. Roy Memorial College, Dhanbad (Jharkhand) have nominated their agricultural graduate and postgraduate students to participate in ten & fifteen days education programme on production, processing and uses of natural resin and gums. A total of 89 students participated through three courses under this educational programme scheme. The details are given in Annexure-2.



### Short term training program

Three days refresher course on scientific lac cultivation, processing and uses for AVMs of JSLPS was organized during the period and sponsored by Jharkhand State Livelihood Promotion Society (JSPLS), Jharkhand. A special refresher course on forecast technique of larval emergence was also organized. A total of 86 stakeholders participated through two courses (Annexure-3).

### On-farm training programme on scientific lac cultivation

ICAR-IINRG has organized twenty six on-farm training programmes on lac cultivation in collaboration with various GOs and NGOs of different states. A total of 2570 farmers were participated from different districts of Jharkhand and Madhya Pradesh. The participants were nominated by Forest Divisions of Jharkhand and NRLM, Raisen. The details are given in Annexure-4.

### On-farm, motivational/supplementary training programme on lac cultivation

A total of 771 participants were trained in on-farm motivational/supplementary training programme on lac cultivation in collaboration with various NGOs and GOs of Jharkhand. The participants represented five districts of Jharkhand viz., Ranchi, Khunti, Palamu and Latehar. The details are given in Annexure-5.

### In-campus one-day Orientation Programme on Natural Resins and Gums

In-campus, one day Orientation Programme (67 nos.) on Natural Resins and Gums were organized in collaboration with GOs and NGOs of different states and 3174 farmers, school children, college students and executives were visited the institute for this purpose. These were nominated by various agencies (Annexure-6).

### Product demonstration training

Short term lac based product demonstration training organized for participants of different states on aleuritic acid, dewaxed bleached lac, lac based varnishes, lac dye etc. The details are given in Annexure-7.

### Kisan gosthi/Workshop/Educational Programme

The institute has organized/participated *Kisan Gosthi*/Workshop/ Educational Programme on lac cultivation in collaboration with various institutions. A total of 4 such events were conducted and 788 stakeholders were benefited (Annexure-8).

### Field and method demonstration conducted

Five field demonstrations on scientific lac cultivation technologies and gum tapping were conducted at various places in Jharkhand and Rajasthan (Annexure-9).

### Diagnostic and crop monitoring visits

A total of 7 crop monitoring visits conducted across the districts of Jharkhand (Annexure-10).

### Participation in Exhibition/*Kisan Mela*

The Experts from ICAR-IINRG, Ranchi were participated in different Exhibition / *Kisan Mela* organized by different other agencies during 2017 and provide technical expertise on NRG to their stakeholders. Altogether institute has participated in eight Exhibition/*Kisan Mela* and around 27790 beneficiaries get benefitted and aware about the technology of ICAR-IINRG. Need based advisory services were also provided among the various stakeholders (Annexure-11).

### ICT intervention on natural resins & gums knowledge dissemination system

A video documentary on scientific lac cultivation on *palas* has been completed. Script writing for another 11 video films like scientific lac cultivation on *kusum, ber*, lac based handicrafts, aleuritic acid production technology, Lac based varnishes (Lac wood shine & Lac glaze), bleached lac production, quality evaluation of NRGs, fruit coating on kinnow, dewaxed decolorized lac technology, tapping of *karaya* gum and extraction technology for lac dye is also completed and soon it will be processed for video/bite recording. To send the advisories to different stakeholders, a registration work was completed in the name of [iinrgictproject@gmail.com](mailto:iinrgictproject@gmail.com) on *m-kisan* website.

## 6. Technology Evaluation, Refinement, Dissemination and Demonstration

### 6.1 Market Information Support (MIS) and Impact Assessment of Technological Interventions for NRGs

About 1234 stakeholders including 124 institutions, 539 farmers, 113 traders, 59 processors/wholesalers/exporters, 191 resource persons were interacted through visits and telephonic conversations in 50 districts of 10 states. Secondary data on NRG about production were collected from various central and state government organizations. Due to low international market price for *guar* gum during 2016-17, total production of NRGs has





decreased from 844646.00 tons in 2015-16 to 566230.00 tons in 2016-17 (Table 8). A decline of about 33 % in the production of NRGs was observed over the previous year. Total production of lac was observed around 12.77% lower than the previous year and

10.3% decrease in lac production was recorded in Jharkhand. Other resins and gum production is increased in 2016-17. Overall, NRG production level during 2015-16 is estimated comparatively lower than the previous year.

**Table 8 : Total NRG production during 2011-12 to 2015-16 (in tons)**

Name of product	2011-12	2012-13	2013-14	2014-15	2015-16	2016-17
Guar gum*	744295	818975	1129134	1094547	817042	542200
Lac	17900	19577	21008	16978	18746	16352
Pine resin	8514	8361	6875	6699	5726	5773
Karaya gum	285	212	129	83	100	145
Dhawda gum	147	380	448	295	194	240
Other gums	716	552	567	333	389	380
Other resins and gums	691	1083	975	1190	980	1140
<b>Grand Total</b>	<b>772549</b>	<b>849140</b>	<b>1159137</b>	<b>1120125</b>	<b>843178</b>	<b>566230</b>

\*Advance estimates of production figure (includes only gums and pine resins)

ITC calculations based on UN COMTRADE statistics, the world trade aggregation of lac, natural gums, resins, gum-resins and balsams during 2016 revealed that India's share in total

import of NRGs was 18% even though India is second largest exporter of NRGs in the World followed by France (28%). EXIM scenario of NRGs is depicted in Table 9.

**Table 9 : Total NRG export and import during 2011-12 to 2016-17**

Year	Export		Import	
	Quantity (in tons)	Value (in lakhs)	Quantity (in tons)	Value (in lakhs)
2011-12	641570.16	1696636.17	80734.60	71497.81
2012-13	340384.75	2176118.62	89746.33	78534.90
2013-14	483060.85	1217055.20	89535.92	96501.64
2014-15	543620.51	963270.94	86189.81	107413.18
2015-16	272462.21	343995.98	96387.62	129169.37
2016-17	329045.55	289060.92	109764.64	137165.89

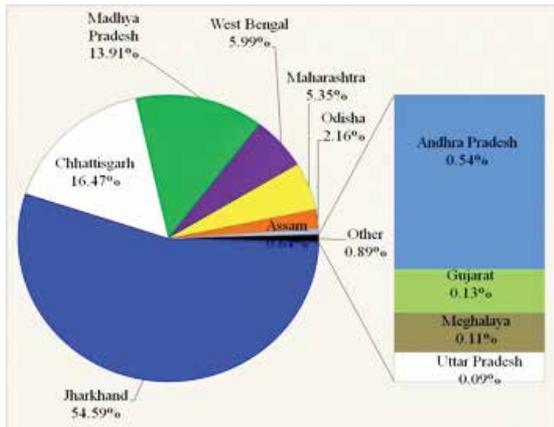
Export quantity of NRGs from India is increased but the value of export has declined as the continuous decline of the price in international market. In case of import scenario, it has increased over the period. During the year 2017, the collection rate announced by the government for gum *karaya* was remained Rs. 10,800 per quintal. Retail packing price of the *guggul* gum, *babul* gum and *salai* was recorded as Rs. 1000/kg; Rs. 160-260/kg and Rs. 240-300/kg, respectively. During the 2016-17, price of rosin and turpentine oil ranged from Rs. 56-84/kg and Rs. 80-85/litre, respectively (HPSFC Ltd.).

On the basis of survey in the markets and processing centers of different lac producing states, the estimated national production of *sticklac* during 2016-17 was approximately 16,352 tons (Fig. 63). Jharkhand state

ranked 1<sup>st</sup> followed by Chhattisgarh, Madhya Pradesh, West Bengal and Maharashtra. These five states contribute more than 90% to the lac production in India (Fig. 64).



**Fig. 63 : Lac production in India during recent years**

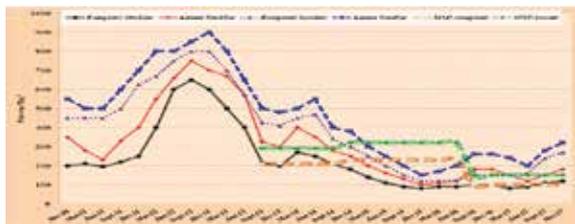


**Fig. 64 :** State wise contribution in lac production

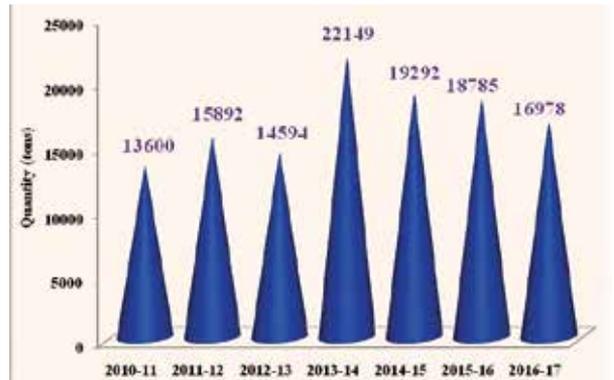
During previous year, the market price for lac has been improved and it was higher than the MSP declared by GOI. The data on prices of *rangeeni* and *kusmi* sticklac and seedlac have been collected from the lac markets on quarterly basis.

Price of *rangeeni* and *kusmi* sticklac was shown decreasing trend from January 2014 to June 2016. The information on the price revealed that price range of *kusmi* sticklac and *rangeeni* sticklac at various levels of markets has improved slightly since September 2016 and continued till December 2017. Subsequently, the per kg price of processed lac products namely seedlac, shellac, button lac and bleached lac also improved (Fig. 65). Lac processing in India during previous seven years is shown in Fig. 66.

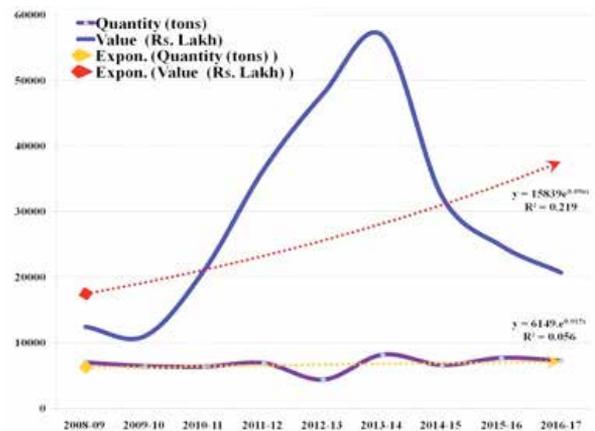
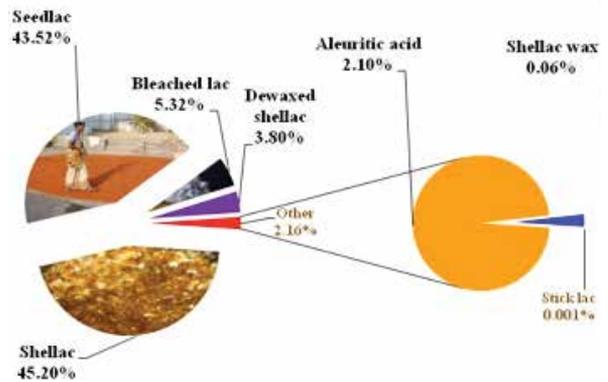
The exported quantity of the lac and lac based products has decreased by 5.58% during 2016-17 over the previous year and it was valued about 20689.92 lakh (Fig. 67). Price of Ambrettolide ranged from 20,000/kg in July 2013 to 7898/kg in Dec, 2015. In December 2017, the average export price of Ambrettolide was observed at low level of 5600/kg. Export price of Aleuritic acid ranged from 9000/kg in December 2012 to 2738/kg in December, 2015. In the subsequent quarters of 2016, price of continuously declined and reached at very low level of 1600/kg. However, it is slightly improved with an increase of 100-150/kg in 2017.



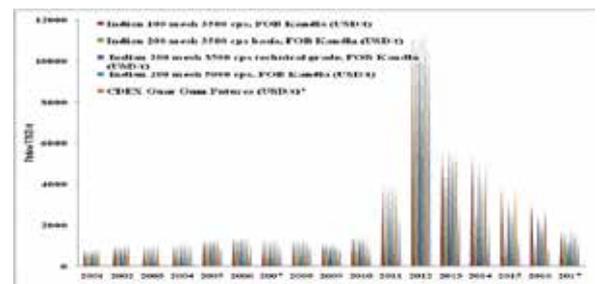
**Fig. 65 :** Movement in prices of scraped lac and seedlac



**Fig. 66 :** Lac processing in India during previous seven years



**Fig. 67 :** Composition and trends in overseas demand of lac & its value added products



**Fig. 68 :** International price level of different grades of guar gum during previous years





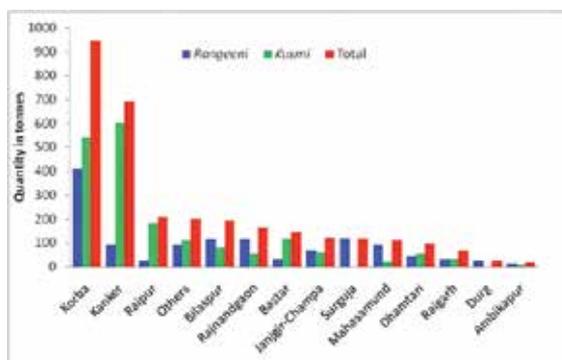
International price of various grades of *guar* gum ranged from \$ 1260/t to \$ 2870/t during the year of 2017 (Fig. 68). Export of NRG showed an increase in quantity while a decrease in value terms in 2016-17 comparatively during 2015-16. Consequently, the total value of NRG export particularly for *guar* gum was less than previous five years. Based on the final data available till October 2017, a total of 215,078.72 Mt of NRGs have been exported worth of 209,392.61 lakh.

Under impact assessment studies, pilot survey for data collection is under progress. Feedback on multimedia use was recorded from the various stakeholders.

## 6.2 Externally funded/Consultancy Project

### Evaluation of Lac Cultivation Processing Activities in Chhattisgarh under Swarnjayanti Gram Swarozgar Yojana Special Project (Phase- II).

Chhattisgarh State Minor Forest Produce (Trading & Development) Co-operative Federation Limited (CGMFPF), Raipur, is an apex organization with three tier co-operative structure comprising of a state level Apex body, 32 District Unions and 899 Primary Forest Produce Co-operative Societies. At present there are about 10080 collection centres spread over the length and breadth of the state and approximately 13.76 lakhs forest produce gatherer families. The study was assigned to the ICAR-Indian Institute of Natural Resins and Gums, Ranchi to assess the impact of Centrally Sponsored Schemes in selected 19 lac growing forest divisions of Chhattisgarh State. The objectives of the study were to examine whether selected SHGs across the various districts have generated the desired benefits or not. If not then, specify reasons for their tardy implementation, shortcomings in implementation and steps required to tone up their implementation, including their monitoring, to achieve the desired results. District-wise lac production scenario in Chhattisgarh during XII plan period is depicted in Fig. 69.



**Fig. 69 :** District-wise lac production scenario in Chhattisgarh during XII Plan Period

Therefore, efforts to incorporate all possible socio-economic features of the identified households have been made during the survey, observation at the time of field visit and interaction with the beneficiaries. Any improvement in terms of economic gain, employment generation and infrastructure development were the major indicators of recording the data. The study entitled, 'Impact assessment of the technology, market and infrastructure based interventions by CGMFP under the SGSY' has been conducted during 2015-16. Members of identified SHGs and other concerned personnel were interviewed regarding the various aspects of lac cultivation and its disposal. Market value of the produce was transferred in the bank accounts of SHG members. For this, the proof of money transfer was checked in bank passbooks of concerned beneficiaries of the SHGs. The data compilation and analysis is under progress. *Paschimanchal Unnayan Parshad* (PUP), Government of West Bengal also requested to prepare Detailed Project Report (DPR) on 'Revitalization of Lac Cultivation and its Value Addition in Purulia District'.

## Extension Activities

### ICAR-IINRG provides process know-how for preparing *gula* from *palas* flowers

Most of the Holi colours available in the market are oxidized metals or industrial dyes mixed with engine oil. These are toxic and can result in skin allergies, eye irritation and even, blindness. In light of potential hazards of synthetic colours, ICAR- IINRG, Ranchi has developed *palas* flower based *gula* which is safe, non-toxic and eco-friendly natural colour. Process know-how for the preparation of *gula* from *palas* flowers was demonstrated to Riddhi-Siddhi Prathmik Lac Utpadak Sahyog Samiti Ltd, Kundri in the lab-scale at Processing and Product Development Division, ICAR-IINRG, Ranchi. Based on the process know-how and the technical guidance related to the specification of grinding machine provided, the Samiti has established a processing unit for preparing *gula* at Kundri in Palamu district of Jharkhand. After the installation of processing unit at Kundri, process know-how for the preparation of *gula* was demonstrated to about 15 participants. Training fee of Rs. 20,000/- was charged from the group.

The first processing unit of Jharkhand State in Kundri was inaugurated by the Deputy Commissioner, Sri Amit Kumar, Palamu for the preparation of the herbal *gula* on 10<sup>th</sup> May, 2017. The inaugural session of the meeting was attended by Sri Ramesh Munda, DFO, Palamu;







area of 10 ha were conducted on Green gram covering 50 farmers. During *Kharif* 2017, 25 CFLD under NFSM having area of 10 ha were conducted on Pigeon pea covering 39 farmers. 5 FLD on Paddy variety 'Sahbhagi' having area of 2 ha covering 7 farmers were conducted. During *Rabi* 2017-18, 25 CFLD under NFSM having area of 10 ha were conducted on chick pea covering 40 farmers (Table 10).

Two Off campus training of farmers on cultivation of green gram (50 participants), One Off campus training of farmers on cultivation of pigeon pea (25 participants), one Off campus training of farmers on cultivation of chick pea (20 participants) and two Off campus trainings of farmers on soil sampling techniques (30 participants) were conducted during the year. Four *Kisan Goshthies*/seminar were organized on Lac Cultivation and Agricultural Technologies in which lectures were delivered along with farmers-scientists interaction (Table 11).

**Table 10 : Frontline demonstration conducted during 2017**

Sl. No.	Season	Crop	Technology	Area (ha)	No. of Demonstrations	Village	Total Farmers
A. CFLD conducted under NFSM							
1.	<i>Rabi</i> (Summer 2016-17)	Green Gram	Variety (IPM 2-3) +INM (Bio-fertilizers= Rhizobium & PSB)	10	25	Gutigada(26) Selda (6) Maliyada(18)	50
2.	<i>Kharif</i> 2017	Pigeon Pea	Variety ( LRG-41)+INM (Rhizobium & PSB) (20:50:25:20)	10	25	Selda(14) Maliyada(9) Gutiguda(6) Kudasud(10)	39
3.	<i>Rabi</i> , 2017-18	Chick Pea	Variety (GNG 1581) +INM (Rhizobium & PSB)	10	25	Bhonda(5) Kathal toli(2) Tungaon(1) Gamhariya(13) Banga-naloya(3) G. Jaltanda(12) Kunkusi Binda -Bazar(1) Mahil(1) Sungi(1) Jurdag(1)	40
A. FLD Conducted							
1.	<i>Kharif</i> -2017	Paddy	Variety (Sahbhagi)	2	5	Budhudih(7)	7

**Table 11 : Extension activities conducted**

Activities	Numbers	Number of Farmers
Off campus training of farmers on cultivation of green gram	2	50
Off campus training of farmers on cultivation of pigeon pea	1	25
<i>Kisan Goshthi</i> /Seminar(Lac cultivatin/Agricultural technologies)	4	720
Farmers Training on cultivation of chick pea	1	20
Scientist visit to fields	20	-
Off campus training of farmers on soil sampling techniques	2	30



### 6.3 Success Story

#### **Lakh se Lakhpati: Scientific Lac Cultivation on *Kusum* and *Semialata* (+91-7697583758)**



Sri Milan Singh Vishwakarma s/o Sri TR Vishwakarma was a poor young farmer of village Kurrubhata in Bagbahara block of Mahasamund district in Chhattisgarh. He came in contact with the experts of ICAR-IINRG during an On-farm training programme in 2003 and initiated lac cultivation on 10 *kusum* trees with assistance of the Forest Department under the scheme for lac promotion; but, his whole crop was damaged due to lack of knowledge on pest management. Consequently, he was discouraged by his family for doing such activities on the cost of other activities. He felt constrained in continuing the activity without any family support. In 2004, the forest department came forward again to support his efforts and provided 500 kg broodlac to him through SHG approach under one of the departmental projects. This year the group got a good crop of 1500 kg scrapedlac but SHG members were still hesitant in adopting lac cultivation because of earlier crop failure. Therefore, Sri Vishwakarma decided to undergo the one week training programme on scientific methods of lac cultivation at ICAR-IINRG, Ranchi. As a result he started getting a regular income of Rs.60000-70000 annually and subsequently, he doubled the utilization of *kusum* trees owned by him as well as taken on lease.



In 2012, he produced 4q of scrapedlac from 50 *kusum* trees valued at Rs 3.00 lakh as the prices of lac were on peak (Rs.700-900/kg). This was the major breakthrough in the farming community of the district. He developed the infrastructure for *semialata* plantation in 10 acre land for intensive lac cultivation. He established two bore-wells with drip irrigation facility for the plantation as well as vegetable production. He also planted 100 *ber* trees under the supervision of experts from IINRG. Consequently, the lac production by the farmer reached the peak of 100q and his turnover increased to 10 lakh / annum. Meanwhile, he got popularity in the farming community as well as the government organizations. He was awarded *Utkrist Lakh Krishak Puruskar* 2014 during *Kisan Mela* at ICAR-IINRG Ranchi. He was also conferred various honours and awards at different platforms. He is a proactive progressive farmer as he keeps himself updated with the new technological interventions developed by the ICAR-IINRG, Ranchi. He has adopted broodlac dipping practices for efficient pest management in lac cultivation. In 2017, he harvested 80q of scrapedlac with a network of 200 households owning lac-host trees. Current year standing summer (Jethwi) crop on 150 *kusum* trees, 300 *ber* trees and 40000 *semialata* plants is expected to yield about 300q of scrapedlac. If sold at Minimum Support / Current Price, it will fetch him an income of more than Rs. 30 lakh.

**Impact:** Seeing the profit earned by Sri Vishwakarma, more than 200 farm families got motivated to start lac cultivation. Sri Vishwakarma has developed his own farm with two bore-wells, drip irrigation facilities for 10 acre land and an orchard of 100 *ber* trees. He has purchased two motor bikes and is confident as well as capable enough to plan for construction of a well furnished Pucca house for his family. Availability and accessibility of broodlac which was a major issue earlier is now is available in plenty. His innovative ideas to adopt the broodlac dipping method as well plantation of *semialata* with drip irrigation have helped in sustainable production of lac. More than 1000 farmers from various parts of the country like Madhya Pradesh, Odisha, Andhra Pradesh come to visit his farm annually to seek his advice. Adoption of the scientific lac cultivation by Sri Vishwakarma has improved the standard of living of the farmers in his locality by creating employment and livelihood opportunities. His achievements have brought in a lot of interest towards lac cultivation in the area.

## Network Projects

### 1. Network Project on Harvesting, Processing and Value Addition of Natural Resins and Gums

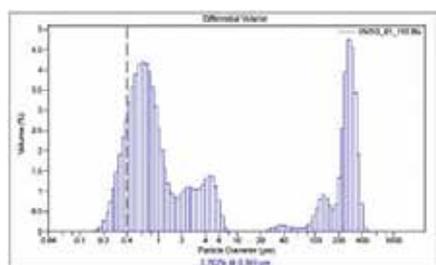
#### 1.1 Lead Centre: ICAR-IINRG, Ranchi

#### Development and antibacterial activity of *Buchanania lanzan* (Piyar) gum-based silver nanoparticles

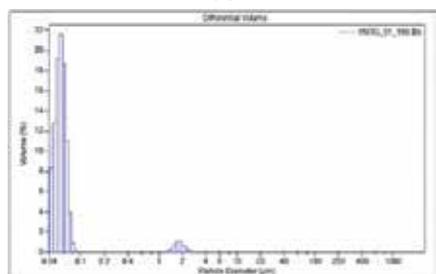
Silver nanoparticles (AgNPs) were synthesized by reacting different concentrations of piyar gum exudates (0.5% to 3.5%), collected from Bilaspur (Chhattisgarh) & Jabalpur (Madhya Pradesh) and 1.0 mM silver nitrate ( $\text{AgNO}_3$ ) solution adopting autoclaving methodology at 121°C and 15 psi.

#### Particle Size Analysis

Analysis of piyar gum and its synthesized AgNPs using 3.5% gum concentration by Laser Diffraction Particle Size Analyzer revealed  $d_{50}$  values as 1.185  $\mu\text{m}$  and 0.055  $\mu\text{m}$  respectively (Fig. 71 a & b).



(a)



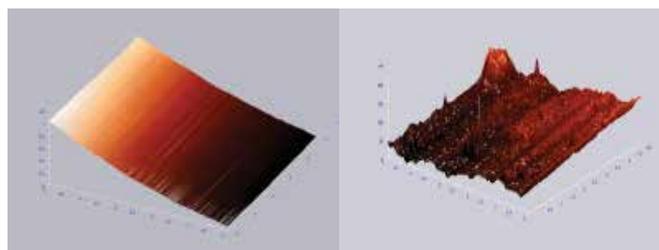
(b)

**Fig. 71 a & b :** Particle size analysis of synthesized piyar gum-based AgNPs

#### Atomic Force Microscopy (AFM) of the synthesized piyar gum-based AgNPs

Atomic Force Microscopy, one of the foremost tools, offers not only 2D/3D visualization but also provides both

qualitative & quantitative information on the physical properties viz. size, morphology, surface texture and roughness of nanoparticles. Statistical information, including size, surface area and volume distribution can be determined as well (Fig. 72).



**Fig. 72 :** AFM image of piyar gum & synthesized AgNPs

#### Antibacterial activity of the synthesized piyar gum-based AgNPs

Antibacterial activity of the synthesized piyar gum-based AgNPs was tested against 17 strains of 14 different bacteria including *Escherichia coli* (3), *Avibacterium sp.*, *Staphylococcus intermedius*, *Paenibacillus macerans*, *Serratia rubidiae*, *Erwinia mallatovora*, *Enterococcus faecalis*, *Staphylococcus haemolyticus*, *Proteus mirabilis*, *Staphylococcus epidermidis* (2), *Staphylococcus chromogenes*, *Enterobacter agglomerans*, *Staphylococcus capitiss sp. capitiss*, *Staphylococcus capitiss sp. urealyticus*. Silver nitrate 1mM solution used as control inhibited growth of all the bacteria tested ( $\text{MIC} \leq 8.4 \mu\text{g/ml}$ ) while piyar gum inhibited only a *S. epidermidis* ( $\text{MIC} 2.4 \text{ mg/ml}$ ) strain. The MIC of nanoparticles was the maximum ( $\geq 8.5 \mu\text{g/ml}$ ) for *S. intermedius* and minimum was for one strain each of *S. haemolyticus* and *E. coli* ( $0.5 \mu\text{g/ml}$ ) when 1% of piyar gum was used for nanoparticles synthesis (Fig. 73).



**Fig. 73 :** Determination of minimum inhibitory concentration (MIC) of piyar gum-based AgNPs using Agar Well Dilution Method for *Staphylococcus intermedius* strain

[Central well filled with 50  $\mu\text{l}$  of sterile NSS; while each well contain 50  $\mu\text{l}$  of different conc. of piyar gum-based AgNPs i.e. No. 1, 1mM; No. 2, 0.5mM; No. 3, 0.25mM; No. 4, 0.125mM; No. 5, 0.062mM; No. 6, 0.031mM; No. 7, 0.015mM & No. 8, 0.0075 mM]

### Exploratory study on Trials of gum tapping from selected tree species

Exploratory trials of *karaya* gum tapping from *Sterculia urens* trees were conducted at village Kankebar, district Ramgarh (Jharkhand) and *moringa* gum tapping from *Moringa oleifera* along with neem gum tapping from *Azadirachta indica* trees at Processing and Demonstration Unit, ICAR – Indian Institute of Natural Resins and Gums, Ranchi. Scientific method of *karaya* gum tapping from *Sterculia urens* trees through semicircular incision developed by Girijan Co-operative Corporation Limited (Andhra Pradesh Government Undertaking), Visakhapatnam (Andhra Pradesh) in collaboration with Koval Foundation, Visakhapatnam (Andhra Pradesh) and inducer technology of gum *arabic* tapping developed by ICAR – Central Arid Zone Research Institute, Jodhpur Rajasthan) were used for gum tapping from *Sterculia urens*, *Moringa oleifera* and *Azadirachta indica* trees. Semicircular incisions were made in branches using specially devised sharp knife (Fig. 74 a & b). In Inducer technology, hand drill was used for drilling holes in the trunk of trees and 4 ml plant growth regulator (mixture of sulphuric acid and ethephon) was injected. Following conclusions were drawn.



**Fig. 74 :** (a) Tool (knife) for making blaze and (b) hand drill for drilling hole on tree trunk

- ❖ Inducer technology (Fig. 75) was found to be better for *karaya* gum tapping as *karaya* gum exudation was double in case of inducer technology over gum tapping through semicircular incision with less harm (17 times by volume).
- ❖ Gum inducer technology of scientific gum tapping was also found better over gum tapping through semicircular incision for *moringa* gum tapping from *Moringa oleifera* tree. Use of battery operated drilling machine for *moringa* gum tapping through inducer technology was observed to be less effective in *moringa* gum tapping. The *moringa* gum tapping (Fig. 76) through gum inducer technology was found to be less injurious to the trees.

- ❖ Exploratory trial on neem gum tapping from *Azadirachta indica* trees using inducer technology was found to be less effective for neem gum tapping from *Azadirachta indica* trees. Not much variation in neem gum exudation was observed with variation in volume of mixture of sulphuric acid and ethephon application.



**Fig. 75 :** *Karaya* gum exudates through inducer technology



**Fig. 76 :** *Moringa* gum exudates through inducer technology

### Network Co-operating Centres

#### 1.2 Project on Gum *arabic* at ICAR-CAZRI, Jodhpur

#### Gum production from known and lesser known arid zone tree species

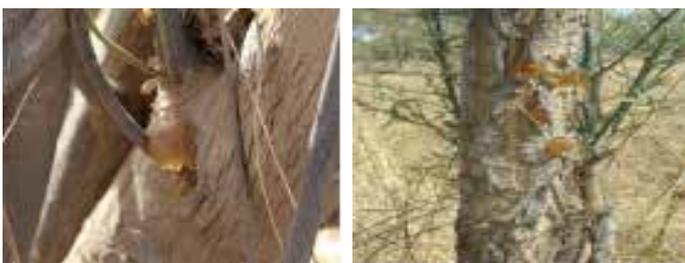
Known and lesser known arid zone tree species were treated by ICAR-CAZRI gum inducer to understand their gum production potential.

- ❖ Attempts were made to accelerate gum production from *Acacia tortilis*, *Anogeissus rotundifolia* (Fig. 77 a) and *Anogeissus pendula* (Fig. 77 b), the well known edible gum yielding tree species, and average gum production was reported to be 426.0, 39.9, and 261.2g / per tree respectively.



**Fig. 77 :** Exudate from (a) *Anogeissus rotundifolia* and (b) *Anogeissus pendula* tree

- ❖ *Balanites aegyptiaca*, *Prosopis juliflora*, *Cordia rothii* and *Cordia gharaf* (lesser known gum/ resin producing tree species of arid western Rajasthan) produce appreciable amount of gum but these species are not known much for their gum production potential. After treating trees by ICAR-CAZRI gum inducer, average 157g/tree and 130g/tree gum production was noticed in *Cordia rothii* and *Cordia gharaf* (Fig. 78 a) respectively. *Balanites aegyptiaca* (Fig. 78 b) and *Prosopis juliflora* exuded, on average basis, 32 and 26 g gum/tree respectively.



**Fig. 78 :** Exudate from lesser known tree species i.e. (a) *Cordia gharaf* and (b) *Balanites aegyptiaca*

### Effect of management practices and dose of gum inducer on gum production from *Acacia senegal* in rocky land form

Gum production from *Acacia senegal* trees through conventional method is almost negligible in rocky and semi-rocky land forms spread over in arid western Rajasthan. Experiments were conducted to analyze the effect of management practices (control, irrigation, manuring and irrigation+manuring) on gum production from *Acacia senegal* trees. It was concluded that when tree were irrigated and manured and then treated with half concentration of ICAR-CAZRI gum inducer, maximum gum (110.42 g/tree gum arabic yield) on average, across six years, was obtained (Table 12). Gum arabic yield increased about 12% in case of half concentration of ICAR-CAZRI gum inducer coupled with irrigation and manuring in comparison to full concentration of

ICAR-CAZRI gum inducer with irrigation and manuring. Normal dose contains 4ml of 195 mg ethephon/ml of solution.

**Table 12 : Pooled data of six years average gum yield of *A. senegal* under different treatments in semi rocky area of Bhopalgarh Jodhpur**

Treatments	Gum Yield (g)		
	Control	Half conc.	Full conc.
Control	4.56	36.99	41.63
Irrigation(I)	11.24	57.00	81.95
Manuring (M)	18.31	77.34	86.71
I+M	19.62	110.42	97.25

### Extension and adoption of gum inducing technique

- ❖ During the year 2016-17, farmers in more than 45 target villages of arid Western Rajasthan earned revenue of more than Rs. 69.76 lakhs from the sale of gum Arabic produced (8.72t) using ICAR-CAZRI gum inducer technology
- ❖ Moreover, in the year 2016-17, ICAR-CAZRI generated revenue of more than Rs. 2.02 lakhs by way of sale of ICAR-CAZRI gum inducer
- ❖ On 16<sup>th</sup> May, 2017, one day farmers-scientist interaction meeting (Fig. 79) was organized at Daikara village, Jodhpur under Feedback cum interaction meeting
- ❖ On 9<sup>th</sup> June, 2017 one-day gum exudation training was organized and also high gum yielding exotic Nigerian *Acacia senegal* seeds were distributed to the farmers at village Phalsund of Jaisalmer district



**Fig. 79 :** Farmers-Scientists interaction meeting organized at village Daikara, Jodhpur on 16<sup>th</sup> May, 2017

### Success Story

A diversified integrated farming system has been developed by Sri Mohan Ram Saran by adopting



many technologies of ICAR-CAZRI. This is a sustainable and highly remunerative system for the farmers in perturbation dependent eco-system of arid western Rajasthan. It has all the ingredient of natural resource conservation strategy. The farm developed by Sri Mohan Ram Saran into diversified farming system has many trees of *Acacia senegal* on farm boundary. He sells his nursery grown seedlings @ Rs. 20/seedling to the needy farmers. In addition, the most important thing about his diversified integrated farming system is that it is 100 % organic. All organic manure and plant protecting solutions are being processed in his farm. He always gives credit to his success to ICAR-CAZRI. Sri. Mohan Ram Saran received 'ICAR-CAZRI Kisan Mitra Award' by Honourable Sri Gajendra Singh Shekhawat, M.P., Govt. of India (Fig. 80). Farmers of other nearby villages and blocks are also coming to see his successful venture and learning to replicate his model on their farm and at least 15 farmers in Daikara village have adopted the model developed by Sri Mohan Ram Saran.



**Fig. 80 :** 'ICAR-CAZRI Kisan Mitra Award' given to Sri Mohan Ram Saran by Hon'ble Sri Gajendra Singh Shekhawat, M.P., Govt. of India

### 1.3 Project Centre at ICAR-CAFRI, Jhansi

#### Agro-forestry models

##### Development of agro-forestry models

From the analysis of data, obtained by monitoring the survival and plant growth in Agro-forestry models (7 years old) raised on ICAR-CAFRI farm, following conclusions were drawn :

- ❖ In agri-horti-silviculture model (Fig. 81), maximum survival and plant height was recorded in *Acacia senegal* while minimum survival and growth in *Carrisa carandus*. Out of 24 citrus plants, 18 plants yielded fruits. During *rabi* season of 2016-17, wheat (var. DBW-17) has been sown as an intercrop. After six years of planting, natural

oozing of gum has been recorded in *A. senegal*.



**Fig. 81:** Agri-horti-silviculture model at ICAR-CAFRI, Jhansi

- ❖ During summer season (2016) natural oozing of gum in *Acacia senegal* (Fig. 82 a) and *Acacia nilotica* (Fig. 82 b) were observed in agri- horti-silviculture and horti- silviculture –II models. The gum yield of *Acacia senegal* ranged from 2.92 g/ tree to 100.8 g/tree with an average value of 38.18 g/tree. The gum yield from *A. nilotica* ranged between 8.66 to 28.40 g/tree, with an average of 18.87 g/tree.



**Fig. 82 :** Natural oozing of gum in *Acacia senegal* (a) and *Acacia nilotica* (b) at ICAR-CAFRI, Jhansi

- ❖ In agri-silvi model (Field No. 40 and 41), after 4 years of plantation, on an average, *Acacia nilotica* (5 X 5 m spacing) has shown better survival and growth than *Acacia senegal* (10 X 10 m spacing).

#### Different agroforestry models at farmers' field in Garhkundar- Dabar (GKD) –(Bundelkhand region) watershed and Ambabai village

- ❖ After 7 years of planting, *Acacia senegal* recorded more survival (78%) than *A. nilotica* (53%) in GKD watershed. Out of planted horti-cultural species, guava had shown maximum survival (98%) while, *karonda* the least (12%). *Aonla* recorded maximum GBH (girth at breast height) and plant height. In terms of plant height *A. senegal* was better than *A. nilotica*.
- ❖ Average survival percentage of *Acacia senegal* (2012 plantation), on field bunds at GKD watershed area, ranged from 45 to 78%. The survival of seedlings of *A. senegal* and *A. nilotica* planted on field bunds of farmer's field during 2015 at village Shivrampur ranged from 40-53% and 40-68%, respectively.
- ❖ In Ambabai village, after 5 years of planting, survival



of *Acacia senegal* was 54% with plant height of 260 cm and average collar diameter 7.3 cm.

### Gum garden

- ❖ A gum garden of *Acacia senegal* was developed in July 2014, which is further extended in 2015 at Central Research Farm of ICAR-CAFRI, Jhansi. In all, total 353 plants of *Acacia senegal* and *Butea monosperma* (as border row plantation) have been planted at 3 x 3 m spacing. Survival percentage was higher in *A. senegal* than *B. monosperma* in both the fields.

### Growth of *Anogeissus pendula* plantation

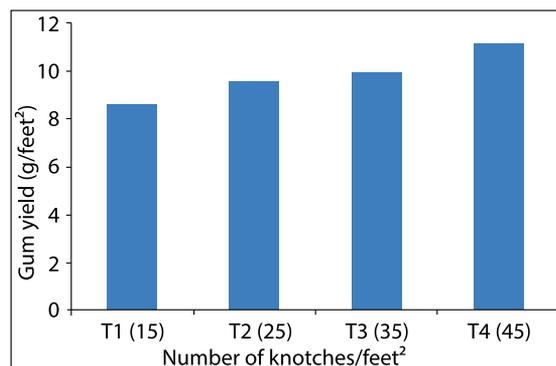
- ❖ Monitoring of plantation of *Anogeissus pendula* and *Anogeissus latifolia*, established in 1990 with 5 x 5 m spacing, concluded that after 26 years of plantation better survival (87.5%) was recorded in *Anogeissus pendula* while, better GBH (42.8cm), canopy spread (24.1m<sup>2</sup>) and height (7.5m) was observed in *Anogeissus latifolia*. This model is now being used as agroforestry models for tapping gum and raising intercrops.
- ❖ Growth of trees were also recorded in experimental field, near farm office, wherein seven progenies of *A. pendula*, raised through tissue culture, were planted in August 1995 along with check in randomized block design in four replications having plot size of 15m x 10m with a spacing of 3m x 2m. Plus trees were selected from plants of Haryana (Bandwari) and Rajasthan (Jodhpur and Udaipur) based on fast growth. The GBH of AP-20, J-241, J-124, J-205, NRC-5, J-185 and J-62 progenies were 29.98, 30.98, 32.92, 37.57, 28.73, 35.74 and 36.60 cm, respectively. Maximum GBH was recorded in J-205 progeny while minimum was recorded in NRC-5
- ❖ Another plantation of tissue culture raised progenies of 5 plus trees of *Anogeissus pendula* (1994), which is now used for standardizing gum tapping techniques, is being monitored continuously. The maximum GBH was recorded by AP-35 progeny while minimum by AP-12.

### Standardization of gum tapping techniques

- ❖ A repeated field trial (January 2016 and 2017) was conducted on naturally occurring 15-20 years old trees of *Butea monosperma* to find out the effect of length of incision on stem of tree for standardization of gum tapping techniques. To

regulate length of cuts, a bill hook was purposely designed and got fabricated locally. The field trial consisted of three lengths of cut viz. 1.0 cm, 2.0 cm and 3.0 cm. Maximum *Butea monosperma* gum was obtained when length of cut was 1.0 cm followed by 2.0 and 3.0 cm long cuts.

- ❖ For assessing the effect of density (i.e. number of notches) of cuts on yield of *Butea monosperma* gum, trial was conducted on naturally occurring *B. monosperma* trees at Central Research Farm of ICAR-CAFRI, Jhansi during month of January, 2017. The depth and length of the cuts were restricted to 1.0 cm. Trial consisted of four treatments viz., T1 (15 cuts/feet<sup>2</sup>), T2 (25 cuts/feet<sup>2</sup>), T3 (35 cuts/feet<sup>2</sup>) and T4 (45 cuts/feet<sup>2</sup>), and it was replicated on nine trees. Maximum gum was collected from the treatment where 45 cuts/feet<sup>2</sup> were made. Results of one year trial suggested that yield of *Butea monosperma* gum increased with the increase in the number of cuts/feet<sup>2</sup> (Fig. 83).



**Fig. 83 :** Effect of number of notches i.e. density of cuts/feet<sup>2</sup> on gum yield (g/feet<sup>2</sup>) in *Butea monosperma* during 2017

### Assessment of allelopathic effect through bioassay

The allelopathic effects of aqueous leaf extracts of gum-yielding tree species, namely *A. senegal*, *A. nilotica* and *B. monosperma* were assessed on seed germination (%) of important *rabi* season crops (chick pea, lentil, mustard and wheat).

- ❖ Maximum reduction in germination was recorded in 15% concentration of aqueous leaf extracts when compared with 10 and 5%.
- ❖ Irrespective of concentrations, the germination of tested crops in leaf extracts of *A. senegal*, *A. nilotica* and *B. monosperma* were recorded in the following orders: chick pea>lentil>wheat> mustard in *A. senegal*, wheat>chick pea>mustard>lentil in *A.*



*nilotica*, and wheat>lentil> chick pea>mustard in *B. monosperma*

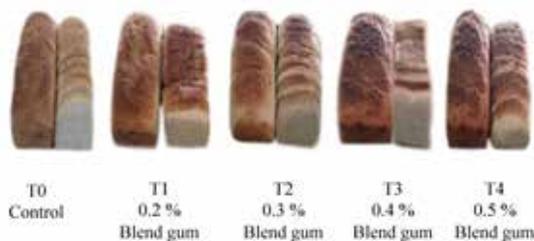
#### 1.4 Project on Guar Gum at VNMKV, Parbhani

Bread and cookies were developed using gum blend (*guar* and *arabic* gum in equal proportion) in the Bakery Plant of the College of Food Technology, VNMKV, Parbhani.

##### Preparation of bread with incorporation of *guar* and *arabic* gum blend

Wheat flour, salt, sugar, GMS (Glycerol mono stearate), shortening, milk powder, calcium propionate, yeast and gum blend were used in formulation of bread (Fig. 84). Gum blend was used in concentrations of 0.0, 0.2, 0.3, 0.4 and 0.5 %.

- ❖ A slight delay in gelatinization temperature of the flour system was reported in bread samples containing gum blend.
- ❖ Dough stability (9.1 min) increased with increased level of addition of gum blend up to 0.4%. Extensibility, resistance to extension and dough development time also increased by addition of hydrocolloids in bread.
- ❖ Addition of blend gum improved crust color, taste, crumb texture and overall acceptability than the control sample and addition of 0.3 per cent of gum blend in bread was found to be overall acceptable with respect to quality.
- ❖ Shelf life of the bread increased by two days compared to the control sample under room temperature.
- ❖ The total production cost for preparation of 1kg bread worked out to be Rs. 36 on the basis of the cost of raw material including processing and packaging cost.



**Fig. 84 :** Bread prepared with different levels of *guar* and *arabic* gum blend

##### Preparation of soy flour supplemented cookies

##### with incorporation of *guar* and *arabic* gum blend

Wheat flour (80%), soy flour (20%), sugar, shortening, baking powder, sodium bicarbonate, ammonium bicarbonate and gum blend were used in preparation of cookies. Blend was used in concentration of 0.0, 0.2, 0.3, 0.4 and 0.5%.

- ❖ The sample of cookies (Fig. 85) containing gum blend showed an increase in thickness as protein content increased and decrease in width and spread factor. The decrease in hardness of cookies was also noticed by addition of gum blend.
- ❖ Cookies containing 0.4% gum blend was found to be overall acceptable and it was found to be overall acceptable up to 180 days during storage as compared to control.
- ❖ The total production cost for preparation of 1kg cookie was Rs. 40.96.



**Fig. 85 :** Cookies prepared with different levels of *guar* and *arabic* gum blend

#### 1.5 Project on Rosin at Dr. YSPUH & F, Solan

##### Standardization of bore hole height for oleoresin tapping from *Pinus roxburghii* tree

##### a) Main campus

Natural stand of chir pine located in the University Campus were classified into six diameter classes *viz.*, 30-35 cm, 35-40 cm, 40-45 cm, 45-50 cm, 50-55 cm and >55 cm. Five boreholes at different times *viz.*, March, May, June, September and October were drilled in each tree and yield was recorded at the end of November for all the five bore holes (Fig. 86). Bore hole treatment was done at 40, 50, 60 and 70 cm of heights from ground level.

- ❖ The highest oleoresin yield of 2141.6 g/season was recorded from the bore hole at height of 40 cm.
- ❖ The highest oleoresin yield of 452.8 g/hole/tree was obtained from the diameter class >55 cm which was statistically at par with diameter class



50-55 cm (412.8 g/hole/tree).

- ❖ Highest oleoresin yield (422.5 g/hole/tree) was obtained from the borehole drilled in the month of May whereas the lowest oleoresin yield (239.7 g/hole/tree) in the month of October.
- ❖ The interaction between borehole height and diameter classes was also observed to be significant at 5 per cent level of significance. The maximum oleoresin yield of 672.0 g/hole/tree was obtained from 70 cm borehole height with diameter classes 50-55 cm.
- ❖ The interaction between diameter classes and month of bore holes drilled, along with the interaction between borehole height and month of borehole, was found non-significant at 5 per cent level of significance.



**Fig. 86 :** Standardization of bore hole height

## b) Bhota-Hamirpur

The resin tapping experiment at Forest Division Hamirpur (HP) was started in April, 2011. Eight diameter classes were formed *i.e.* 30-35 cm, 35-40 cm, 40-45 cm, 45-50 cm, 50-55 cm, 55-60 cm, 60-65 cm and >65 cm depending upon the availability of trees. Three boreholes at different times (April, June and September) were drilled in each tree and yield was recorded at the end of November. The main objective of this experiment was to know the resin yielding potential of chir pine trees. There were 4 treatments (heights 40, 50, 60 and 70 cm) with each treatment having three replications. Each replication comprised of five trees.

- ❖ The highest oleoresin yield of 2,372.0 g/season

was recorded from the bore hole at height of 40 cm.

- ❖ For different months of boreholes drilled the highest average oleoresin yield of 757.4g/hole/tree was obtained in the month of May.
- ❖ For a particular drilling height, the highest oleoresin yield of 1177.4 g/hole/tree was obtained from borehole height of 40 cm drilled in the month of May.

### Effect of latitudinal clines, altitudes and color of needles on oleoresin yield of *Pinus roxburghii*

- ❖ Based on latitudinal clines, Dharamshala (-32o to 33o N) was recorded with maximum oleoresin yield (544.4 g).
- ❖ For different altitudes, the maximum yield (543.3 g) was recorded for 1500-2000m.
- ❖ For different needle colour morphotypes, the highest yield of 564.4 g was observed for dark green coloured needles.

### Differential Scanning Calorimetry (DSC) study of rosin samples

The critical scrutiny of data revealed significant differences for the month of collection of oleoresin whereas non-significant for oleoresin colour on melting point of oleoresin at 5 per cent level of significance. For different months of collection of oleoresin, the highest melting point of 57.9°C was obtained for oleoresin collected in the month of June. Among different oleoresin colours, the maximum melting point (56.8°C) was recorded in white sample while, minimum melting point (55.8°C) in yellow-white sample. The interaction between oleoresin colour and the month of collection of oleoresin were found to be non-significant.

### Rosin and turpentine content of high resin yielders of *Pinus roxburghii* Sargent

The critical scrutiny of data revealed significant differences for rosin and turpentine content of high resin yielders of *Pinus roxburghii* Sargent from different sites at 5 per cent level of significance. The highest (82.9%) rosin content was found for Piplughat (Solan) whereas lowest (78.5%) for Nauni. The maximum (21.4%) turpentine content was found for Nauni whereas minimum (17.0%) for Piplughat (Solan).

### Demonstration of Borehole method of oleoresin



### tapping to the State Forest Department Trainees

The bore hole method of resin tapping was demonstrated to the Forest Guards and Ranger Forest Officers, ACF's (Assistant Conservator of Forests) and DFO (Divisional Forest Officer) trainees of State Forest Department and Forest Departments of other States also (Fig. 87).



**Fig. 87 :** Demonstration of borehole resin tapping method to Forest trainees

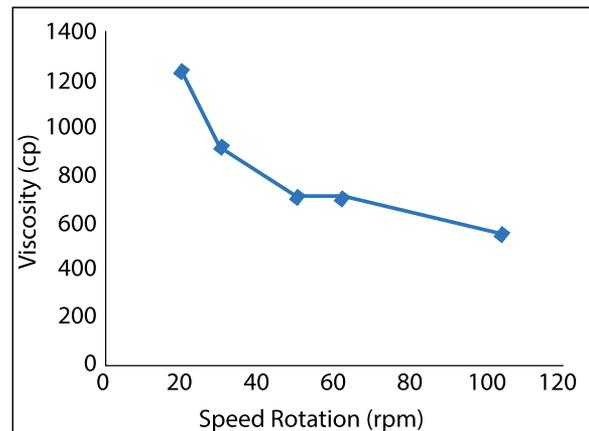
### 1.6 Project on *Karaya* Gum at IGKVV, Raipur

#### Physico-chemical and rheological properties of gum *karaya*

- ❖ The angle of repose of *karaya* gum grits at 17.47±0.44% moisture content was found to be 47.27±2.91°.
- ❖ The coefficient of static friction of *karaya* gum grits were determined with respect to four different structural materials, namely, glass, plywood, mild steel sheet and rubber, and it was observed that the coefficient of static friction was least for glass material.
- ❖ The value of ash content, pH and refractive index of *karaya* gum was found 4.62 %, 4.26 and 1.336, respectively.
- ❖ Water activity of granular *karaya* gum, measured at moisture content of 17.47±0.44% (db) and room temperature, was 0.651.
- ❖ The solubility of *karaya* was determined by using various solvent such as hot water, cold water, ethanol, acetone and chloroform. The maximum solubility (27.22 per 100 ml) was found for hot water.
- ❖ The data for water sorption capacity and water holding capacity of *karaya* gum was obtained as 0.885 % and 84.76 per 100 ml, respectively.
- ❖ The length of *karaya* gum grits was found to be ranged from 5 to 45 mm, bulk mass and GMD

(geometric mean diameter) varied from 0.38 to 110.24 gm and 4.52 to 18.48 mm, respectively.

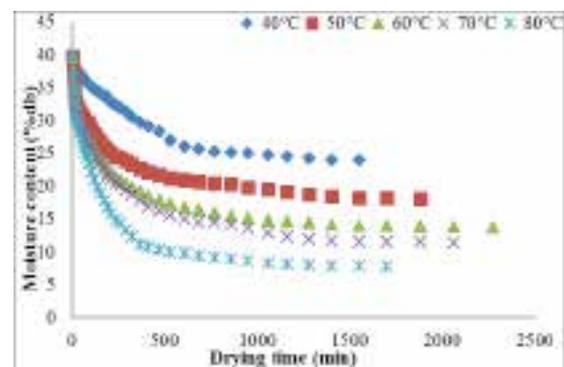
- ❖ The value of sphericity, aspect ratio and surface area was reported to be in the range of 85.79 to 42.33 %, 43.22 to 226.01 % and 33.10 to 1093.50 mm<sup>2</sup>, respectively.
- ❖ The viscosity of *karaya* gum was determined by Brookfield viscometer and it decreased with increase in rotational speed (Fig. 88).



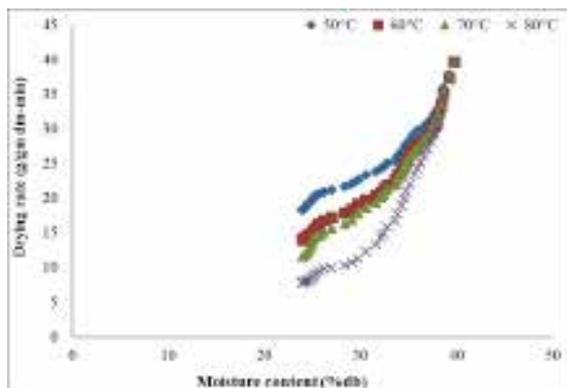
**Fig. 88 :** Viscosity (cp) versus speed rotation (rpm)

#### Drying characteristics of gum *karaya* grits

- ❖ The curve for moisture content versus drying time indicates that the drying time for *karaya* grits get reduced when the drying temperature increases from 40 to 80°C (Fig. 89 a).
- ❖ The drying rate versus moisture content curve indicates that the drying rate decreased from 2.0064 to 0.00021 kg water/ kg dry matter/min., when moisture content decreased from 69.721 to 3.794 % (db) at temperature change from 40° to 80°C, respectively (Fig. 89 b).



**Fig. 89 a :** Moisture content (% db) versus drying time (min.)



**Fig. 89 b :** Drying rate versus moisture content (db)

### Biochemical studies of *dhawara*, *babool* and *karaya* gum

- ❖ The pH and protein content in *karaya* gum did not differ significantly in gum content extracted by chemical as well as mechanical method. The response was similar in *dhawara* and *babool* gum.
- ❖ However, the viscosity was more in *karaya*, *babool* and *dhawara* gum, extracted through gum inducer method.
- ❖ These gums are water soluble and solubility was more in hot water. In case of *karaya* gum, the solubility was more in gum extracted by mechanical method. However, in *babool* and *dhawara* the solubility of gum was more in gum extracted by gum inducer method.

### Characterization of genetic diversity of *karaya* gum tree

- ❖ The terminal portion of the branch having more endogenous level of hormones was found better for the establishment of the *karaya* plant through cuttings. The length of the cuttings should be 30-45 cm (with circumference 4-6 cm) at the base.
- ❖ The portion of the branch or basal branches initiated from roots of main trunk was found very effective for fast propagation of *karaya* trees.
- ❖ The nursery raising is continued at the center and developed plantlets were shifted at various sites and research stations of the University. The work on seed collection and the study of seed viability and longevity is continued. However, the seed collected from ethephon injected trees were not showing any significant impact on seed germination per cent, germination time, or on establishment of nursery.

- ❖ The observation on nursery plants indicates that the growth of the plant depends on the proper care, timely irrigation at initial period (up to 3-4 years) of growth, particularly in summer period.

### 1.7 Project on *Guggul* at JNKVV, Jabalpur

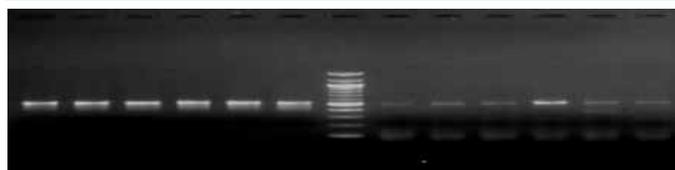
#### DNA barcoding of *Commiphora wightii* genotypes

Methods for identifying species by using short orthologous DNA sequences, known as 'DNA barcodes', have been initiated to facilitate biodiversity studies, identify juveniles, associate sexes, and enhance forensic analyses. The main aim of DNA barcoding is to establish a shared community resource of DNA sequences that can be used for organismal identification and taxonomic clarification. A total of six genotypes of *Commiphora wightii* were collected from Madhya Pradesh, Gujarat and Rajasthan. Leaves of two genotypes from each place were collected for DNA extraction. Extracted DNA samples were quantified and diluted up to 25 ng/ $\mu$ l. Quantified DNA samples were used as template for polymerase chain reaction (PCR) with *rbcl*, *matK*, *trnH-psbA* and *ITS2* universal primers.

Genomic DNA from all six samples was amplified with *rbcl* and *matK* universal primers (Fig. 90 a). Primer *rbcl* amplified about 700bp amplicon with all samples while, *matK* amplified about 850 bp amplicon with them. Primers *trnH-psbA* and *ITS2* (Fig. 90 b) amplified about 500bp amplicons with all studied samples.



**Fig. 90 a :** PCR amplification of *C. wightii* genotypes using A. *rbcl* and B. *matK* markers



**Fig. 90 b :** PCR amplification of *C. wightii* genotypes using A. *trnH-psbA* and B. *ITS2* markers

#### Chemico-physical analysis of *guggul* gum stored in different packaging

After harvesting of oleoresin gum from *C. wightii*, the gum passes through various stages of storage and



transportation before it reaches the industry. Thus a trial was conducted to find out the changes in quality parameters of *guggul* gum due to storage in different packaging systems. Freshly harvested *guggul* gum was stored in container of four different packing systems - Earthen Pot (T1), Plastic Box (T2), Poly Bag (T3) and Jute Bag (T4) for 12 months at room temperature. The samples from each of the packing systems were analyzed to know the elemental composition of *C. wightii*.

- ❖ CHNS Analysis : Carbon, hydrogen, nitrogen and sulphur of gum sample (after one year of storage) is given below :

Sample	Percentage of				Sample weight (mg)
	C	H	N	S	
Earthen Pot (T1)	51.79	8.66	2.30	6.51	15.38
PET container (T2)	48.36	8.68	1.68	1.07	18.15
Polyethene bag (T3)	55.77	9.59	1.52	2.83	16.99
Jute bag (T4)	50.47	9.04	3.59	0.75	18.61

- ❖ FT-IR Analysis: The findings of FT-IR analysis indicated that the chemical compositions of *guggul* gum remains the same for all four packing conditions. No significant changes in the presence of functional groups was observed among all four samples T1, T2, T3 and T4.
- ❖ PXRD Analysis: There were certain unassigned peaks of X ray diffraction, which may be assigned to amorphous and organic phases of SNPs. The maximum of eight peaks of *guggul* gum in earthen pot (T1) indicated the presence of a range of nanoparticles.
- ❖ DSC Analysis: DSC was carried out to monitor physical and chemical changes that occur in the gum during thermal processing. Peaks obtained at various temperature ranges for all samples indicated that the *guggul* gum stored in different packing had good stability.
- ❖ TGA/DTA Analysis: Thermal analysis of two types *viz.*, Thermo-gravimetric analysis (TGA) and Differential thermal analysis (DTA) were employed for the measurement of physical and chemical changes of the materials as a function of temperature. Maximum thermal degradation in the samples took place between 200–400 °C which was due to decomposition of organic moiety. At temperature 200–350 °C, carbon oxides

are emitted and at 350-750 °C volatile organic compounds are emitted.

### Impact of continuous tapping and alternate year tapping on oleo-resin yield in *Commiphora wightii*

Unsustainable as well as continuous tapping is severely affecting the *C. wightii* population in Chambal ravines. *Guggul*, a threatened species is tapped to extract medicinally important oleo-gum-resin (*guggul*). However, the plant dies after gum exudation or due to soil erosion or termite attack. The present trial was initiated in 2014-15 by selecting 15 *C. wightii* plants for tapping in alternate years *i.e.* 2014-15 and 2016-17 along with another set of 17 *C. wightii* plants for tapping continuously during tapping period for two successive years *i.e.* 2014-15 and 2015-16. *Guggul* tapping was done using Jawhar *Guggul* Blazer during the tapping season (*i.e.* last week of February). By comparing the *guggul* production data during year 2014-15 and 2016-17, an increase in gum production of 4.68% was recorded in the plant A-15 followed by 3.17% in plant A-10, while highest decrease of 6.19% was in plant A-2 followed by 5.29% in plant A-14. For *guggul* production during year 2014-15 and 2015-16, the highest decrease of 57.83% production was shown by plant C-6 followed by 49.89% by plant C-13. The results indicated huge decrease of *guggul* gum production in continuous tapping for two successive years. Hence, it is concluded that successive tapping in same plant decreased *guggul* production in all studied plants while tapping in alternate year increased the *guggul* production in few plants.

### 1.8 Project on Tamarind seed gum at TNAU, Coimbatore

#### Characterization of tamarind seed gum with source variation

For source variation, the matured tamarind pods were collected from 35 places in four states *viz.*, Tamil Nadu, Kerala, Karnataka and Andhra Pradesh. Morphological parameters like seed weight, kernel weight, oil and fat free TKP (tamarind kernel powder) and gum yield were analyzed. Maximum and minimum gum yield was obtained from samples of Aasan, Karnataka (2.54g gum from 5g TKP) and Nokkanur, Karnataka (1.98 g gum from 5g TKP) respectively. The physio-chemical properties recorded in the tamarind kernel powder was pH (5.49), ash content (2.38 %), volatile matter (15.55 %), and viscosity (13.8 Cp) of 1% solution.



## Genetic influence on tamarind seed gum production (TSG)

For experimentation purpose, the matured tamarind pods were collected from seven genetic sources collected in Tamil Nadu. Morphological parameters like pod area, seed area, seed weight, kernel weight, tamarind kernel powder, oil and fat free TKP and gum yield were analyzed. Maximum (2.31g gum/5g TKP) and minimum (1.98g gum/5g TKP) gum yield was obtained from genetic source - TN Hasanur 09 and TN Urigam 112 respectively.

## Establishment of tamarind processing unit

Tamarind processing unit (Fig. 91) was established with equipments, viz., tamarind dehuller, hot air oven, pulverizer and seed decorticator for processing tamarind pod to tamarind kernel powder.

- ❖ Tamarind dehuller – Pod shell attached with pulp is broken and removed
- ❖ Tamarind decorticator – Seed testa and seed kernel (white) is separated
- ❖ Seed pulverizer – Seed kernel to tamarind kernel powder



Fig. 91 : Tamarind Processing Unit

## Silvicultural management

### Foreign Application (Application of growth regulator and chemicals)

The tamarind plantation was treated with different combination of growth regulators and chemicals through foliar application. The treatments namely T1 (ZnSO<sub>4</sub> 0.5 % + Boric acid 0.3 %), T2 (Planofix), T3 (Paclobutrazol), T4 (Ethephon) and T5 (Control) were applied in a 15-year-

old plantation raised at Chinnakupam village, Harur taluk, Dharmapuri district, Tamil Nadu. The effect of growth regulator and chemicals sprayed on tamarind plantation were compared by analysing nutrient status, chlorophyll content in leaves, biochemical constituents in leaves and fruit yield.

- ❖ Increase in the nutrient status of the tamarind leaves was noticed in foreign applied trees when compared to control and nutrient status of leaf (total nitrogen, total phosphorus and total potassium) was highest for Paclobutrazol treatment followed by Planofix.
- ❖ Maximum and minimum Chlorophyll content (Chlorophyll 'a', chlorophyll 'b', total chlorophyll and chlorophyll a/b ratio) in leaves was found in case of Paclobutrazol treatment and control respectively.
- ❖ Highest biochemical constituents (soluble protein, total carbohydrate, starch and C/N ratio) was recorded in case of Planofix treatment and lowest in control.
- ❖ Highest (42 kg/tree) and lowest (12 kg/tree) fruit yield was obtained from Paclobutrazol treatment and control sample respectively.

## Canopy Management (Different Pruning Intensities)

The pruning treatment was carried out in 15-year-old tamarind plantation at Chinnakupam village, Harur taluk, Dharmapuri district, Tamil Nadu. The selected tamarind plantation was imposed with different intensities viz., 15% pruning, 30% pruning and 50% pruning for enhancing the flowering and fruiting behavior with Randomized Block Design.

- ❖ Nutrient status of leaf (total nitrogen, total phosphorus and total potassium) was highest in T2 (30 % pruning) followed by T1 (15 % pruning) and lowest in control sample.
- ❖ Maximum and minimum chlorophyll content (chlorophyll 'a', chlorophyll 'b', total chlorophyll and chlorophyll a/b ratio) was recorded in case with pruning intensity of 30 % and control sample respectively.
- ❖ Highest biochemical constituents (soluble protein, total carbohydrate, starch and C/N ratio) was observed in case of 30% pruning intensity.
- ❖ Highest (39 kg/tree) and lowest (14 kg/tree) fruit



yield was obtained from tree having 30% pruning intensity and control sample respectively.

### 1.9 Project on Natural Dammars at KAU, Thrissur

#### Standardization of dammar tapping process strip cut method for *Canarium strictum* trees

Experiments were conducted at Malakkapara and Nelliampathy from January 2016 to December 2016. Strip cut method (Fig. 92) was found to be more efficient method in resin extraction. In this method, a small portion of bark was removed from the *Canarium strictum* tree and half blown polythene cover was fixed underneath this cut. The resin oozes through the strip and was flown to the polythene cover directly. The advantage of this method was the minimum injury to the wood and the resin oozes directly to the polythene cover. This method of extraction, yielded maximum amount of first quality resin when compared to traditional method. The highest production of resin was observed in trees having girth >150 cm along with maximum quantity of 1st quality resin for the same diameter. In this method, there was a gradual increase in the production of resin towards monsoon season and it continued up to December. In strip cut method, both ends of the cut joins naturally within two to three months whereas, in traditional method, it took six to ten months to produce new cells for closing the gaps.



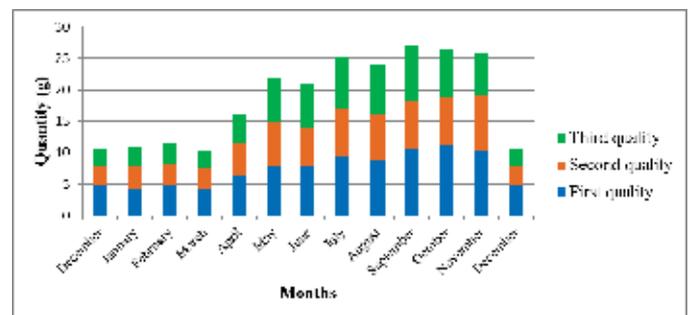
**Fig. 92 :** Strip cut method of resin collection in *Canarium strictum* tree

#### Deep cut Method for *Vateria indica* trees

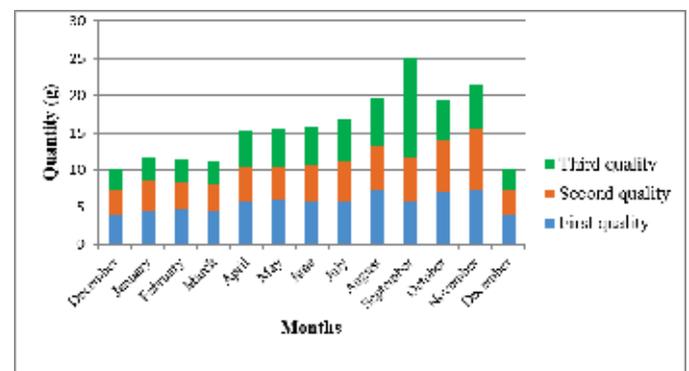
Resins were collected from *Vateria indica* trees at Malakkapara as well as at Peechi. Since the white dammar exudates from the sap wood of the tree, deep cuts were made at a depth of 2-3 cm on the wood. Mean data indicated that the maximum quantity of first quality resin was obtained from trees >150 cm. The contribution of trees >150 cm to the total resin production was 30% followed by girth class 100-150 cm. The lowest production was noticed in the trees <50 cm. The resin yield increased with increasing girth of trees. Dammar yield

was relatively higher at Peechi when compared to Malakkapara. Monthly variation in the production of resin at Peechi and Malakkapara (Fig. 93 a & b) indicated that maximum production for first and second quality resin was in the month of November and October respectively. Contrary to this, maximum quantity of third quality resin was obtained in the month of September. It was noticed that resin production was relatively higher during post monsoon period.

It was noticed that *Vateria indica* trees exuded more resins from natural injuries than man made injuries. Whereas, *Canarium strictum* trees exuded more amount of resin from natural as well as artificial wounds.



**Fig. 93 a :** Total resin production in monthly intervals at Peechi under deep cut method



**Fig. 93 b :** Total resin production in monthly intervals at Malakkapara under deep cut method

#### Physico-chemical analysis of Black dammar and White dammar

Black dammar and white dammar collected from the study sites (at Malakkapara, Nelliampathy, Peechi) and their respective tree girths (< 50, 50-100, 100-150 and > 150 cm) were sent to the quality control laboratory of ICAR-IINRG, Ranchi. A total of 16 samples were analyzed and their detailed reports are as follows :

- ❖ The loss on drying test was designed to measure the amount of water and volatile matters in



a sample when the sample was dried under specified conditions. At Mallakapara, black dammar showed highest value in the trees with girth <50. It correspondingly decreased in the higher girth classes. Whereas at Nelliampathy a reverse trend was noticed in which higher girth class showed maximum value. In white dammar almost same trend was followed at different girth classes. However, the data depicted that black dammar showed relatively lower values (maximum 4.26%) when compared to white dammar (maximum 5.465%).

- ❖ The ash content was found to be lower in black dammar, but it showed a higher value in white dammar. The highest ash content was obtained from white dammar which was collected from the trees greater than 150 cm.
- ❖ Black dammars melting point ranged from 114-115 °C and that of white dammar from 169-170 °C.
- ❖ Black dammar acid values varied from 2.96 to 8.43 and interestingly acid value was found to be relatively very high for white dammar (22.35 to 22.88).

### Training to tribals on scientific harvesting of Dammar

A one-day workshop (Fig. 94) was conducted on the topic 'Harvesting techniques and value addition of black dammar' at Nelliampathy. The main theme of the workshop was the sustainable harvesting and value addition of black dammar. 30-40 indigenous tribals from Nelliampathy region participated in the workshop. An open discussion was conducted on the importance of the sustainable harvesting of resins.



**Fig. 94 :** One-day workshop on 'Harvesting techniques and value addition of black dammar' at Nelliampathy

### 1.10 Project on *Pinus kesiya* Resin at ICAR - Research Complex for NEH Region, Umiam Resin Tapping from *Pinus kesiya* trees

Borehole method was used for resin tapping in *Pinus kesiya* (Khasi Pine). In this method holes of 2.5 cm in

diameter were drilled to a depth of 10 cm depth. The holes were drilled with slight slope towards opening to allow the flow of oleoresin. Three bore-holes were made around the tree circumference and chemical spray of 1:1 mixture of 10 percent 2-chloroethyl-phosphonic acid (CEPA commercially known as Ethephon) and 20 percent sulphuric acid were applied inside boreholes with spray bottle. Spout was used to connect boreholes with polythene bags. Polythene bags were attached to the spout with the help of tie for collection of oleoresin and replaced when filled with oleoresin during the period of tapping (Fig. 95). This is a closed system having the advantages of capturing volatile monoterpenes and prevents premature solidification of the resin acid.

- ❖ Maximum resin yield was in the month of March, 2017 in all the diameter classes viz. 30-40 cm (306.3 g tree-1), 40-50 cm (483.3 g tree-1) and >50 cm diameter class (702.8 g tree-1).
- ❖ Resin yield was found to be higher in diameter class >50 cm for all the months studied. The average monthly turpentine yield was found to be 400.1 g tree-1 for >50 cm diameter class. Resin yield was recorded minimum for 30-40 cm diameter class (average monthly yield 212.0 g tree-1).
- ❖ The yield of resin is affected by both mean monthly temperature and mean monthly rainfall. Resin yield was recorded to be higher during pre-monsoon season and resin yield decreased with high rainfall during rainy season and low temperature during winter season.



**Fig. 95 :** Bore hole method of resin tapping used in *Pinus kesiya*

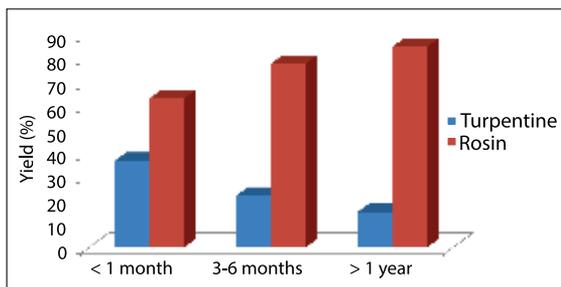
### Resin processing

Resin was processed and turpentine was separated using distillation process. About 20-25 gm of resin was mixed with 50 ml distilled water. The distillation was



carried out at 60° C. To reduce bumping, stones/glass beads was used and temperature was set initially as 40°C and gradually increased to 60° C. Experiments for estimation of rosin and turpentine content in fresh resin and stored resin samples were carried out. To study the effect of storage length on turpentine yield, resin was processed within one month after tapping, 6 months after tapping and one year after tapping.

- ❖ It was found that turpentine yield in resin decreased drastically during storage period (Fig. 96).
- ❖ Fresh distillation of resin yielded very high amount of turpentine oil (mean turpentine 36.84 per cent) and turpentine oil in different trees ranged between 23.90 – 54.15 per cent.
- ❖ For the samples distilled in 3-6 months, the average turpentine oil was found to be 22.10 per cent and oil content in different trees ranged between 20.48 – 24.60 per cent. In the samples stored for 1 year, average turpentine yield was found to be very low (15.07 per cent) and yield in different trees ranged between 10.38-21.72 per cent.



**Fig. 96 :** Yield of turpentine as affected by storage duration

## 2 Network Project on Conservation of Lac Insect Genetic Resources

### 2.1 Lead Center: ICAR-IINRG, Ranchi

#### Propagation of *F. semialata* on *F. macrophylla*

Vegetative propagation methods like budding, cleft grafting and inarching were tried on *macrophylla* with *semialata*. Among them the most successful cleft grafting method was selected and continued. 100 *semialata* were cleft grafted on *macrophylla* achieving forty one per cent success rate.

#### Forecasting of lac insect larval emergence

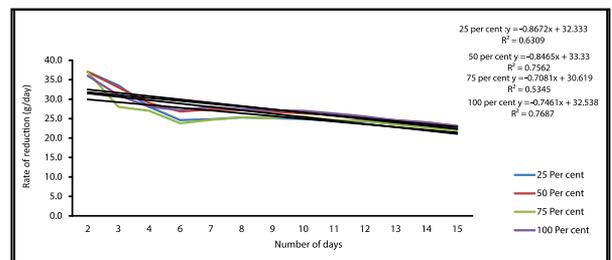
Lac insect female cells were collected and grouped into six different stages (Stage 0, 1, 2, 3, 4 and 5) based on appearance of yellow spot. Time lag relation (in days)

between initiation of larval emergence and different stages of yellow spots varied greatly. Time taken for actual larval emergence to begin was 15.68±3.2, 9.82±1.51, 7.28±2.74, 5.61±1.91, 5.11±1.63 and 1.68±0.82 days in stage 0, 1, 2, 3, 4 and 5 respectively during summer season (*jethwi*) 2017 *kusmi* crop period.

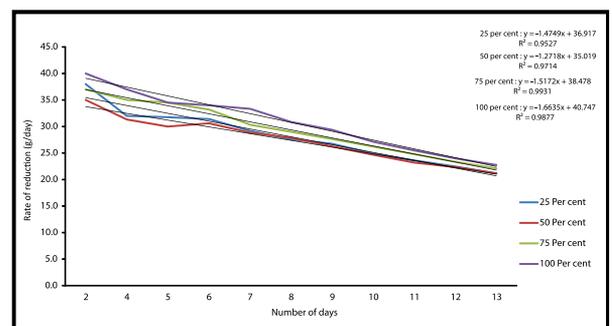
#### Broodlac quality of lac insects

Broodlac quality study continued with different quality of broodlac viz., 25, 50, 75 and 100 per cent lac encrustation harvested from different lac hosts *palas* and *kusum*. Maximum lac crawlers emerged on 6 and 4 days after harvesting of broodlac and most of the crawlers emerged by 11 and 12 days after harvesting of broodlac during *baisakhi* (summer season, *rangeeni*) and *jethwi* crops 2017, respectively

To address the freshness assessment of the broodlac, the rate of weight reduction of broodlac was taken as an indicative parameter. Rate of reduction in weight of broodlac in different categories viz., 25, 50, 75 and 100 per cent lac encrustation was calculated in *palas* (0.9, 0.8, 0.7 and 0.7 per cent per day) during *baisakhi* 2017 and *kusum* (1.5 1.3, 1.5 and 1.7 per cent per day) during *jethwi* 2017 (Fig 97 a & b). Rate of weight reduction is higher during first few days indicating its freshness (became constant after 15 and 13 days during *baisakhi* 2016-17 and *jethwi* 2017 respectively).



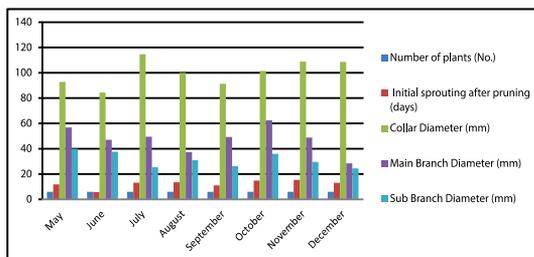
**Fig. 97 a :** Rate of weight reduction in broodlac during *baisakhi* 2016-17



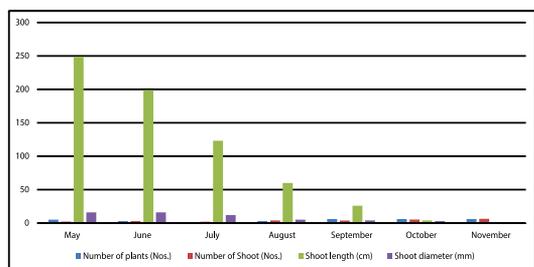
**Fig. 97 b :** Rate of weight reduction in broodlac during *jethwi* 2017

### Pruning response of *Calliandra calothyrsus*

Pruning was done in fourth week of every month from May, 2017 to December 2017. Observations viz., time of initial sprouting, collar diameter, main and sub branch diameter, number of shoots, shoot length, shoot diameter were recorded monthly intervals per plant in each month of pruning (Fig. 98 a & b).

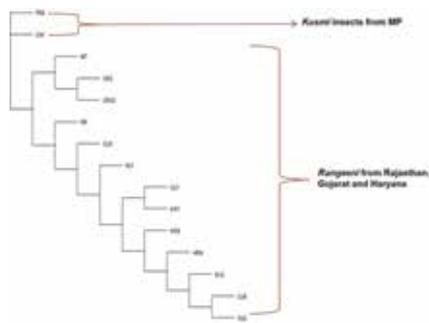


**Fig. 98 a :** Characteristics of selected plants during different month of pruning



**Fig. 98 b :** Pruning response at monthly interval of pruning recorded during December 2017

Barcoding of new lac insect collections: Fifteen new lac insect lines collected from different regions of the country (Punjab, Rajasthan, Haryana, Madhya Pradesh and Tamil Nadu) have been characterized using *cox1* barcode gene. Lac insects collected from Punjab, Rajasthan, Haryana and Tamil Nadu were found to be *rangeeni* strain of *Kerria lacca*, whereas the lac insect lines collected from Madhya Pradesh were *kusmi* strain of *K. lacca* (Fig. 99)



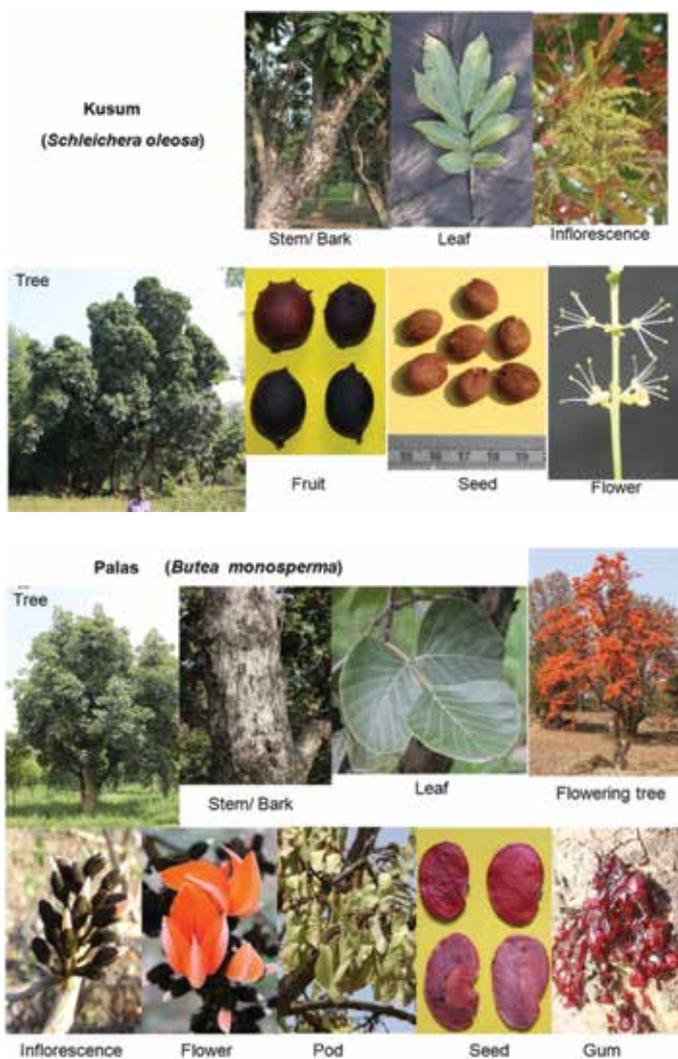
**Fig. 99 :** Phylogenetic tree of new lac insect lines based on *cox1* barcode

### Isolation and identification of endosymbionts from lac insects:

Bacterial endosymbionts were isolated from the adult female lac insects grown on *kusum*. 16S rRNA gene sequence analysis was done to identify the bacterial isolates. It revealed that the isolated bacteria from lac insects were *Bacillus kochii*, *Bacillus amyloliquifaciens*, *Bacillus bataviensis*, *Bacillus velezensis*, *Bacillus oceanisediminis*, *Arthrobacter enclensis* and *Escherichia fergusonii*.

### Field guide for identification of major lac host plants

Different parts such as leaves, flowers, fruits, seeds, bark, lac bearing twigs of some of the hosts-plants viz., *kusum*, *palas*, *semialata*, rain tree, pigeon pea, *Galwang*, Red *Calliandra*, *Jalari* were photo documented and are given below:



**Ber**  
(*Ziziphus mauritiana*)



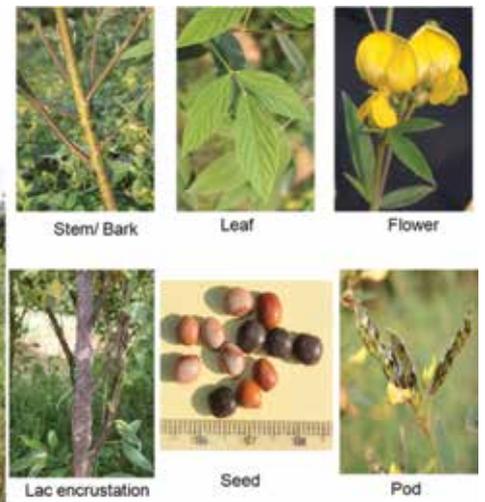
**Rain Tree**  
(*Albizia saman*)



**Semialata**  
(*Flemingia semialata*)



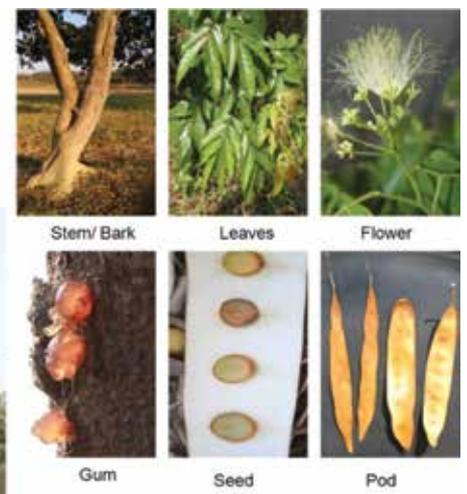
**Pigeon pea**  
(*Cajanus cajan*)



**Bhalia**  
(*Flemingia macrophylla*)



**Galwang**  
(*Albizia lucida*)





**Elemental budgeting of lac production system in *Flemingia semialata* for sustainable lac insect-host plant ecosystem**

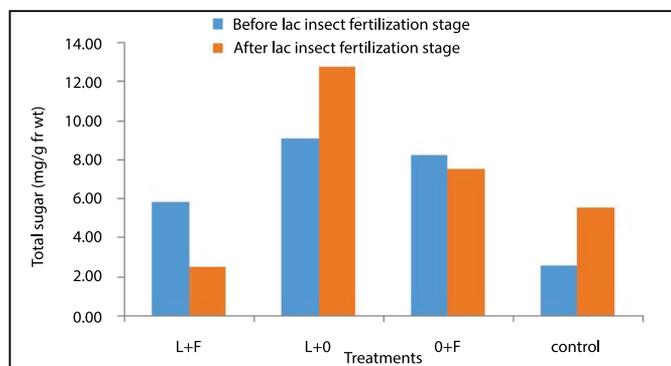
**Total sugar estimation**

The sugar content of the host plant was affected due to lac inoculation in both with and without fertilization

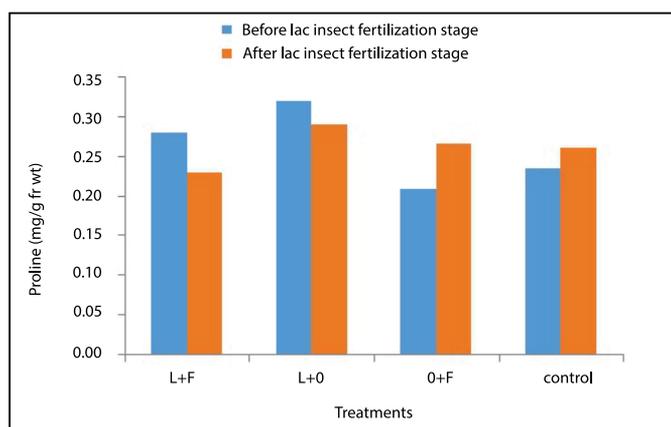
application. Treating host plant with fertilizer application decreased total sugar content after lac insect sexual maturity stage compared to pre-sexual maturity stage. The treatment with lac insect alone increased the total sugar content in after lac post-sexual maturity stage compared to before pre-sexual maturity stage (Fig. 100 a).

**Proline estimation**

The stress parameter, proline has showed that lac insect infestation affects the host plant stress status with respect to fertilizer application of the soil. There is an increase in proline content after lac inoculation. Host plant felt more stress when soil is not supplemented with nutrients as compared to the situation when the NPK is supplemented (Fig. 100 b).



**Fig. 100 a :** Effect of lac inoculation on sugar content of the *F. semialata*



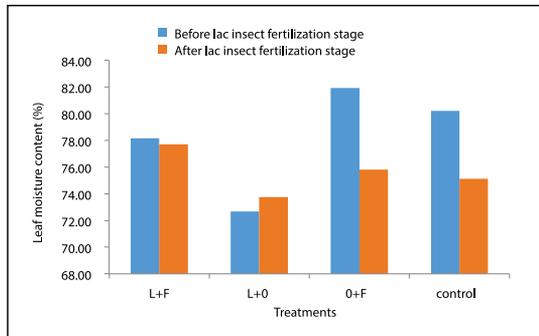
**Fig. 100 b :** Effect of lac inoculation on proline content of the *F. semialata*

**Leaf moisture content**

When leaf moisture content was measured it was found that lac inoculated host plant showed slight decrease in the moisture content as compared to control whereas lac with fertilizer treatment showed higher moisture



content than lac alone. The decrease in moisture content causes proline content to increase. This shows that lac insect feeding decreased the moisture content of the host plants however nutrient application maintains the moisture content of the host plant (Fig. 100 c).



**Fig. 100 c :** Effect of lac inoculation on leaf moisture content of the *F. semialata*

### Supervision and liasioning of co-operating centres

Visited lac inoculated plants *F. macrophylla* at farmers field at Guruvayur and home garden with *F. semialata* at Thrissur (Fig. 101). Conducted on farm training programme on lac cultivation for 45 farmers in collaboration with Cooperating Center PJTSAU, at Adilabad, Telangana on 26<sup>th</sup> October, 2017 (Fig. 102). Lac insect was collected from *Albizia saman*, at Medipattinam and observed lac insect on other lac host plants viz., *Peltophorum sp.* and *Ficus sp.* at various places of Hyderabad city.



**Fig. 101 :** Monitoring potted lac insect inoculated plants at KFRI, Peechi

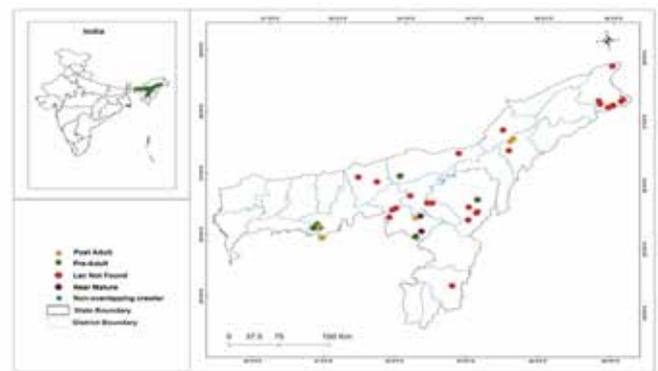


**Fig. 102 :** On farm training at Adilabad, Telangana

## Network Co-operating Centres

### 2.2 Assam Agricultural University (AAU), Jorhat Surveys conducted in Assam

Eleven districts of Assam were surveyed (Fig. 103), Out of which, lac insect was recorded in four districts, viz., Kamrup, Dhemaji, Sonitpur and West Karbi Anglong. In the Lower Lumpi region of Kamrup district, naturally occurring lac was found in large quantities on peal-pal tree. In Sonitpur district also naturally occurring lac was found on Litchi Plant whereas, in Dhemaji district lac was cultivated on *Ber* plant by some farmer under supervision of local NGO.



**Fig. 103 :** Survey map of Assam (Developed by KFRI)

### Disseminate scientific lac cultivation technologies and *insitu* conservation of the same

Three hands-on-training have been conducted to generate awareness and to disseminate technology on lac cultivation. First training cum workshop was conducted on Lac Cultivation Technology at AAU, Jorhat on 24<sup>th</sup> March, 2017. Twenty one farmers from Udalguri, Jorhat, Karbi Anglong, Nagaon, Kokrajhar, Majuli, Kamrup, Chirang, Sivsagar, and Tinsukia districts of Assam attended the training. During the session foot sprayers and seeds of *F. macrophylla* were distributed to the farmers to initiate the commercial cultivation of lac (Fig. 104 a & b).

Second training was conducted on 19<sup>th</sup> April, 2017 at AAU, Jorhat in collaboration with *Krishi Vigyan Kendra*, Kolasib, Aizawl, Mizoram, under a NABARD sponsored scheme 'Capacity Building for Adoption of Technology (CAT)'. Fifteen farmers from different districts of Mizoram guided by two scientists of the KVK, Kolasib, attended the training (Fig. 105). The farmers actively participated in the training program and took keen interest to undertake the cultivation in their fields.

Third workshop on 'Scientific Lac Cultivation' was conducted on 26<sup>th</sup> August, 2017 in collaboration with National Bureau on Soil Survey and Land Use Planning to train the farmers of Nam Deori, Upper Deori and Bahfola villages of Dhekorgorha Block of Jorhat, Assam. 19 farmers attended the training and were given a comprehensive knowledge on the scientific methods of cultivation of lac and various management practices associated with it.

Three numbers of OFT were also conducted in three districts of Assam, viz., Jorhat, Udalguri and Tinsukia (Fig. 106).



Fig. 104 a : Farmers at Lac Park, AAU, Jorhat



Fig. 104 b : Distribution of Foot Sprayers to the farmers



Fig. 105 : Hands-on training provided to the farmers at Lac Park, AAU, Jorhat



Fig. 106 : Selected ber plantation for OFT at Baghmora

### Indigenous Technical Knowledge (ITK)

One tribal resident of West Karbi Anglong reported that they use the fresh lac encrustation as curative medicine against body pain. According to him, fresh lac encrustation is boiled in hot water till the colour of the water turn red. Then they allow it to cool and take one or two teaspoon during body pain.

### Broodlac multiplication

Brood lac collected from Jhalda, West bengal (AAUK-03) was successfully inoculated at the Lac Park, AAU, Jorhat on 39 plants of *F. semialata*, 26 plants of *F. macrophylla*, 7 plants of *F. strobilifera*, 3 plants of *Ficus* sp. and 1 *Ziziphus* sp. plant from which 14.675 Kg, 2.000 Kg, 1.150 Kg, 0.600 Kg and 0.300 Kg of fresh brood lac was harvested, respectively. After inoculating brood lac of 7.6 kg in these trees, a total of 18.725 Kg fresh brood lac was harvested (Fig. 107) Under the climatic condition of Jorhat, Assam, the highest brood lac yield was obtained from the host plant, *F. semialata*, whereas, lowest from *F. macrophylla*.



Fig. 107 : Harvesting of broodlac (AAUK-03)



### Study on life cycle of lac insect strain from Jhalda (West Bengal) and West Karbi Anglong (Assam)

The life cycle of two races of lac insect, AAUK-03 and AAUK-06 collected from West Bengal and West Karbi Anglong respectively was studied under the climatic condition of Jorhat, Assam, with respect to their different life stages and total life span. The *aghani* (winter) crop of the race, AAUK-03 was inoculated during the month of July, 2016 and harvested during January, 2017. The life cycle was completed in 192 days. But, the *jethwi* (summer) crop of the same race inoculated on January, 2017 and harvested on July, 2017 completed its life cycle in 170 days

The indigenous race of lac insect, AAUK-06 collected from Langerdang, W. Karbi Anglong, Assam, was inoculated during November, 2016 and got matured during May, 2017 and the total life span was of 168 days. Brood lac harvested from the present crop was re-inoculated during the month of May, 2017 and harvested during October, 2017 and a shorter life span of 155 days was recorded.

### Settlement behavior of lac insect crawlers on *Flemingia semialata* and *Ziziphus* sp.

An investigation was undertaken to find out directional preference for settlement of *Kusmi* strain of *K. lacca* considering cardinal directions of branches of *Flemingia semialata* and *Ziziphus* sp. under climatic conditions of Assam.

Direction wise settlement of crawlers of lac insect (Fig. 108 a) was recorded highest in the north direction (97.0 crawlers/sq. cm. and 91.8 crawlers/sq. cm.) and lowest settlement density (31.2 crawlers/sq. cm. and 57.2 crawlers/sq. cm.) was recorded in west direction for both summer and winter crop, respectively. In case of summer crop, density of settlement towards west (31.2 crawlers/sq. cm.) and south (34.6 crawlers/sq. cm.) was very low as compared to north (97.0 crawlers/sq. cm.) and east (89.2 crawlers/sq. cm.) direction. Settlement density towards east and north differed significantly from west and south at 0.05 per cent probability level. While, in case of winter crop, the density of settlement was more or less equal in all the direction except north. Towards north, highest settlement density (91.8 crawlers/sq. cm.) was recorded which differed significantly from the settlement density in the west (57.2 crawlers/sq. cm.) at 0.05 per cent probability level.

In horizontal branches ( Fig. 108 b), settlement density was much higher in the lower side of the branch (92.6

crawlers/sq. cm. and 77.2 crawlers/sq. cm.) compared to the upper side (26.8 crawlers/sq. cm. and 25.6 crawlers/sq. cm.) for both summer and winter crops, respectively. Independent sample t- test showed that there was significant difference between upper side and lower side with respect to settlement of the insect. From the above observations, it could be concluded that, most possibly crawlers of lac insect prefer shade and escape from direct exposure to sunlight. Generally, towards north and east as well as lower side of branch, shade is more which might be the reason for highest settlement density.

During the initial settlement period of the winter crop (Jun/Jul), the solar elevation angle (Fig. 109) reaches its peak values of about 82° - 85° and the sun appears away from the southern horizon which peaks out slightly south of overhead point. Therefore, all the sides of the branches receive almost equal sunlight with partial shadowing towards north in case of vertical branching and lower sides with respect to the horizontal branching. However, in case of summer crop, during settlement period (Dec/Jan), the sun moves toward southern horizon with the sun angle of about 39° - 41°. Hence, sunlight falls more towards south and west direction which might be the reason for lower settlement density of lac insect toward south and west.

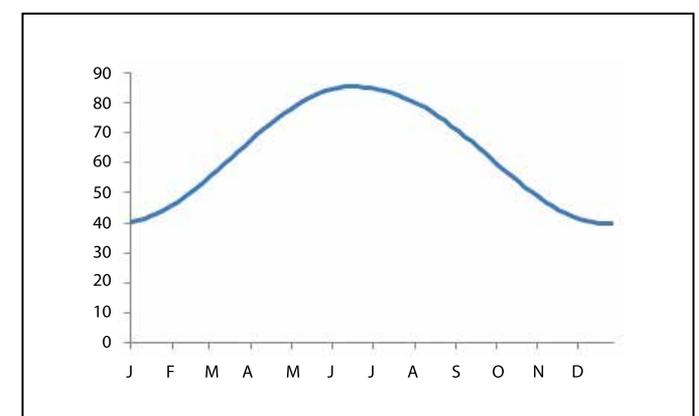
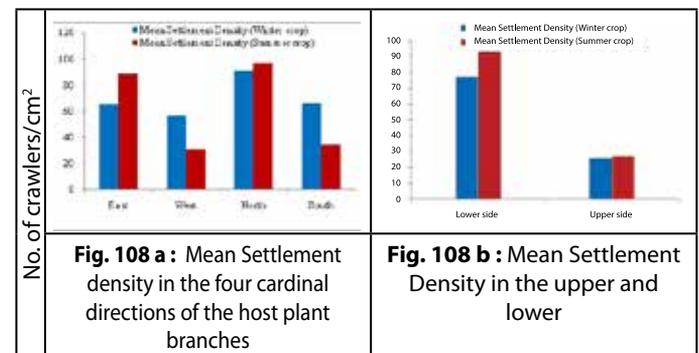


Fig. 109 : Annual Variation of Solar Elevation Angle



### Study on Productivity Linkage Parameters of AAUK-03 (Jhalda, WB) and AAUK-06 (Langardang, West Karbi Anglong) on different host plants

Productivity linked study of AAUK-03 (Jhalda, WB) on *F. semialata*, *F. macrophylla*, *F. strobilifera*, *F. religiosa*, *C. cajan* and *Ziziphus* sp. revealed that *F. semialata* was superior to the other host plants in terms of broodlac production. While, *phunki* lac and scrapped lac production per meter was recorded to be highest on *Ziziphus* sp. Laboratory study on crawler emergence from matured female cell was also recorded to be highest on *F. semialata* (129 crawlers) followed by *Ziziphus* sp. (127.3), *F. macrophylla* (50.66 crawlers) and *F. strabilifera* (26.66 crawlers). No crawler emerged from the cell which were collected from *F. religiosa*. In case of *C. cajan*, lac insect died few days after sexual differentiation. From the above it could be concluded that *F. semialata* and

*Ziziphus* sp. are suitable host for cultivation of the exotic race (AAUK-03) in the climatic condition of Jorhat.

The local race (AAUK-06) was studied on two host plant (*viz.*, *F. semialata* and *F. macrophylla*). It was observed that *F. semialata* was much better as compared to *F. macrophylla* all in terms of brood lac, *phunki* lac and scrapped lac yield. Crawler emergence from mature lac cell of *F. semialata* was 164.8 crawler while no crawler emerged from the cell which were collected from *F. macrophylla*.

The comparison between AAUK-06 and AAUK-03 (Table 1) on *F. semialata* revealed that the local strain (AAUK-06) was better than AAUK-03. Brood lac ratio (Output/Input), brood lac-scrapped lac ratio was 3.76 and 3.85, respectively for AAUK-03 which was almost twice in case of AAUK-06 (6.60 and 6.05, respectively). Broodlac, *phunki* lac and scrapped lac weight per meter branch length was also recorded higher in the local race.

**Table 13 : Comparison between AAUK-06 and AAUK-03 on *F. Semialata***

Parameters		AAUK-06			AAUK-03		
		Lower	Middle	upper	Lower	Middle	upper
Initial density settlement (No/cm <sup>2</sup> )		103.50	95.50	97.50	98.20	92.40	89.60
Density after 21 days (No/cm <sup>2</sup> )		86.50	83.00	72.50	90.00	85.80	80.60
Initial mortality (No/cm <sup>2</sup> ) (21 days after inoculation)		17.00	12.50	25.00	8.20	6.60	9.00
Initial mortality percentage		16.16	13.19	25.96	8.35	7.14	10.04
Male		9.50	6.50	6.00	9.60	8.80	7.60
Female		15.50	12.00	15.00	15.40	14.00	12.80
Sex Ratio (%)		38.31	35.15	28.71	38.38	38.69	37.17
Survival at maturity (No/cm <sup>2</sup> )		8.50	7.00	7.00	5.80	5.50	5.20
Size of lac insect cell (mm)		4.37			4.54		
Weight (g)		0.08			0.068		
Crawler emergence from one matured female cell		164.8			129		
Inoculated Brood Lac (Kg)		0.100			3.90		
Brood lac yield at harvest (Kg)		0.660			14.675		
Brood lac ratio Output/Input		6.6			3.76		
Brood lac-scrapped lac ratio		6.05			3.85		
Weight of one meter	Broodlac	0.162			0.141		
	Phunki lac	0.141			0.115		
	Scrapped lac	0.06			0.04		
	Wood weight after harvest	0.07			0.07		



### Insects associated with lac encrustation

Three hymenopteran parasitoids emerged from laboratory stored lac encrustation and were identified as *Apanteles sp.*, *Eupelmus tachardiae* and *Eurytoma pallidiscapus* (Fig. 110 a to c) and the remaining one coleopteran predator were sent to IARI, New Delhi, for identification. *Oryzaephilus surinamensis* (Fig. 110 d) was also found to be associated with stored lac.

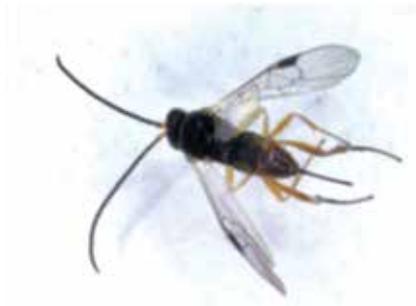


Fig. 110 a : *Apanteles sp.*



Fig. 110 b : *Eupelmus tachardiae*



Fig. 110 c : *Eurytoma pallidiscapus*



Fig. 110 d : *Oryzaephilus surinamensis*

### 2.3 Central Agricultural University (CAU), Imphal Survey at Arunachal Pradesh and Mizoram

A survey on lac insect was conducted during February and March 2017 in the state of Arunachal Pradesh and Mizoram covering more than 4 districts of each state. In both the state many potential host plants like *Malvaviscus*, *Ficus*, *Ber*, *Arhar* were found abundantly but none of the host plants were infested by lac insect. The lac insect was found infested only on the litchi plant in both the state.

#### Ant nest encrustation on lac

Thorough studies for identification of factors which control ant nest encrustation on lac were done at different location of Manipur. Observations were done on 20 host plants in different locations (10 *Malvaviscus penduliflorus*, 5 *Flemingia macrophylla*, 3 *Ficus religiosa* and 2 *Mallotus phillipensis*). Observations were made in two factors i.e micro-climate and ant species. Many ant species were seen visiting over lac encrustation in all the host plants but not all the ant visiting over the lac encrustation built their nest. The ant, *Crematogaster sp* was the only ant species which built their protective shelter (ant nest) over the lac encrustation. Among the host plants including *Malvaviscus sp*, the ant nest were built only in the host plant that were visited by *Crematogaster sp* of ant. No micro-climate has caused any affects in the ant nest covering over the lac encrustation. Out of 10 observed lac encrustation in *Malvaviscus* plant only six plants which were visited by *Crematogaster* ant species are covered with ant nest over lac encrustation (Fig. 111 a). In case of *Flemingia macrophylla* out of 5 observed sample only 2 sample having lac inset were visited by the *Crematogaster* species and built their nest over lac encrustation (Fig. 111 b). No ant nest over lac encrustation was seen in *Ficus religiosa* and *Mallotus phillipensis* due to non visiting of *Crematogaster* ant species.



Fig. 111 a. *Crematogaster* ant nest over lac encrustation in *F. macrophylla*



Fig. 111 b. *Crematogaster sp.* of ant visiting Lac insect on *Malvaviscus* plant

### Insect- pest complex of *Flemingia sp.*

A study of insect- pest complex of *Flemingia sp.* has been done in the research field (Table 14)

**Table 14 : Insect infesting the *Flemingia* recorded during January to December 2017**

Pest	Common Name	Order	Family	Destructive stage	Plant part affected
<i>Aphis craccivora</i>	Cow pea aphid	Hemiptera	Aphididae	Nymph & Adult	Suck the sell sap of leaves and stem
<i>Orgyia sp.</i>	Yellow tussock moth	Lepidoptera	Lymantriidae	Larva	Leaves
<i>Aristobia appomixitor</i>	Long horned beetle	Coleoptera	Cerambycidae	Adult & larva	Leaves & Stem
<i>Archips sp.</i>	Tortrix moth	Lepidoptera	Tortricidae	Larva	Leaves
<i>Stauropus alternus</i>	Lobster moth	Lepidoptera	Notodontidae	Larva	Leaves
<i>Plannococcus sp.</i>	Mealy bug	Hemiptera	Pseudococcidae	Nymph & Adult	Leaves & Stem

### Awareness Programme

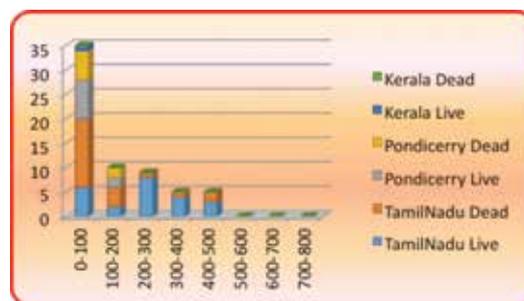
Two days awareness programme on ‘Importance of Lac Insect and its Cultivation’ were successfully organised on 14<sup>th</sup> and 15<sup>th</sup> July 2017 at College of Agriculture, Central Agricultural University, Imphal. More than 20 farmers and students participated in the awareness programme (Fig. 112). A field visit programme in the project site of Lamsang was also included during the awareness programme.



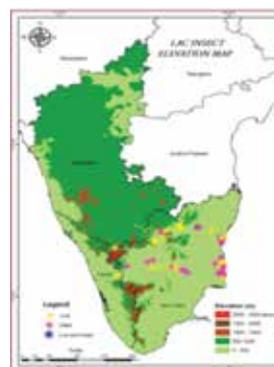
**Fig. 112 :** Awareness programme at College of Agriculture, Central Agricultural University, Imphal during 14<sup>th</sup> and 15<sup>th</sup> July 2017

### 2.4 Kerala Forest Research Institute (KFRI), Thrissur Survey

Survey was conducted in parts of Kerala, Tamil Nadu, Karnataka and Union Territory of Pondicherry. A total of 6,494 host plants of lac were observed in a total distance of 2019 kilometers during 2016-2017. Lac was observed at 65 locations of which 33 were live and 32, dead. Elevation map of lac distribution South India was created and shown elevation wise distribution of lac (Fig. 113 a & b).



**Fig. 113 a :** Graph showing the state and elevation wise distribution of lac



**Fig. 113 b :** Elevation map of lac distribution in South India



### Lac survey in Kerala

Palakkad, Ernakulam, Kottayam and Pathanamthitta districts were surveyed during the study period (Fig. 114). *Albizia saman* and *Ficus religiosa* were found as the host plants of lac in these districts. Lac recorded on *Albizia saman* from Vadavannur (Palakkad) showed two months of growth. Brood lac was collected in the month of June. Other districts were reported with the absence of lac.

### Lac survey in Karnataka

Dakshina Kannada, Uduppi, Shivamogga and Uttara Kannada of Karnataka State were surveyed in the month of October 2017 (Fig. 115). A total of 1,499 lac insect host plants were observed but lac insect was absent.

### Lac survey in Tamil Nadu

Erode, Tirupur, Karur, Thiruchirappilly, Thiruvarur, Thanjavur, Nagapattinam, Cuddalore, Dharumapuri, Krishnagiri, Salem, Thiruvannamalai, Villupuram and Nagapattinam districts were surveyed (Fig. 116) and lac was recorded from 46 locations, out of which 22 sites had live lac and 24 sites had dead lac. *Albizia saman* and *Albizia lebbekwere* the host plants of lac at Erode. From *Tirupur*, lac was recorded from the host plants; *Albizia saman*, *Ficus religiosa* and *Ficus bengalensis*. For the rest of the sites, lac was recorded from *Albizia saman* only.

### Lac survey in Pondicherry

A total of 1961 lac host trees were observed in a total distance of 181 km. Twenty one sites were recorded with the presence of lac in Puducherry and Karaikkal of Pondicherry Union Territory (8 from Karaikkal and 13 from Pondicherry) (Fig. 117 & 118). *Albizia saman* was observed as host plant for these locations except for *Nellithoppe* of Pondicherry where the lac was collected from *Ficus religiosa*. In Karaikkal district, of the 8 lac reported sites, four were dead and in Pondicherry district, of 13 lac reported sites, 8 were found dead



Fig. 115 : Survey Map of Karnataka State

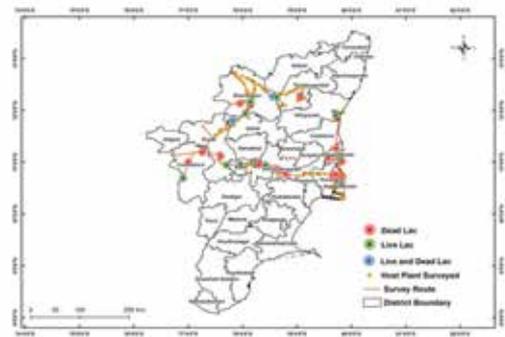


Fig. 116 : Locations recorded with live and dead lac in Tamil Nadu



Fig. 117 : Locations recorded with live and dead lac in Karaikkal

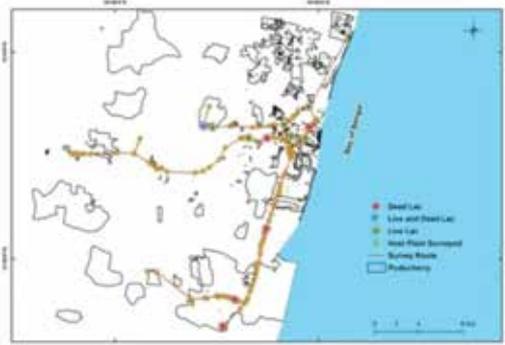


Fig. 118 : Locations recorded with live and dead lac in Pondicherry

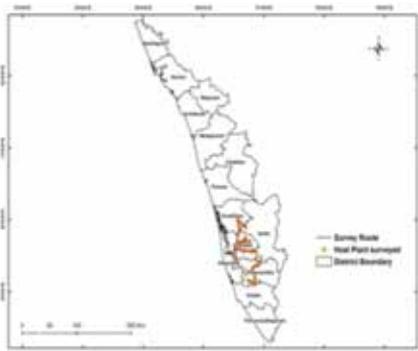


Fig. 114 : Survey Map of Kerala State





### Extension work in Farmer's plot

As a pioneer step, 25 plants of *Flemingia semialata* was supplied to 5 farmers who showed keen interest on lac cultivation and they planted it on their plots along with other crops. By mid-November live matured lac collected from Puliampatti of Tamil Nadu was inoculated in these host plants. To avoid insect pest attack the branches were covered with net, on which the lac insect got settled. In April 2017, mature lac was collected from three farmer's plot and the broodlac was reinoculated on remaining host plants. The emerged crawlers were found to be settled well. After one month all lac insect died due to unknown reason/s. The plants were pruned about 4 centimeters from the ground level for next cultivation.

### Insect and other pest complex of lac host plant *Flemingia*

During the summer period (March-May), the major pest recorded in *Flemingia* was a stem borer, *Sinoxylon anale* which belongs to Bostrichidae family of order Coleoptera. It was observed in three of five places where *Flemingia* was planted – in the farmers plot at Kandanasserry (Thrissur), in KFRI campus and at Kottappara (Ernakulam) where gene bank for lac host plants were set up. Many holes were observed in the stem of the infected plant and insect debris was found near to the holes. Sap suckers of *Flemingia* sp. were mainly recorded during summer season. A total of 9 species belonging to 9 families and 2 orders were identified. Among them high abundance was shown by *Megacopta* sp. *Leptocoriza oratorius*, *Trialeurodes vaporariorum*, *Icerya* sp. and Mealy bug (Table 15 & 16).

**Table 15 : Population of sap suckers on *Flemingia* sp.**

S.No.	Order	Family	Pest Species	Mode of Damage	No. of Insects (in 170 plants)
1	Hemiptera	Plataspidae	<i>Megacopta</i> sp.	Sapsucker	35
2	Hemiptera	Alydidae	<i>Leptocoriza oratorius</i>	Sapsucker	59
3	Hemiptera	Membracidae	<i>Leptocentrus taurus</i>	Sapsucker	2
4	Hemiptera	Aleyrodidae	<i>Trialeurodes vaporariorum</i>	Sapsucker	50
5	Hemiptera	Cercopidae	Spittle bug	Sapsucker	5
6	Hemiptera	Pseudococcidae	Mealy bug	Sapsucker	22
7	Hemiptera	Margarodidae	<i>Icerya</i> sp.	Sapsucker	52
8	Hemiptera	Pyrrhocoridae	<i>Dysdercus cingulatus</i>	Sapsucker	13
9	Coleoptera	Elateridae	Click beetle	Sapsucker	14

**Table 16 : Abundance of defoliators on *Flemingia* sp.**

S. No.	Pest Species	No. recorded in 170 plants during one month period
1	<i>Dasychira Olene mendosa</i>	8
2	<i>Euproctis</i> sp. 1	3
3	<i>Euproctis</i> sp. 2	35
4	<i>Hyposidra talaca successaria</i>	13
5	Unidentified sp.	28
6	Unidentified sp.	2
7	Unidentified sp.	3



S. No.	Pest Species	No. recorded in 170 plants during one month period
8	<i>Hypena reactivittalis</i>	52
9	<i>Hyblaea puera</i>	40
10	<i>Asota caricae</i>	43
11	<i>Bagworm</i>	1
12	<i>Lecithocer sp.</i>	5
13	<i>Myllocerus sp.</i>	25
14	<i>Unidentified sp.</i>	46
15	<i>Neothacris acuticeps</i>	7

### Fungi infestation on live lac

The collected live lac sample from Mettur dam was found to be infested with four different kinds of fungi, identified as *Penicillium sp.*, *Fusarium sp.*, *Cladosporium* and *Aspergillus sp.* Daily observations were noted on live lac stick by keeping it in a plastic jar to check the emergence of pests. Another fungus infestation was found in KFRI lac insect gene bank and identified as *Aureobasidium sp.*

### Biological parameters

#### Productivity linked parameters of lac insect from

### Madurai sample

Mature broodlac collected from the host plant *Albizia saman* from Madurai, Tamil Nadu during the month of December 2016 was inoculated in the host plant *Flemingia semialata* in KFRI campus. Five grams of brood lac was inoculated in *F. semialata* in ten pots, of which five plants were selected for productivity studies. Observations on initial density of settlement (Number of insects per sq.cm), and initial mortality were taken from these five plants. The mature lac insect collected from Madurai was inoculated in *F. semialata* in 20 pots of which 10 plants were taken to check biological parameters (Table 17).

**Table 17 : Productivity linked parameters of lac insect (Madurai sample) inoculated in *F. semialata***

Sample	Part	Initial density settlement	Initial mortality	Sex ratio (%of male)	Survival at maturity	Broodlac yield at Harvest (g)	No.of <i>Eublemma</i> collected	Life period (days)
A	Upper	70	21.42	64.7	4	90.82	3	180
	Middle	68	7.705	78.04	4			180
	Lower	66	17.51	56.25	2			180
B	Upper	83	21.55	54.9	3	123.054	0	178
	Middle	68	16.52	54.28	5			178
	Lower	78	16.46	52.08	4			178
C	Upper	93	38.16	58.82	2	94.84	2	179
	Middle	73	9.98	67.39	3			179
	Lower	71	18.88	43.24	5			179
D	Upper	116	55.65	60	6	57.15	12	181
	Middle	63	15.38	63.33	4			181
	Lower	95	44.47	58.33	3			181
E	Upper	96	56.41	57.89	2	63.25	4	180
	Middle	78	11.33	53.84	4			180
	Lower	92	48.52	62.5	5			180



## 2.5 Maharana Pratap University of Agriculture & Technology (MPUAT), Udaipur

### Survey of lac insects and its host plants in different parts of arid western plain region of the country

Since the inception of the project total 71 districts out of 88 have been surveyed in the three states viz. Haryana, Rajasthan, Gujarat of arid western plain region of the country. A total of 121 locations have been identified and recorded for the preference of lac insect on different hosts in the region during 2017. A number of surveys were conducted during January, 2017 to December, 2017 to identify the various host plants prevailing in the Udaipur region and to locate the presence of lac insect genetic resources in the region. The observations on different parameters of host plants were recorded as per the passport data sheet of host plants. The host plants were thoroughly surveyed and noticed for the presence of lac insects, their stage, intensity, presence of predators if any and observations were recorded for the parameters of lac insect as per passport data sheet.

The survey was conducted in 18 villages and nearby area of Udaipur region, in which 80 different location were covered (Fig. 119) and it was observed that the *Palas* (*Butea monosperma* Lam.) *Ber* (*Zizyphus mauritiana* Lam. and *Z. jujube* Lam.), *Pipal* (*Ficus religiosa* Linn.), *Paras pipal* (*Ficus benjamina* Linn.) *Caliandra* (*Caliandra* spp), *Siris* (*Albizia lebbek* Denth.), Custard Apple (*Annona squamosa* Linn.), *Khair* (*Acacia Catechu* Willd.), *Arhar* (*Cajanus cajan* Linn.), *Gular* (*Ficus racemosa* Linn.), *Babool* (*Acacia arabica* Willd.), *Amaltas* (*Cassia fistula* Linn.) and *Bargad* (*Ficus bengalensis* Linn.) were found frequently prevailing as major lac insect host plants in the Udaipur region. It was also observed that at almost all locations only *Rangeeni* strain was found growing well on these natural hosts. In the majority of Udaipur region the *pipal*, *ber*, *kikar* and *babool* were found in higher number as compared to other hosts.



Fig. 119 : Survey and collection of broodlac from various available host of the region

### Collection and conservation of lac insect under ex-situ conditions

The samples of brood lac sticks bearing mature female

lac insects were collected from the various areas surveyed and were inoculated on the *arhar*, *palas*, *Flemingia* and *ber* available in the lac garden, Department of Entomology during *Katki* and *Baisakhi* season. The total 893.5 kg brood lac sticks of mature live lac insects were collected from 82 locations during April-July and October-November, 2017 and were maintained on *arhar*, *palas*, *Flemingia* spp. and *ber* at lac insect gene bank under development for each location. Also the *ber* plantation at horticulture farm were pruned and utilized for conservation of lac insect genetic resources. A total 10 trees were used for the conservation of lac insect.

### Conservation of lac insect under in situ conditions

For the conservation of insect under *in situ* conditions, the different locations at farmers field where host plants were available was identified. The brood lac sticks bearing mature female lac insects were collected from the various host plant from Udaipur region during *katki* and *baisakhi* season and were inoculated on the *ber*, *seetafal* and *palas* on farmers' field. The *in situ* conservation was undertaken on six different locations of farmers' field viz. Mavli, Barwada, Talai-Jhadol, Bhilwara, Prema Khara-Bhopal Sagar and Kolyari-Jhadol on 507 different host trees (Fig. 120).



Fig. 120 : Activities of *in situ* conservation of lac insect at Barwada during *Katki* 2017

### Studies on productivity linked parameters of *rangeeni* strain of lac insect

Studies on biology and productivity-linked parameters of lac insect on pigeon pea and its natural enemies were carried out in the lac insect gene bank cum garden with an aim to study duration of pre-sexual stages (days), duration of male emergence (days), sex ratio (per cent male insect) and life period of female lac insect (days) on pigeonpea and to evaluate initial and final density of settlement (crawlers per sq. cm), initial mortality (%), density at crop maturity (number of female cells per sq. cm), fecundity (larvae per female cell), weight of female cell and resin (mg) and yield (g) of lac insect and to record the natural enemies (parasitoids and predators) of lac insect.

The mean duration of pre-sexual stages lasts 48.36 days from the inoculation of broodlac with 11.50 days mean duration of male emergence and 11.33, 7.33, 4.02; 17.75, 10.63, 6.23 and 17.75, 11.73, 11.56 per cent male in lower, middle and upper portion of plant in three plots respectively. The total life period of *Rangeeni* strain of lac insect in *Katki* crop season on pigeon pea recorded was 117 days.

The initial density of settlement of first instar crawlers on a plant varied in different parts of plant which ranged from 20-121 crawlers per sq.cm and with a mean initial density of settlement of 92.60, 84.10, 60.00; 86.70, 91.60, 71.00 and 67.40, 64.70, 61.00 crawlers per sq. cm at lower, middle and upper parts of plants in three plots respectively and the per cent mortality ranged from 6.46-12.58 per cent. The mean final density of settlement first instar crawlers ranged from 17-114 crawlers per sq. cm with mean of 85.50, 78.20, 53.10; 80.20, 85.90, 65.00 and 61.90, 57.30, 54.60 crawlers sq. cm on lower, middle and upper portion of plant in three plots respectively. The density of female cells during maturity ranged from 01-11 cells per sq. cm and the fecundity recorded for single female cell was 95-430 larvae per cell. The cell and resin weight ranged from 6-24 mg per cell, 4-19 mg per cell, respectively while mean sticklac and scrappedlac yield recorded were 235g per plant, 15.63 g per plant respectively

### Establishment of Lac Museum cum Laboratory at the Center

A well developed Lac Museum-cum-Laboratory has been established at the department of Entomology, RCA, MPUAT, Udaipur. Posters on lac cultivation, host plants, lac insect life cycle, its uses, different lac products

and other activities of project has been displayed, Besides live and preserved samples, lac sticks of different hosts and herbarium has also been kept. All literature developed by the Centre and photographs of ongoing activities are also displayed in Museum. All necessary facilities needed for the carrying out the research activities has been developed as lac laboratory at center. The complete information on lac insect life cycle, its life pattern, its cultivation, and processes is illustrated by means of glow sign board in the museum.

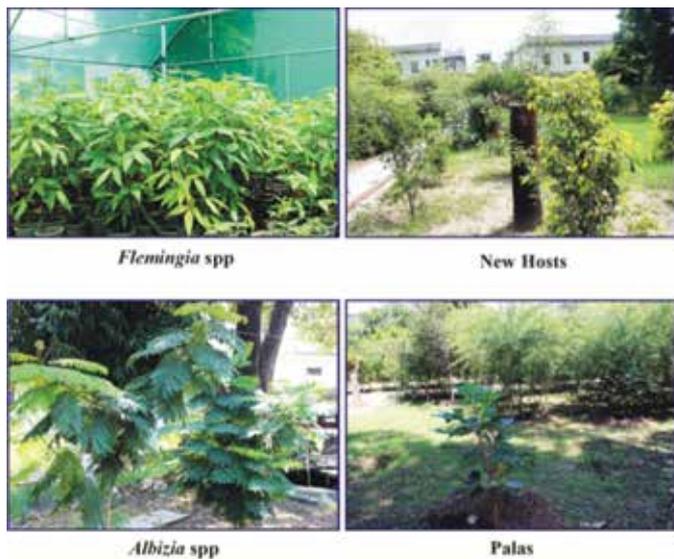
The Museum-cum-Laboratory was inaugurated on 09-5-2017 by Hon'ble Vice-Chancellor Prof. U. S. Sharma. He visited museum as well as gene bank and appreciated the project work and ICAR-IINRG, Ranchi for providing support (Fig. 121).

### Establishment of lac gene bank for conservation of the biodiversity of local lac insect species

The lac Insect gene bank for ex situ conservation of lac insect biodiversity of the region is well developed with a green house at Department of Entomology, RCA, MPUAT, Udaipur (Fig. 122). The lac host arhar and ber has been raised and inoculated with the lac insects collected from surveyed regions.



**Fig. 121 :** Inauguration of Museum-cum-Laboratory by Hon'ble Vice-Chancellor, MPUAT, Udaipur



**Fig. 122 :** Lac gene bank for conservation of the lac insect biodiversity

**Mass awareness among farmers for adoption and conservation of lac insect genetic resources**

Two trainings were conducted at Talai village for farmer’s awareness about lac insect and lac cultivation. 56 farmers attained training during 2017-18 (Fig. 123).



**Fig. 123 :** Farmers training on lac cultivation at Talai-Jhadol

**2.6 Punjab Agricultural University (PAU), Ludhiana**

**A. In situ conservation**

**Punjab:** All the districts of Punjab have been covered for the survey of lac insect and its host plant. During survey following inferences have drawn:

- ❖ Most of the lac insect infestation was on wild *Z. mauritiana* and the intensity of its population was low to heavy. Other host plants of lac insect recorded are *peepal* (*F. religiosa*), *kikar* (*Acacia nilotica*) and *siris* (*Albizia sp.*). No lac insect infestation found as there was very few host trees located in the districts of Gurdaspur, Jalandhar, Pathankot, Rupnagar, Sahibzada Ajit Singh Nagar and Shaheed Bhagat Singh Nagar. In Amritsar and Mansa, number of wild trees of *Z. mauritiana*

was observed, however, there was no infestation of lac insect. Moderate to heavy infestation was on *Z. mauritiana* in most of the districts of Punjab and order of infestation was Ferozepur > Ludhiana > Sangrur > Patiala > Faridkot > Barnala > Muktsar > Bathinda > Moga > Fatehgarh Sahib > Kapurthala > Hoshiarpur > Tarn Taran (Table 18). There was low to heavy infestation of lac insect on *kikar*, *A. nilotica* from four locations in Nihalewal (Barnala), Matwani (Ludhiana), Samalsar (Moga) and Malout (Muktsar). There was heavy infestation of lac insect on *peepal*, *F. religiosa* from three locations Alam Ke (Ferozepur), Ghagga (Patiala) and Mauran (Sangrur). Heavy infestation of lac insect was found on new host plant, *Siris*, *Albizia spp* from Moga city (Fig. 124).

**Table 18 : Status of population of lac insect on *Z. mauritiana* collected in different districts of Punjab during 2017**

Districts	Number of locations in which lac insect population			
	Nil	Low	Moderate	Heavy
Amritsar	4	-	-	-
Barnala	1	-	1	4
Bathinda	-	-	1	3
Faridkot	2	-	1	5
Fatehgarh Sahib	1	-	1	2
Ferozepur	6	3	2	7
Kapurthala	-	-	1	-
Hoshiarpur	-	-	1	-
Ludhiana	4	-	1	5
Mansa	2	-	-	-
Moga	4	2	1	2
Muktsar	1	1	-	4
Patiala	5	3	3	4
Sangrur	2	1	-	5
Tarn Taran	8	-	1	-

**Delhi NCR :**

- ❖ *Beri*, *Z. mauritiana* growing wild on road side in



the interiors of Delhi, was the main host plant on which there was low to moderate infestation of lac insect. There was heavy infestation of lac insect on *peepal*, *F. religiosa* at few spots in Delhi.

### Uttar Pradesh :

- ❖ Five host plants *peepal*, *F. religiosa*, *beri*, *Z. mauritiana*, *bargad*, *F. benghalensis*, *pilkhan*, *F.virens* and *gular*, *F. racemosa* were recorded to harbor lac insect infestations in this state. Lac insect population ranging between moderate to heavy were recorded throughout the state. *Peepal* (*F. religiosa*) was found to be major host plant on which heavy lac populations were recorded. *Pilkhan* (*F. virens*) harbored huge population of lac insect at many locations. *Z. mauritiana* harbored moderate to heavy infestation of lac insect. *Bargad* (*F. benghalensis*) and *Gular* (*F. racemosa*) had moderate to huge population of lac insect at few locations (Fig. 125).

### Haryana and Himachal Pradesh :

Moderate to huge population of lac insect was on *peepal* *F. religiosa* in Madhuban region of Haryana. Moderate infestation of lac insect was recorded on cultivated *Z. mauritiana* tree in village Damtal at the border of Pathankot district (Punjab) and Kangra district (Himachal Pradesh).

### Ex-situ conservation

The brood samples collected from different areas of Delhi, Haryana, Himachal Pradesh, Punjab and Uttar Pradesh were inoculated on arhar (*Cajanus cajan*), weeping fig *Ficus benzamina*; *peepal*, *Ficus religiosa* and *Flemingia semialata* grown in Lac Insect and Lac Host Park for *ex-situ* conservation at Entomological Research Farm, Punjab Agricultural University, Ludhiana.



Village - Dhanaula, District- Barnala, Punjab (N30018.323', E75029.568')(Beri)



Bus Stand Kotkapura, Faridkot, Punjab (N30034.002', E74049.409')(Beri)



Village - AlamKe, Ferozepur, Punjab (N30048.368', E74025.788')(Peepal)



Moga City, Punjab (N30049.164', E75012.389')(Sareen)

**Fig. 124 :** Lac insect infestation on different hosts from different locations in Punjab during 2017



**Fig. 125 :** Lac insect infestation on Gular in Uttar Pradesh



## 2.7 Prof. Jayshankar Telangana State Agricultural University (PJTSAU), Hyderabad

**Raising of *Flemingia Sp.*** : The seeds of *Flemingia macrophylla* and *F. semialata* were sown on the nursery beds in the month of August 2017. The nursery beds were prepared by mixing the soil with FYM and 10 per cent Chlorpyrifos 20EC. Daily irrigation and weeding at frequent intervals was done. The nursery plants were then transplanted in already prepared field and the earthen pots during the month of December 2017 for the *ex-situ* conservation of lac insect at Lac Insect and Lac Host Park, AICRP on Biological Control, Professor Jayashankar Telangana State Agricultural University (PJTSAU), Hyderabad.

**Raising of pigeon pea, *Cajanus cajan* (Arhar)** : Seeds of pigeon pea were procured from Seed Research & Technology Centre (SRTC), PJTSAU, Hyderabad. The crop was sown during the second fortnight of July 2017 for the *ex-situ* conservation of lac insect at Lac Insect and Lac Host Park, AICRP on Biological Control, PJTSAU, Hyderabad. All recommended agronomic and cultural practices have been followed for the cultivation of pigeon pea according to the Package of Practices of PJTSAU.

**Planting of Lac Host Trees** : Various host plants such as Ber (*Z. mauritiana*), Shisam (*Dalbergia sissoo*), Palas (*Butea monosperma*), Peepal (*Ficus religiosa*) and Tumma (*Acacia nilotica*) have been planted in Lac Insect and Lac Host Park, AICRP on Biological Control, PJTSAU, Hyderabad. The seedlings of these plants were procured from Department of Horticulture, Govt. of Telangana. All the recommended agronomic and cultural practices have been followed for the plantation of these host plants in the park. These trees are being regularly maintained for their demonstration as lac insect host plants.

**Ex situ Conservation** : The brood lac sticks collected from different places were inoculated on *Flemingia* spp, *C. cajan*, *A. nilotica* and *F. religiosa* plants at Lac Insect and Lac Host Park, AICRP on Biological Control, PJTSAU, Hyderabad for *ex-situ* conservation. These plants are being monitored regularly for the emergence of nymphs and their establishment on new plants.

### In situ conservation

In addition to the old places visited previous year, during July – December 2017, some new places were also visited where live population of lac insect was recorded.

All these places along with host plants were marked for in situ conservation and these areas will be visited in the next season to check the status of lac insect. The detailed area wise scenario of lac insects and their host plants is enumerated as under.

### Telangana

All the thirty one districts of Telanganawere surveyed during the year for the identification of host plants, collection of lac insect and recording of its availability on possible host plants (Fig. 126)

**Adilabad:** Huge infestation was observed on trees of *Peltophorum pterocarpum* and *Albizia saman* at Adilabad rural (78.534137°E, 19.658252°N) and Nirmal Town (78.343074°E, 19.092705°N), predominantly occurs in the urban area.

**Mahabubnagar:** Moderate to huge infestation was observed on wild species of *Ficus bengalensis*, *F. religiosa* and *F. hipsida*. In the village of Misigandi (78.30928 E, 16.57243 N) nearby temple huge infestation of lac was observed on *F. religiosa* when compared to other spp.

**Hyderabad:** This urban area is having huge plantation of *Peltophorum pterocarpum* and *Albizia saman* by roadside. Most of these plants were infested with Lac insect. The areas where the infestation was huge are, Ravindra bharathi, Nampally (78.28144 E, 17.241065 N), Gandhi nagar (78.29283 E, 17.25750 N), Masab Tank (78.265985 E, 17.235656 N), Ashok Nagar (78°49'08.97"E, 17°40'64.78"N), Chandravihar Complex, Nampally (78.282422 E, 17.231052 N).

The moderate lac insect population was observed in the areas of Osmania University nearby hostel E location (78.31561 E, 17.24780 N), on *Ficus bengalensis*, Lac insect was also observed on bare tree (*Ziziphus spp.*), also observed at Law Hostel Osmania university- Law Hostel (78.31534 E, 17.24843 N), Lac infestation was observed on rain tree (*Albizia saman*), Osmania University Law Hostel (78.31550 E, 17.24852 N), Osmania University ECE department (78.31083 E, 17.24460 N), Osmania University UGC – HRDC (78.31508E, 17.24829 N), Gandhi nagar high infestation was found (78.29283 E, 17.25750 N), OU Hostel E (78.31561 E, 17.24780 N), Masab Tank (78.265985 E, 17.235656 N), Chandra vihar, Nampally, (78.282422 E, 17.231052 N), Musheerabad, Arabindo Ashram (78°30'4.89"E17°25'13.58"N), Musheerabad, Mosque (78°30'0.52"E, 17°25'15.17"N), Prasad's IMAX (78°27'56.61"E, 17°24'49.61"N), NTR Gardens (78°28'4.83"E, 17°24'50.74"N), Lac host plants such as *F. bengalensis*, *Zizipus spp*, *Albizia saman*, *Peltophorum*



*pterocarpum*, and *F. religiosa* were observed during the survey.

**Rangareddy:** Low to huge population of Lac insect was reported in many parts of this district. High infestation was found on *A. saman* at Gudi Malkapur major Lac insect infestation was observed during the field (78°26'19.14"E, 17°23'0.77"N), (78°26'19.71"E, 17°22'55.33") and Vanasthalipuram (78.35109 E, 17.201147 N), 2-4 location was recorded on *P. pterocarpum* most of the population's crawlers were reported from this area and almost all the host plants having huge lac infestation in this area.

Conducted survey other areas of Rangareddy district, namely Shankarpally, Gundlapally and Gandipet areas and LAC insect incidence was not recorded during the field visit.

**Nizamabad:** Survey was conducted in Nizamabad urban (78.093197° E, 18.673408° N) having Lac infestation moderate on *Albizia saman* also conducted a transit walk survey in surrounding area reserve forest, but Lac insect incidence was not found. Kamareddy region Basawapur village (78.415971° E, 18.152927° N) recorded huge population of Lac insect on *Albizia saman*

**Karimnagar:** Huge population of Lac insect is recorded on *Ficus religiosa* and *Albizia saman* at the roadside plantation in the Shabashpalle village (78°55'24.98"E, 18°26'3.12"N) and at temple of Bheemeshwaralayam in Vemulawada town (78°52'1.11"E, 18°28'8.82"N).



Vemulawada  
(78°52'1.11"E, 18°28'8.82"N)



Maisigandi  
(78.30928 E, 16.57243 N)



GudiMalkapur  
(78°26'19.14"E, 17°23'0.77"N)



Osmania University- Law Hostel  
(78.31534 E, 17.24843 N)

**Fig. 126 :** Prevalence of lac insect in different locations of Telangana State during 2017

## 2.8 Sher-e-Kashmir University of Agricultural Sciences and Technology (SKUAST), Jammu

### Conservation on natural hosts

**Outer plains of Jammu:** The success rates of survival on inoculated plants were 34.62, 66.67, 38.46 and 38.89 per cent on wild *Ber*, *Kikar*, *Ficus* and *palas*, respectively. The mean brood cell mortality in each host plant was recorded. It was found that for conservation, *Kikar* showed the lowest mortality (47.59) while it was highest on *Ber* plant (62.07). There is no denying the fact that *palas* and *Ficus* also supported brood maintenance to a desired level but the local prune these trees for fodder purpose thereby hampering conservation efforts. As *Kikar* is hardly pruned for local purpose, we are further exploring the possibility to use it for summer brood maintenance. Mean number of lac sticks per plant were recorded in *Kikar* (24.97/plant) followed by *Ber* (14.90/plant) and *Ficus* (11.13/plant) and least was in *palas* (9.39/plant).

**Mid Hills:** In comparison to plains, mid hills showed better potential as the brood cell mortality was lower in these areas. Mean survival of lac on inoculated plant was highest on wild *Ber* (62.50 per cent) followed by *Ficus* (52.78 per cent) and *Khair* (40.62 per cent). The mortality percentages were 59.38 per cent on *Khair*, followed by 47.22 per cent in *Ficus* spp. and least mortality was recorded in wild *Ber* (37.50 per cent) in mid hills. The mean number of lac sticks were recorded highest in wild *Ber* (35.14/plant) followed by *Khair* (29.32/plant) and *palas* (26.19/plant).

It was concluded that among the natural hosts of lac insect which include *Ber*, *Palas*, *Kikar*, *Pipal* etc. the least mortality was recorded in *Kikar* trees in plains during the summer season while in mid hills wild *Ber* with high canopy was found to be most suitable. Regarding *Baisakhi* Crop (October inoculated): The progress about lac insect settlement and growth was found to be satisfactory. However, during the second fortnight of December, 2017 the mortality of the lac cells increased subsequently.

### Establishment of Brood Farm at Vijaypur and Chatha

**Brood Farm at Chatha:** For the establishment of brood farm at Chatha, the site selected for nursery was cleaned in advance and the existing growth was uprooted. The whole area was then divided into sub-plots so that

plantation is effectively made. Seeds of *Flemingia* procured from IINRG were then sowed in the plots. The nursery of *Flemingia* raised in the nursery beds were then transplanted into field, where trials were laid down for the inoculation of brood lac.

**Brood farm at Vijaypur:** Plants raised in the nursery at Chatha were also transplanted to brood farm at Vijaypur in Samba District for the preparation of brood lac from where farmers can easily get the brood for the inoculation on Ber plants in their fields. Partial plants were inoculated by putting of collected sticks of brood lac (lac sticks containing gravid females) in the host twigs for allowing young lac larvae (crawlers) to come out of their mother cells and settle on the host plant

#### A. Artificial Inoculation for multiplication on ber and Kikar at Raya and Jammu region (Baisakhi lac)

Artificial inoculation was done for the multiplication of lac insect. Brood twigs were cut in size 20 - 30 cm in length. Then, the cut pieces of brood twig were tied to fresh tree twigs in such a way that each stick touches the tender branches of trees at several places. This was done on or pre pruned Ber (172 No.) and succulent branches of Kikar (117 No.) at university research station Raya and around the Jammu region where brood twigs were tied with the selected and tagged plants of Ber and Kikar. Out of the total plants inoculated, settlement was observed on about 70 per cent plants.

#### B. Parasitism

##### I. Mean number of parasitoids infested lac cell at 90 days after BLI

Two applications of Indoxacarb (0.5ml/l) significantly reduced the infestation of parasitoid infested lac cell on *Rangeeni* lac on ber over the control at 90 days after BLI. At 90 days after BLI the mean incidence of parasitoids was lowered from 1.80/2.5sq cm to 0.30/2.5sq cm. However, the parasitoid numbers varied from 13 to 30.

##### II. Mean number of predator and parasitoids infested lac cell at harvest per 30cm Sticklac

Pesticide applications significantly reduced the mean number predators/parasitoids infested lac cells at harvest. It was 36.33 in case of control and

was reduced to 23.61 in treated plants at harvest (Fig. 127).

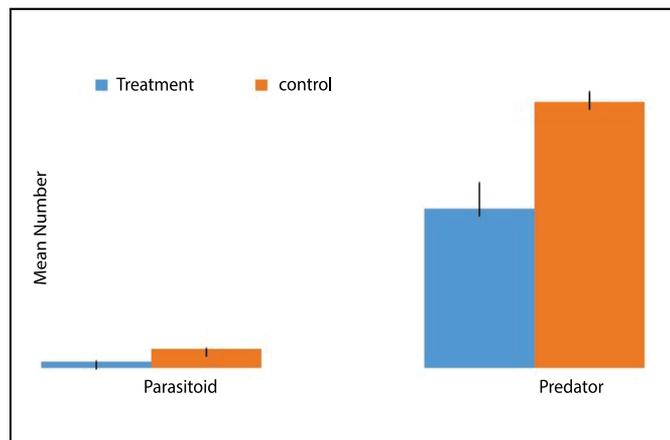


Fig. 127: Mean number of parasitoids and predators over control at harvest

#### On-farm trials and demonstrations of lac cultivation technologies

##### a. Trials at Research Farm, SKUAST-Jammu as well as at selected progressive growers

Two trials were conducted at Research Farm, SKUAST-Jammu and eleven trials at selected progressive grower's fields for the demonstration of lac cultivation technologies. Saplings of *F. semialata* and *F. macrophylla* and brood lac were distributed to the potential grower for conservation and multiplication. One hundred and three farmers were provided with brood lac. Forty three visits for continuous deliberations with the people of the areas were conducted regarding the presence of lac insect in the area and also information was given to them regarding lac cultivation and its value and uses. Informative pamphlets (564 No.) were also distributed among the participants. Eight interactive sessions were conducted for the farmers.

##### b. Training programmes

One day training programmes (4 No.) were conducted at Raya Station of SKUAST-Jammu in collaboration with IINRG, Ranchi. The farmers were briefed about the importance of lac insect and lac cultivation to the progressive growers of the region. Progressive growers were also informed about the monetary benefits of lac and how can they create their own livelihood while attaining lac cultivation on large scale. Near about thirty



five progressive growers actively participated in each training programme.

## 2.9 State Forest Research Institute (SFRI), Jabalpur Survey of the area for the lac insect and host plants

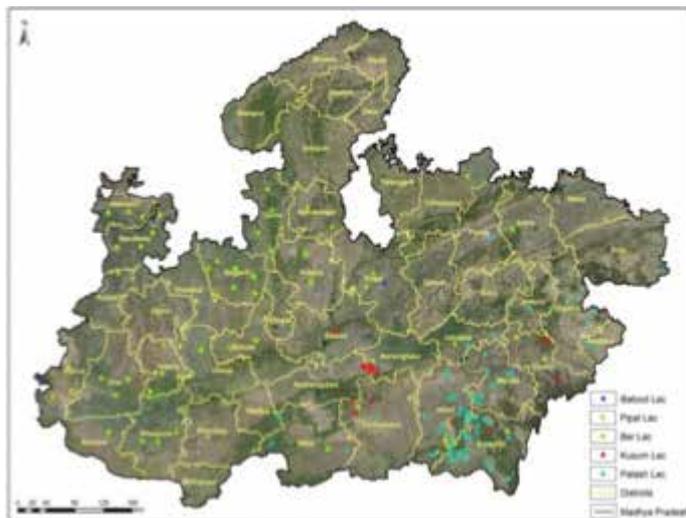
### Madhya Pradesh

Intensive survey was conducted block wise in Madhya Pradesh for lac insect and their host plants. Survey of lac insect and host plants was done 53 blocks of 09 districts have been surveyed but lac occurrence were found in 22 blocks of 08 districts in Madhya Pradesh. Lac insect species were occurring naturally in farm lands, revenue lands, and forest lands (Fig. 128). The information on lac insect/host plants during each field survey was recorded in passport data sheets and compiled.

### Maharashtra

Intensive survey was conducted in Maharashtra for lac insect and their host plants. Survey of lac insect and host plants was done 103 blocks of 17 districts had been surveyed but lac occurrence were found in 23 blocks of 14 districts in Maharashtra.

The following districts/blocks have been surveyed as shown in Fig. 129. Lac insect species occurred naturally in farm lands, revenue lands, and forest land insects found in following blocks. The information on lac insect/host plants during each field survey was recorded in passport data sheets and compiled.



**Fig. 128 :** Map showing the occurrence of the lac insect in different host plants of Eastern Madhya Pradesh which were surveyed



**Fig. 129 :** Map (GIS) showing the occurrence of lac insects Maharashtra which were surveyed

### Goa

Intensive survey was conducted in Goa for lac insect and their host plants. During the survey it was found that lac insect does not occur in this area but there were lac host plant species like Rain tree (*Albizia saman*), Akashmani (*Acacia auriculiformis*) and Ber (*Z. mauritiana*) occurring in abundance. In north Goa, Akashmani (*Acacia auriculiformis*) was found in abundance on road sides and revenue land. In case of south Goa, Rain tree (*Albizia saman*), Akashmani (*Acacia auriculiformis*) and Ber (*Z. mauritiana*) was found in abundance on road side and revenue land.

### Daman

Intensive survey was conducted in Daman for lac insect and their host plants. During the survey, lac insect occurrence was not found in this area but lac host plant Ber (*Z. mauritiana*) and Rain tree (*Albizia saman*) were found in abundance in Daman. Besides, other host trees were found such like that Pipal (*Ficus religiosa*), Bargad (*Ficus benghalensis*), Babool (*Acacia nilotica*), Akashmani (*Acacia auriculiformis*), sitaphal (*Annona squamosa*) and Jangli jalevi (*Pithecellobium dulce*).

### Identification of lac associated fauna in different parts of Madhya Pradesh

The study was carried out for the identification of predator, parasitoids, and hyperparasitoids insect associated with lac insect *Kerria lacca* in various blocks in Madhya Pradesh. Lac associated fauna were collected from parasitoids emergence from cage thereafter lac



associated fauna were separated and the numbers recorded based upon morphological identification character with the help of lac insect and associated fauna practical manual.

In the study 4 predators, 6 parasitoids and 7 hyperparasitoids were reported from *Kerria lacca* attacking culture in different parts of Madhya Pradesh.

*Eublemma amabilis* and *Pseudohypatopa pulverea* were found in most of the lac culture in various blocks of Madhya Pradesh both are reported to be most destructive on lac culture in lac abundant areas whereas *Tachardiaphagus tachardiae* and *Aprostocetus purpureus*

were reported from different parts of Madhya Pradesh both are abundantly present on lac culture.

This study was carried out in 24 sites of 16 blocks of 04 districts on *palas* lac (*rangeeni* crop) in eastern Madhya Pradesh. According to Table 19, there are 03 types of predator occurring in lac in which *Pseudohypatopa pulverea* was observed in the highest percentage (95.83%) in *palas* host plants. Whereas *Oryzaphilus surinamensis* was found the minimum percentage (8.33%) in samples and *Eublemma amabilis* was found 45% in the samples. The total study sites taken were 24.

**Table 19 : Lac associated fauna (*rangeeni* lac) in Eastern Madhya Pradesh**

Sl. No.	Predator	Occurrence sites	Total sites	Percentage (%)
1	<i>Eublemma amabilis</i>	11	24	45
2	<i>Pseudohypatopa pulverea</i>	23	24	95.83
3	<i>Oryzaphilus surinamensis</i>	02	24	8.33
<b>Parasitoids</b>				
4	<i>Aprostocetus purpureus</i>	12	24	50.00
5	<i>Tachardiaphagus tachardiae</i>	20	24	83.33
6	<i>Parechthrodryinus clavicornis</i>	07	24	29.16
7	<i>Eupelmus tachardiae</i>	04	24	16.66
8	<i>Coccophagus tschirchii</i>	01	24	4.16
9	<i>Erencyrtus dewitzi</i>	01	24	4.16
<b>Hyper parasitoids</b>				
10	<i>Elasmus claripennis</i>	01	24	4.16
11	<i>Eurytoma pallisiscapus</i>	05	24	20.83
12	<i>Brachymeria tachardiae</i>	04	24	16.66
13	<i>Apanteles sp.</i>	05	24	20.83
14	<i>Brocon greeni ashmead</i>	03	24	12.5
15	<i>Pristomerus sulci</i>	05	24	20.83

Six parasitoids were found in samples in which the highest occurrence was observed in (83.33%) *Tachardiaphagus tachardiae* while, minimum 4.16% in *Coccophagus tschirchii* and 4.16% in *Erencyrtus dewitzi*

as given in Table 20.

Six Hyperparasitoids were found of which the highest was in 20.83% in *Eurytoma pallisiscapus* Hyperparasitoids was noted as well as *Apanteles sp.*



**Table 20 : Lac associated fauna on *Pipal (rangeeni lac)* in Western Madhya Pradesh**

Sl. No.	Predator	Occurrence Sites	Total Sites	Percentage (%)
1	<i>Eublemma amabilis</i>	08	13	57.14
2	<i>Pseudohypatopa Pulverea</i>	05	13	35.71
3	<i>Oryzaphilus surinamensis</i>	01	13	7.14
<b>Parasitoids</b>				
4	<i>Aprostocetus purpureus</i>	05	13	25.00
5	<i>Tachardiaphagus tachardiae</i>	11	13	55.00
6	<i>Parechthrodryinus clavicornis</i>	-	13	
7	<i>Eupelmus tachardiae</i>	03	13	15.00
8	<i>Coccophagus tschirchii</i>	01	13	5.00
<b>Hyper parasitoids</b>				
9	<i>Elasmus claripennis</i>	-	13	
10	<i>Eurytoma pallisiscapus</i>	06	13	54.54
11	<i>Brachymeria tachardiae</i>	04	13	36.36
12	<i>Apanteles sp.</i>	-	13	
13	<i>Brocon greeni ashmead</i>	01	13	9.09
14	<i>Pristomerus sulci</i>	-	13	00.00

It can be perused from Table 20 that in western Madhya Pradesh, where study was carried out in 13 sites of 13 blocks of 07 districts of Madhya Pradesh on Pipal lac. The highest predator (*Eublemma amabilis*) 57.14% was observed in 08 out of 13 sites, whereas, the lowest population of predator (*Oryzaphilus surinamensis*) were 7.14% observed in 01 site of out of 13 sites.

In case of *rangeeni* crop of western Madhya Pradesh, *Tachardiaphagus tachardiae* parasite was noted to be the highest 55% in the study sites, while *Coccophagus tschirchii* was noted minimum 5%.

In the case of Hyperparasitoids, *Eurytoma pallisiscapus* was observed to be highest 54.54%, whereas *Brocon greeni* Ashmead was noted as lowest 9.09%.

It has been observed that in Eastern Madhya Pradesh, *rangeeni* lac is commercially cultivated abundantly on *palas* tree (*Butea monosperma*) whereas in western Madhya Pradesh, *rangeeni* lac is found in abundance on Pipal (*Ficus religiosa*) in natural condition.

Study undertaken on Eastern and western Mad-

hya Pradesh revealed that in case of Eastern Madhya Pradesh, Lac predator *Pseudohypatopa pulverea* was most destructive and found in higher number whereas in western Madhya Pradesh, *Eublemma amabilis* was found abundantly in mostly lac occurring sites.

Parasitoids *Tachardiaphagus tachardiae* are destructive parasitoids in both eastern and western Madhya Pradesh, *Aprostocetus purpureus* is the second abundantly distributed parasitoids found in both Eastern and western Madhya Pradesh

In Eastern Madhya Pradesh, 6 Hyper parasitoids were identified in which *Eurytoma pallisiscapus*, *Apanteles sp.* *Pristomerus sulci* were found occurring in study sites whereas in Western Madhya Pradesh only three hyper parasites occur in which *Eurytoma pallisiscapus*, *Brachymeria tachardiae* occur frequently.

#### **Pests of *Flemingia macrophylla* and *Flemingia semialata* at regional lac insect field gene bank**

Many pests damage leaves and seeds of *Flemingia macrophylla* and *Flemingia semialata*. This pest of *Flemingia*





*macrophylla* and *Flemingia semialata* were captured from potted plant at lac insect field gene bank thereafter pest of *Flemingia macrophylla* and *Flemingia semialata* were identified with the help of pictographic keys of insect identification (Table 21 & 22).

#### **Insect Pest Complex of *Flemingia macrophylla***

In Lac insect field gene bank (SFRI, Jabalpur) the occurrence of 16 phytophagous pests of *Flemingia macrophylla* plant. These pests were categorised as Defoliators (11

species), Sucking pest (3 species), and Seed sucker (2 species).

#### **Insect Pest Complex of *Flemingia semialata***

20 insect-pests were recorded during the year on *Flemingia semialata* plants

These pests were also categorised as Defoliators (14 species), Sap Sucking pest (5 species), and Seed sucker (1 species).

**Table 21 : Pests of *Flemingia macrophylla* at lac insect field gene bank**

Sl. No.	Pest	Common name	Order	Family	Affected part
<b>Defoliators</b>					
1	<i>Archips micaceana</i>	Totrix moth	Lepidoptera	Tortricidae	Leaves
2	<i>Calliteara pudibunda</i>	Pale tussock	Lepidoptera	Lymantriidae	Leaves
3	<i>Orgyia sp.</i>	Tussock moth	Lepidoptera	Erebidae	Leaves
4	<i>Epicallia villica</i>	Tiger caterpillar	Lepidoptera	Erebidae	Leaves
5	<i>Malacosoma neustria</i>	Lackey moth	Lepidoptera	Lesiocampidae	Leaves
6	<i>Monolepta signata</i>	Flea beetle	Coleoptera	Chrysomeloidea	Leaves
7	<i>Euproctis similis</i>	Schwan deu	Lepidoptera	Noctuidae	Leaves
8	<i>Somena scintillans</i>	Hairy caterpillar	Lepidoptera	Lymantriidae	Leaves
9	<i>Achyra rantalis</i>	garden webworm	Lepidoptera	Crambidae	Leaves
10	<i>Anarsia ephippias</i>	peach twig borer	Lepidoptera	Gelechiidae	Leaves
11	<i>Euonymus webworm</i>	Euonymus caterpillar/ Spindle ermine			
<b>Sucking Pest</b>					
1	<i>Plannococcus sp.</i>	Mealy bug	Hemiptera	Pseudococcidae	Stem and leave
2	<i>Halyomorpha halys</i>	Brown marmorated sting bug	Hemiptera	Pentatomidae	Stem and Leaves
3	<i>Oxyrachis sp.</i>	Cow bug tree hopper	Hemiptera	Membracidae	Leaves
<b>Seed suckers</b>					
1	<i>Aphis craccivora</i>	Black aphid	Lepidoptera	Aphididae	Seed
2	<i>Megacopta cribraria</i>	Sting bug	Hemiptera	Palaspidae	Seed



**Table 22 : Pest of *Flemingia semialata* at lac insect field gene bank**

Sl. No.	Pest	Common name	Order	Family	Affected Part
<b>Defoliators</b>					
1	<i>Dasychira mendosa</i>	Tussock moth	Lepidoptera	Lymantriidae	Leaves
2	<i>Hyposidra talaka</i>	Black looper/ Black inchworm	Lepidoptera	Geometridae	Leaves
3	<i>Uresiphita reversalis</i>	moth caterpillar	Lepidoptera	Crambidae	Leaves
4	<i>Archips epicyrta</i>	Bell moth/Tortrix moth	Lepidoptera	Tortricide	Leaves
5	<i>Hypena rectivallalis</i>	Lantana defoliators	Lepidoptera	Noctuidae	Leaves
6	<i>Argyroploce aprobola</i>	Leaf webber	Lepidoptera	Tortricide	Leaves
7	<i>Orgyia sp.</i>	Rust tussok	Lepidoptera	Lymantridae	Leaves
8	<i>Somena scintillans</i>	Hairy caterpillar	Lepidoptera	Lymantriidae	Leaves
9	<i>Aspidomorpha miliaris</i>	Tortoise shell beetle	Lepidoptera	Chrysomelidae	Leaves
10	<i>Hyphantria cunea</i>	Fall webworm	Lepidoptera	Arctiidae	Leaves
11	<i>Spodoptera litura</i>	Tobacco caterpillar	Lepidoptera	Noctuidae	Leaves
12	<i>Neoconocephalus incertus</i>	Cone head Katydid	Orthoptera	Tettigoniidae	Leaves
13	<i>Daphnis nerii</i>	Oleander hawk-moth or army green moth	Lepidoptera	Sphingidae	Leaves
14	<i>Choreutis pariana</i>	Apple leaf skeletonizer	Lepidoptera	Choreutidae	
<b>Sap Sucking pest</b>					
1	<i>Icerya aegyptiaca</i>	Douglas	Hemiptera	Margarodidae	Stem
2	<i>Plannococcus</i>	Mealy bug	Hemiptera	Pseudococcidae	Stem and leave
3	<i>Lawana conspersa</i>	White mouth cicada	Hemiptera	Flatidae	Leaves and Flower
<b>Seed suckers</b>					
1	<i>Malanagromyza obtusa</i>	Pod fly/bean pod fly	Diptera	Agromyzidae	seed

### Colour variation of lac insect in different parts of Madhya Pradesh

Lac insect colour variation was observed in 75 Blocks of 29 districts in Madhya Pradesh. Observation reveals that there are only 2 colours from study sites. These colours are crimson and yellow colour. In Madhya Pradesh, crimson lac insect have been reported from 55 sites while yellow lac in 19 sites. Pure yellow lac insects were found abundant in various sites in Dhar, Khandwa, Khargone, Badwani, Indore, Dewas, Alirajpur and Jhabua districts of western Madhya Pradesh. Crimson lac insect found abundantly in various sites of Seoni, Balaghat, Mandla,

Shahdol, Anuppur, Umaria, Dindori, Hoshangabad, Narsinghpur, Chhindwada, Betul, Rewa, Sidhi, Satna, Panna, Sagar, Jabalpur in eastern Madhya Pradesh. Mixed population yellow and crimson lac insects have been reported from Segaoon (Khargone), Sanwer (Indore) and some of Pipal trees in Alirajpur district.

### On-farm trials on lac cultivation technologies

- ❖ Brood lac samples were inoculated on Palas trees for the first time in village Madosa in Panna district and production was taken by samiti.
- ❖ Brood lac samples were inoculated on *palas* trees



in Banoda, Pali block in Umariya and production was taken, some brood lac were left on plants for next season.

- ❖ Brood lac samples were inoculated on *palas* trees in Chauri, block Shahdol and production was taken some brood lac was remained on plants for next season.
- ❖ Brood lac samples were inoculated on *kusum* trees in Nandiya, Pipariya in Hoshangabad district and production was undertaken in July 2018.

#### **Training of adopted/selected farmers in collaboration with ICAR-IINRG for *in situ* conservation**

- a. **Madosa, Panna:** The workshop comprised of 43 farmers from Madosa, Belhai, Silee Villages
- b. **Chouri, Shahdol:** The workshop comprised of 23 farmers from Chauri, Madi, Gagvahi, Vardhar, Nogai, Tukri Villages.
- c. **Banoda, Umariya:** The workshop comprised of 26 farmers from Banoda, Sarvakala, Parsauta Villages.
- d. **Nandia, Hoshangabad:** The workshop comprised of 25 farmers from Nandia Renikheda Villages and field staff of the Forest Department.
- e. **SFRI for Damoh farmers:** The workshop comprised of 15 farmers from Bagdari, Emlidol and Tendukhed of Damoh district with Forest Department.
- f. **Haldi, Shahdol:** The workshop comprised of 20 farmers from Devgai, Semra Saranpur, Kodwar, Hardi of Shahdol district, Lakhvaria Villages with Forest Department.
- g. **Sukhri, Niwas:** The workshop comprised of 17 farmers from Sukhri and Kharkhara Villages
- h. **Javaida, Mandla:** The workshop comprised of 23 farmers from Javaida and Paili Villages

## **Publications**

### **Research Papers in NAAS Journals:**

Hazarika LK, Das P, Mohanasundaram A, Saikia R and Islam Athar Nishat (2017). A comprehensive study on pest complex of *Flemingia* sp. from Jorhat, Assam, *J. Entomol. Zool. Stud.*, 5(4): 506-511.

Chetan Kalahal, Hemant Swami and Lekha 2017. Productivity-linked parameters of the *Rangeeni* strain Lac Insect, *Kerria lacca* (Kerr) on Pigeonpea, *Cajanus cajan* Linn. at Rajasthan. *Journal of Entomology and Zoology Studies*, 5(3): 1745-1751.

Hemant Swami, Chetan Kalahal, Lekha and Deepak Jain 2017. Biology of Rangeeni strain of lac insect (*Kerria lacca* Kerr.) on Pigeonpea (*C. Cajan* Linn.). *Journal of Entomology and Zoology Studies*, 5(5): 1648-1650.

Hemant Swami, Lekha, Virendra Singh and S.K. Sharma 2017. Studies on lac insect host biodiversity in arid western plains of India. *Trends in Biosciences*, 10 (46): 9464-9466.

Lac host plant diversity in Balaghat and Seoni districts of Madhya Pradesh. *Journal of Tropical forestry* 33 (1): 1-17

### **Popular Articles**

*La Khetir babe bagisa prostutkaron* - Assamese (2017), *Abaad*

*Lakh keet palan in Krishi expert*, May 2017.

*Lakh keet palan in Modern kheti*, June 2017.

*Dali todo, Lakh Kamavo*, Haldhar Times, Page no. 8

### **Folder**

Lac Insect (An Introduction)

### **Technical bulletin**

*Ber par Lakh ki Kheti* 2017



## Approved on-going Research Projects

S. No.	Project No.	Title of the Project	Principal Investigators
<b>Core Program – I : Productivity and Quality Improvement</b>			
1.	1.1.060	Collection, conservation, characterization and documentation of lac insect/host plant biodiversity (Phase - III)	Dr. VD Lohot
	Sub-Project	Comparative analysis of life table and population parameters of both <i>kusmi</i> and <i>rangeeni</i> strains of lac insect, <i>Kerria lacca</i> on three bushy host plants	Sri Asish Kumar Rout
2.	1.1.049	Integrated nutrient management and vegetative propagation technique for quick establishment of <i>Kusum</i> ( <i>Schleichera oleosa</i> (Lour.) Oken)	Dr. S Ghosal
3.	1.1.056	Development and evaluation of lac production practices for swadi palas for productivity and two bushy hosts- <i>arhar</i> and <i>semialata</i> for summer sustainability	Dr. J Ghosh
4.	1.1.064	Identification and cloning of putative key genes involved in terpene biosynthesis of the Indian lac insect, <i>Kerria lacca</i> (Kerr)	Dr. Thamilarasi K
5.	1.1.066	Morpho-physiological characterization vis-à-vis strategies to augment quality and storability of seeds of <i>Schleichera oleosa</i> under ambient condition	Dr. NK Sinha
<b>Core Program – II : Crop Production System Management</b>			
6.	1.1.047	Tritrophic interaction in lac ecosystem	Dr. A Mohanasundaram
7.	1.1.058	Lac Integrated Farming System-Phase II	Sri Asish Kumar Rout
8.	1.1.059	Effect of abiotic factors on lac associated fauna in <i>rangeeni</i> crops	Dr. A Mohanasundaram
<b>Core Program – III : Processing, Storage and Quality Management</b>			
9.	1.2.060	Development of pilot-plant of dewaxed decolourized lac (DDL) for training, demonstration and process refinement	Er. SK Pandey
10.	1.2.061	Control of deacetylation in gum <i>karaya</i> on storage for quality retention	Dr. S Srivastava
11.	1.2.066	Biodegradation studies on lac resin using soil burial method processing	Dr. MF Ansari
12.	1.2.070	Development of pilot plant of <i>guar</i> gum derivative for training and demonstration	Dr. SC Sharma





S. No.	Project No.	Title of the Project	Principal Investigators
<b>Core Program – IV : Value Addition, Application Development and Product Diversification</b>			
13.	1.2.062	Synthesis and evaluation of cross-linked <i>guar</i> gum hydrogels for application in bio-remediation and in agriculture	Sri N Thombare
14.	1.2.063	Green synthesis of silver nanoparticles capped in <i>acacia</i> and <i>jhingan</i> gum for bactericidal application	Dr. MZ Siddiqui
15.	1.2.065	Development of coating formulation for paper packaging materials	Dr. MF Ansari
16.	1.2.067	Modification of <i>guar</i> and <i>arabic</i> gum for potential use as dietary fibre	Dr. AR Chowdhury
17.	1.2.068	Natural gum based adsorbents for removal of heavy metals from water	Sri Mohd Ali
18.	1.2.069	Synthesis of natural gum based nanocomposite hydrogel for wound healing and water treatment	Dr. S Srivastava
19.	1.2.071	Synthesis of <i>guar</i> gum hydrogel-nanoparticle hybrid scaffold	Dr. SKS Yadav
<b>Core Program – V: Capacity Building of Farmers and Entrepreneurship Development</b>			
20.	1.3.052	Capacity building, skill development, extension education and information service on natural resins and gums	Dr. SKS Yadav
<b>Core Program – VI: Technology Evaluation, Refinement, Dissemination and Demonstration</b>			
21.	1.3.050	Information & Communication Technology (ICT) intervention on natural resins and gums knowledge dissemination system.	Dr. RK Yogi
22.	1.3.053	Market information support and impact assessment of technological interventions for NRGs.	Dr. RK Yogi
<b>Network Projects (ICAR, New Delhi sponsored)</b>			
23.	3.2.026	Network Project on Harvesting, processing and value addition of natural resins and gums.	Dr. N Prasad (PC)
24.	3.1.054	Network Project on Conservation of lac insect genetic resources.	Dr. KK Sharma, (PC)
<b>ICAR-DBT</b>			
25.	2.1.055	Identification, cloning and characterization of genes involved in pigment biosynthesis of the Indian lac insect, <i>Kerria lacca</i> (Kerr)	Dr. Thamilarasi K
<b>ICAR-ICRAF</b>			
26.	2.1.054	Enabling tribal communities to improve their livelihoods through agroforestry systems on a sustainable basis	Dr. J Ghosh
<b>Inter-Institutional (ICAR-IINRG &amp; ICAR-IIAB)</b>			
27.	1XX12912	Development and evaluation of the efficacy of novel nanoparticles for enhancing yield in rice and Indian major carp	Dr. A Roy Chowdhury
28.	--	Enhancing food, nutritional and livelihood security of marginal and small farmers in Jharkhand through need based agricultural technologies	Dr. Nirmal Kumar



## Publication and Publicity

### Publications

#### Research Papers

- ❖ Ali Md, Nair KK, Kumar R, Gopal M, Srivastava C and Siddiqi WA (2017). Development and evaluation of chitosan-sodium alginate based etofenprox as nanopesticide. *Advanced Sci. Engg. & Medicine* 9, 1–7.
- ❖ Ansari MF and Sarkhel G (2017). Improving coating properties of shellac-epoxidised-novolac blends with melamine formaldehyde resin. *Pigment & Resin Technol.* 46(2): 92-99.
- ❖ Gani M, Gupta RK, Zargar SM, Kour G, Monobrullah Md, Kandasamy T and Mohanasundaram A (2017). Molecular identification and phylogenetic analyses of multiple nucleopolyhedrovirus isolated from *Lymantria obfuscata* (Lepidoptera: Lymantriidae) in India. *Appl. Entomol. Zool.* (DOI: 10.1007/s13355-017-0490-3).
- ❖ Ghosal S, Meena SC, Lohot VD and Thamilarasi K (2017). Effect of macro-micro nutrients and liming on winter season kusmi lac yield on *Flemingia semialata*. *Ind. Forester* 143: 676-679.
- ❖ Ghosal S (2017). Effect of shoot age, liming and potassium application for summer season lac cultivation on *Butea monosperma* trees. *Ind. Forester* 143(3): 245-248.
- ❖ Ghosh J, Lohot VD, Ghosal S, Singhal V and Sinha NK (2017). Drought resilient *Flemingia semialata* Roxb. for improving lac productivity in drought prone ecologies. *Ind. J. Genet.* 77(1): 153-159.
- ❖ Hazarika LK, Das P, Mohanasundaram A, Saikia R and Islam AN (2017). A comprehensive study on pest complex of *Flemingia* spp. from Jorhat, Assam. *J. Entomol. Zool. Stud.* 5(4): 506-511.
- ❖ Jeet P, Singh DK, Sarangi A, Singh SD, Iquebal MA and Kumar R (2017). Modeling, probability analysis and forecasting of rainfall in Betwa river basin in Bundelkhand region, India. *Int. J. Agri. Innovations & Res.* 6 (2): 312-319.
- ❖ Kumawat RN, Santra, P and Sinha NK (2017). Effect of different cultural practices and fertilization on the regeneration of degraded *Lasiurus indicus* grassland in extreme arid conditions of Jaisalmer, India. *Annals Arid Zone* 56 (3 & 4): 89-95.
- ❖ Mohanasundaram A, Monobrullah Md, Sharma KK, Anees K, Singh RK, Meena SC and Verma S (2017). Climate change: Effect of weather parameters on production of summer season crop of rangeeni strain of Indian lac insect, *Kerria lacca* (Kerr) at Ranchi, Jharkhand. *J. Agrometeorol.* 16 (Special Issue-I): 108-113.
- ❖ Pandey SK, Prasad N, Sharma SC and Srivastava S (2017). Effects of packaging and storage on keeping quality of bleached lac. *J. Agri Search* 4(4): 264-269.
- ❖ Raja P, Singh N, Srinivas CV, Singhal M, Chouhan P, Singh M and Sinha NK (2017). Analyzing energy–water exchange dynamics in the Thar desert. *Climate Dynamics* 1-20.
- ❖ Shamim G, Ranjan SK, Thamilarasi K, Sharma KK and Ramani R (2017). Bacterial flora associated with *Kerria lacca* (Kerr). *Ind. J. Entomol.* 79(1): 41-48 (DOI: 10.5958/0974-8172.2017.00010.4).
- ❖ Shamim G, Ranjan SK, Pandey DM, Sharma KK and Ramani R (2017). Lac dye as a potential anti-neoplastic agent. *J. Cancer Res. & Therapeutics* 12 (2):1003-35.
- ❖ Siddiqui MZ, Prasad N and Tewari JC (2017). Physico-chemical properties and toxicity test of *Prosopis juliflora* and *Balanites aegyptiaca* gum exudates from Rajasthan. *Ind. J. Experimental Biol.* 55: 782-788.
- ❖ Sinha NK, Bhadana VP, Meena SR, Giri SP, Brajendra (2017). Seed dormancy, its alleviation and importance in agriculture. *J. Pharmacognosy & Phytochem.* 333-334.
- ❖ Srivastava S, Chowdhury AR and Maurya S (2017). Antimicrobial efficacy of methylated lac dye, an anthraquinone derivative. *Ind. J. Microbiol.* 57(4): 470–476.
- ❖ Srivastava S and Thombare N (2017). Safety assessment of shellac as food additive through long term toxicity study. *Trends in Biosci.* 10(2): 733-740.





- ❖ Srivastava S, Chowdhury AR, Thombare N (2017). Quality requirement and standards for natural resins and gums. *Int. J. Bioresource Sci.* 3(2): 89-94.
- ❖ Tewari JC, Pareek K, Shiran K and Prasad N (2017). On exudation of gum *arabic* through advance technology. *Int. J. Environmental Sci. Natural Resources* 2(5): 001-007.
- ❖ Thombare N, Mishra S, Siddiqui MZ, Jha U, Singh D and Mahajan GR (2018). Design and development of *guar* gum based novel, superabsorbent and moisture retaining hydrogels for agricultural applications. *Carbohy. Polym.* 185, 169–178.
- ❖ Thombare N, Jha U, Mishra S and Siddiqui MZ (2017). Borax cross-linked *guar* gum hydrogels as potential adsorbents for water purification. *Carbohy. Polym.* 168, 274–281.
- ❖ Thombare N, Srivastava S and Prasad M (2017). Chronic toxicity assessment of lac dye as potential food colorant. *Trends in Biosci.* 10(2): 741-748.
- ❖ Tribhuvan KU, Pawar DV, Lohot VD, Alam S, Singh BK, Bhat SB, Sharma KK and Thamilarasi K (2017). Isolation and characterization of root nodule bacteria from *Flemingia spp.* for plant growth enhancement. *Multilogic in Sci.* VII (XXIII): 274-278.
- ❖ Yogi RK, Jaiswal AK and Sharma KK (2017). Enabling rural households of Chotanagpur plateau me. *Jharkhand J. Development and Mgmt. Studies* 15 (1): 7179-7195.
- ◆ Ghosal S, Meena SC, Lohot VD and Thamilarasi K. Effect of macro-micro nutrients and liming on winter season *kusmi* lac yield on *Flemingia semialata*, p. 11.
- ◆ Rout AK, Mohanasundaram A and Sharma KK. Determining causative factors for mortality evaluation in lac insect *Kerria lacca* (kerr) using life table analysis on *Cajanus cajan* and *Flemingia semialata*, p. 12.
- ◆ Ghosh J, Lohot VD, Ghosal S, Singhal V and Thamilarasi K. Pigeon pea: An alternative host plant for natural resins and food security, p. 13.
- ◆ Sinha NK, Ghosh J, Lohot VD, Monobrullah M and Lal SK. Enhancing seed production potential of *Flemingia semialata* by using plant growth regulators: An approach to improve lac biopolymer production, p.18.
- ◆ Mate CJ, Thombare N and Thamilarasi K. Comparative studies of gum *ghatti* and unexplored *jhingan* gum using advance analytical techniques, p. 20.
- ◆ Sharma SC, Prasad N, Pandey SK and Kar AK. Selected physico-engineering properties of exudates gums, p. 20.
- ◆ Siddiqui MZ, Chowdhury AR and Prasad N. Thermal studies of *Buchanania lanzan* gum exudates collected from different places, p. 27.
- ◆ Pandey SK, Sharma SC and Prasad N. Drying study of aleuritic acid for determining suitable drying method/system, p. 28.
- ◆ Sharma SC, Prasad N, Pandey SK and Bhargav VK. Development and evaluation of Integrated Small Scale Lac Processing Unit, p. 28-29.
- ◆ Lohot VD, Kumari N, Gunjan, Ghosh J, Thamilarasi K, Mohanasundaram A, Anees K, Monobrullah Md and Sharma KK. Influence of lac insect feeding on oxidative stress and organic osmolytes of *Kusum (Schleichera oleosa)* host plant, p. 29.
- ◆ Yogi RK, Kumar A and Singh AK. Recent trends in demand and supply of natural resins: An econometric analysis, p. 30.
- ◆ Mohanasundaram A, Sharma KK, Verma

#### **Papers presented/ contributed in conferences/ symposia/ seminars**

- ❖ Following papers were presented in National Symposium on Recent Trends in Biopolymers, ICAR-IINRG, Ranchi, February 17-18, 2017:
  - ◆ Prasad N. Indian natural resins and gums – A potential source of livelihood in forests, sub-forests, arid regions and mountains (Lead Paper), p. 2.
  - ◆ Sharma KK. Integrating lac cultivation with agriculture: A new concept for increasing lac production and land use diversification (Lead Paper), p. 5.
  - ◆ Yogi RK, Kumar A and Singh AK. Temporal analysis of natural gums: Trends, patterns, performance and future projections for sustainable development planning, p.9.



S, Kishore A, Anees K and Monobrullah M. Assessment of lac insect broodlac quality during *katki* (rainy) season crop on *ber* and *palas*, p. 32.

- ◆ Ali M. Synthesis, characterization and bioefficacy of nanoetofenprox, p. 35.
- ◆ Thamilarasi K, Anees K and Sharma KK. *In vitro* production of lac resin and pigments using biotechnological tools, p. 36.
- ◆ Thombare N, Jha U, Mishra S and Siddiqui MZ. Borax cross-linked *guar* gum hydrogels as potential dye removing agent, p. 46.
- ◆ Chowdhury AR. *Guar* gum –A potential source of dietary fibre, p. 48.
- ◆ Srivastava S, Yadav SKS, Chowdhury AR and Gorai S. *Guar* gum hydrogel--An efficient biopolymer for the removal of heavy metals, p. 49.
- ◆ Ansari MF and Prasad N. Shellac as bio-coating material for paper packaging, p. 53.
- ◆ Yadav SKS, Kumar R and Srivastava S. Design and development of *guar* gum based hydrogel for potential biomedical applications, p. 53.
- ◆ Mohanasundaram A, Sharma KK, Upnit Shree, Thamilarasi K, Lohot VD and Ghosh J. Study of biological attributes of lac insects collected from three distinct agro ecological regions in India, p. 72.

❖ Following papers were presented in 19<sup>th</sup> Indian Agricultural Scientists & Farmers' Congress on Prospects of Green Economy and Value Addition Technology for Attracting and Retaining Youth in Agriculture and Rural Sector, Bioved, Allahabad, February 18-19, 2017:

- ◆ Jaiswal AK, Yogi RK, Kumar A and Singh AK. An instability analysis of natural gum, resins and future projections for the international market, p. 2.
- ◆ Yogi RK, Kumar A and Singh AK. Attracting rural youths through low volume high value crops: An Overview, p. 6.

❖ Yogi RK (2017). Bio-resource utilization for sustainable income generation in lower gangetic plains and eastern plateau hills. 3<sup>rd</sup> International Conference on Bio-resource and Stress Management, Society for Bio-resource and Stress

Management in Association with RKM Foundation, Jaipur, Rajasthan, November 8-11, p. 354.

- ❖ Ghosh J, Lohot VD, Ghosal S, Thamilarasi K and Gunjan (2017). Effect of lac culture on quality traits in pigeon pea. International seminar on Agriculture and Food for Inclusive Growth and Development, NBRI, Lucknow, January 14-15, p. 106.
- ❖ Mohanasundaram A, Sharma KK, Lohot VD and Thamilarasi K (2017). *Calliandra calothyrsus* – A potential new host for lac insect, *Kerria lacca* cultivation in India. International Conference & Expo on Agriculture & Veterinary Sciences: Research & Technology, Professor Jayashankar Telangana State Agricultural University, Hyderabad, October 23-25, p. 118.
- ❖ Thombare N, Mishra S and Siddiqui MZ (2017). *Guar* gum based moisture retaining hydrogels for water stress management in agriculture. 3<sup>rd</sup> International Conference on Bio-resource and Stress Management, Jaipur, Rajasthan, November 08-11, p. 249.

#### **Book/Chapters/Bulletins/Manuals/Extension folders/Project reports**

- ❖ Kaushal P and Sharma KK (2018). Doubling of Farmers' Income by 2022: Strategy Document for Jharkhand, jointly published by BAU and ICAR-IINRG, Ranchi, 1-167pp.
- ❖ Kumar A, Kumar R, Yogi RK, and Kumar R (2017). Fruit farming and sustainable livelihood security: E resources. In: Dutta AK and Mondal B (Eds.). Fruits for livelihood: Production technology and management practices. Agrobios (India) (ISBN-978-81-933644-5-1), Jodhpur, 541-554pp.
- ❖ Raja P, Sinha NK, Kumawat RN, Rajan K and Singh JP (2017). Khadin - A traditional water harvesting method for sustainable agriculture in western Rajasthan, pp. 261-269. In: Soil and Water Management Strategies for Drylands (Eds.) Shamsudheen Mangalassery, Devi Dayal, Deepesh Machiwal, Kalyani Publishers, p. 358.
- ❖ Sharma KK (2017). Lac insects and host plants. pp. 157-180. In: Omkar (Ed.) Industrial Entomology, xvi+465 pp. Springer Nature Singapore Pte. Ltd., Singapore. DOI 10.1007/978-981-10-3304-9. ISBN 978-981-10-3303-2; ISBN 978-981-10-3304-9 (e book).
- ❖ Sharma KK (2017). Lac crop harvesting and





processing. pp. 181-196. In: Omkar (Ed.) Industrial Entomology, xvi+465 pp. Springer Nature Singapore Pte. Ltd., Singapore. DOI 10.1007/978-981-10-3304-9. ISBN 978-981-10-3303-2; ISBN 978-981-10-3304-9 (e book).

- ❖ Siddiqui MZ, Thombare N, Chowdhury AR, Ansari MF, Prasad N and Sharma KK (2017). Souvenir and Abstracts Book. National symposium on recent trends in biopolymers. SANRAG & ICAR-IINRG, Ranchi, February 17-18, xvi+88 pp.
- ❖ Yogi RK, Kumar A and Jaiswal AK (2017). Lac, plant resins and gums statistics 2015: At a Glance ICAR-IINRG, Ranchi, ISSN: IS-2454-8782 17/2017, 1-72 pp.
- ❖ Yogi RK, Jaiswal AK and Sharma KK (2017). Commercial utility of *ber* (*Ziziphus mauritiana*): A mean for livelihood security. In: Dutta AK and Mondal B (Eds.). Fruits for livelihood: Production technology and management practices. Agrobios (India), (ISBN-978-81-933644-5-1), Jodhpur, 453-472 pp.

### Popular articles

- ❖ Following popular articles were published in Laksha, 2017 (ISSN No. 2454-7840), ICAR-IINRG, Ranchi, 106 p.:
  - ◆ अजय कुमार सिंह, सौमेन घोषाल, शिव बचन आजाद एवं ए. के. जायसवाल। लाख पंक का सब्जियों एवं फूलों की खेती में उपयोग, पृष्ठ 1-3।
  - ◆ महताब जाकरा सिद्दीकी, नंद किशोर ठोंबरे एवं अंजेश कुमार। हींग: गुणवत्ता एवं महत्व, पृष्ठ 4-5।
  - ◆ ज्योर्तिमय घोष एवं वैभव डी लोहोट। जैव विविधता: जीवन का आधार, पृष्ठ 6-7।
  - ◆ निरंजन प्रसाद एवं छाया। सहजन का गोंद: एक परिचय, पृष्ठ 8-9।
  - ◆ अजय कुमार सिंह, राजकुमार योगी एवं ए. के. जायसवाल। लाख की खेती के समसामयिक क्रियाकलाप, पृष्ठ 10-12।
  - ◆ तमिलारसी के, कंचन कुमारी एवं साजिया इकबाल। आनुवंशिक रूप से संशोधित फसलें, पृष्ठ 13-17।
  - ◆ राजकुमार योगी, आलोक कुमार, अजय कुमार सिंह एवं निर्मल कुमार। हस्तशिल्प उद्योग: लाख की घरेलु खपत का महत्वपूर्ण क्षेत्र, पृष्ठ 18-19।

- ◆ सतीश चन्द्र शर्मा, संजय कुमार पाण्डेय एवं निरंजन प्रसाद। प्राकृतिक गोंद एवं राल: वैकल्पिक आय का एक स्रोत, पृष्ठ 20-29।
- ◆ अर्णब राय चौधुरी एवं संजय श्रीवास्तव। रेशा युक्त आहार: कार्यात्मक आहार का एक नया स्रोत, पृष्ठ 30-32।
- ◆ नवलेश कुमार सिंहा एवं केवल कृष्ण शर्मा। स्वच्छ भारत अभियान में गाजर घास प्रसार, खतरे, प्रबंधन रणनीति एवं वैकल्पिक उपयोग, पृष्ठ 33-38।
- ◆ शिराज सलीम भट। जलवायु परिवर्तन को रोकने में वनों की भूमिका, पृष्ठ 39-41।
- ◆ नीतू कुमारी, शशि भूषण चौधरी, निभाबाड़ा, निर्मल कुमार एवं संतोश कुमार बिश्नोई। झारखंड के परम्परागत औषधीय पौधे एवं उनका उपयोग, पृष्ठ 42-43।
- ◆ शशि भूषण चौधरी, नीतू कुमारी, संतोश कुमार बिश्नोई एवं निर्मल कुमार। कटहल: झारखंड का एक बहुउपयोगी फलीय पौधा, पृष्ठ 44-46।
- ◆ समर पाल सिंह। घर में उगायें गमलों में सब्जियां: आम के आम गुठलियों के दाम, पृष्ठ 55-57।
- ◆ महताब जाकरा सिद्दीकी एवं अंजेश कुमार। वर्ष 2016-17 में अनुसंधान की उपलब्धियां, पृष्ठ 75-78।
- ◆ अंजेश कुमार एवं महताब जाकरा सिद्दीकी। राजभाषा हिन्दी के प्रसार में समाचार/संचार माध्यमों की भूमिका, पृष्ठ 86-88।
- ◆ महताब जाकरा सिद्दीकी। शिक्षा और बेरोजगारी, पृष्ठ 89-90।
- ◆ अंजेश कुमार एवं महताब जाकरा सिद्दीकी। आयोजन, पृष्ठ 94-101।
- ❖ एस. सी. शर्मा एवं प्रेम कुमार सुन्दरम (2017)। गन्ना बुवाई यन्त्रीकरण। स्मारिका बदलते जलवायु परिवेश में कृषि के नये आयाम, भाकृअनुप - भारतीय गेहूं एवं जौ अनुसंधान संस्थान, करनाल, हरियाणा, पृष्ठ 88-90।
- ❖ प्रेम कुमार सुन्दरम, एस. सी. शर्मा एवं विकास सरकार (2017)। वर्टिकल कनवेयर रीपर : बहु उपयोगी कटाई यंत्र। स्मारिका बदलते जलवायु परिवेश में कृषि के नये आयाम, भाकृअनुप-भारतीय गेहूं एवं जौ अनुसंधान संस्थान, करनाल, हरियाणा, पृष्ठ 98-99।
- ❖ Ghosal S, Meena SC and Bhat SS (2017). Nutritional support to *Flemingia semialata* for kusmi lac production. *Kisan Gyan*, January, p. 35-36.



- ❖ Sharma KK and Kumar A (2017). Prakritik raal avam gond – bahupyogi utpaad. *Rajbhasha Johar, Nagar Rajbhasha Karyanvan Samiti*, Ranchi, p. 53-56.
- ❖ Sharma KK (2017). *Lah ki vaigyanik kheti avam lah aadharit udyog, Krishi avam Pashudhan: Nutan Vayvsaya*, BAU, Ranchi, p. 27-34 & Divyayan KVK, Ranchi, 68 pp.
- ❖ Sharma KK (2017). Indian Institute of Natural Resins and Gums encourages farmers to take up lac cultivation for additional income. *Agriculture and Industry Survey*, Vadamalai Media Group, Bangalore, 27(12): 24-25.
- ❖ Siddiqui MZ (2017). Potentials of Asafoetida. *Van Sangyan* 4(8): 14-16.
- ❖ Singh RK, Sharma KK and Ramani R (2016). Pitcher irrigation enhances winter season *Kusmi* lac winter (*aghani*) crop production on *ber*. *Soil and Water Conservation Bulletin*, Indian Association of Soil and Water Conservationists, Dehradun, 1: 101-103.
- ◆ Mohanasundaram A, Sc. visited laboratory of semiochemical study at ICAR-CRIJAF, Kolkata for olfactometer along with aquarium pump for carrying out preliminary trials of semiochemicals research, January 24, 2017.
- ◆ Yadav SKS, Sc. visited lac based industries at Balarampur, Purulia, West Bengal, March 02 and at Khunti, Jharkhand, February 11, 2017.
- ◆ Ansari MF, Sr. Sc. visited ICAR-CIPHET (Ludhiana) regarding evaluation of barrier properties of paper packaging materials coated with lac based coating formulations, March 05-11, 2017.
- ◆ Yogi RK, Sc. visited officials of Line Departments in a village of Nagri to showcase the technological interventions during the workshop on Doubling the Farm Income, Birsa Agricultural University, Ranchi, March 08-10, 2017.
- ◆ Yogi RK, Sc. conducted an industrial visit with the officials from UAS Dharwad, National Enterprise, under Technology Dissemination Activities, Karnataka, March 15, 2017.
- ◆ Ghosal S, Pr. Sc. visited Mangubandh to provide advisory services under *Mera Gaon Mera Gaurav* (MGMG) programme, March 28, 2017.
- ◆ Mohanasundaram A, Sc. and Singh AK, Sr. Sc. visited and provided technical advice to the farmers about scientific lac cultivation on *kusum* under 'MGMG' programme, Dharampur, Silli, Ranchi, March 28, 2017.
- ◆ Thombare N, Sc. conducted a survey for identification and photography of resin and gum producing trees in forests of Kerala and Tamil Nadu, April 28 to May 05, 2017.
- ◆ Yogi RK, Sc. conducted field/industrial visit along with the officials of NABARD at various blocks of Khunti district (Silladone, Rania, Torpa, Murhu and Khunti) to study lac value chain and to prepare the district specific area development schemes for the state of Jharkhand, May 20 and August 11, 2017.
- ◆ Yogi RK, Sc. conducted field visits in gum collection areas of Udaipur district including Badgam, Moras, Rohida Kotda, Jhadol and Tarpal (Rajasthan), June 05-09, 2017.

### Patent

Srivastava S, Chowdhury AR, Lohot VD, Walia S and Saha S (2017). Provisional patent application on 'Lac wax policosanol – A natural plant growth regulator' has been accepted by Indian Patent office, Kolkata.

### Institute Publications

- ❖ ICAR- IINRG Annual Report, 2016-17, 156 p.
- ❖ Laksha, Rajbhasha Patrika, 2017, 112 p.
- ❖ Year Planner-cum-Publicity Brochure, 2018, 28 p.
- ❖ Ms D Norris Memorial Lecture Booklet on 'Role of Farm Engineering in Enhancing Agriculture Production and Farmers Income, 2017, 8 p.
- ❖ Natural Resins and Gums, ICAR-IINRG Newsletter, January - March 2017, 21(1), 12 p.
- ❖ Sarkar PC, Anees K and Yogi RK (2017). SFC (2017-2020): Scheme on post production mechanization and value addition, ICAR-IINRG, Ranchi, 1-211 pp.

### Publicity

#### Tours/Visits

- ◆ Ghosal S, Pr. Sc. along with team members visited Banaburu village, Ranchi to see the status of early emergence of *kusmi* lac, January 05, 2017.





- ◆ Yogi RK, Sc. conducted industrial visits at Jaipur and interacted with the traditional bangle makers, Forest Departments, Departments of Agriculture, local markets and industrial areas for data collection on NRGs from gum processing factories, gum traders and other stakeholders, Rajasthan, June 14-16, 2017.
- ◆ Mohanasundaram A, Sc. visited Division of Entomology, ICAR-Indian Agricultural Research Institute, New Delhi for Electroantennogram (EAG) and Olfactometer studies, July 24-29 and November 06-12, 2017.
- ◆ Lohot VD, Sc. and Thombare N, Sc. visited library of Botanical Survey of India, Kolkata for detailed study of literature on gum and resin producing plant species, to be used for publication of book on 'Field Guide for Identification of NRG trees', September 04-09, 2017.
- ◆ Yadav SKS, Sc. visited industries to strengthen liaisoning with lac-based industry and feedback from ex-IINRG trainees, Mumbai, Maharashtra, September 16, 2017.
- ◆ Pandey SK, Sc. visited M/s National Enterprise, Ranchi for cost estimation of Integrated Lac Processing Unit w.r.t. its licensing/commercialization, September 21, 2017.
- ◆ Sharma SC, Sc. visited Kankebar, Ramgarh regarding trials of *karaya* gum tapping and discussion with a progressive farmer, September 22, 2017.
- ◆ Pandey SK, Sc. visited M/s Dass Group, Ranchi for cost estimation of Integrated Lac Processing Unit w.r.t. its licensing/commercialization, September 27, 2017.
- ◆ Mohanasundaram A, Sc. visited and monitored project progress under NP-CLIGR co-operating center Kerala Forest Research Institute, Thrissur and the Professor Jayashankar Telangana State Agricultural University, Hyderabad, October 13 and October 27, 2017.
- ◆ Ghosal S, Pr. Sc. participated in Advisory Committee Meeting of *Krishi Darshan* programme of Doordarshan for preparing schedule of TV programmes, October 18, 2017.
- ◆ Sharma SC, Sc. visited Government Secondary School, Tati Singari, Ranchi on the occasion of Vigilance Awareness Week organized by the institute under 'MGMG' and actively participated in interaction with students of the school on various issues like *ujjwala yojna*, solar power, lac cultivation, November 01, 2017.
- ◆ Ansari MF, Sr. Sc.; Yadav SKS, Sc.; Mohanasundaram A, Sc. and Jeet P, Sc. adopted new village Benyazara, Angara (Ranchi) and conducted a programme on vigilance and created awareness amongst school children and farmers under 'MGMG' programme, November 02, 2017.
- ◆ Yadav SKS, Sc. visited Beniajara Village, Angarah, Ranchi to observe Vigilance Awareness Week and 'MGMG' programme, November 11, 2017.
- ◆ Jeet P, Sc. participated as Chief-de-Mission (CDM) in ICAR-Zonal Sports Tournament-2017, ICAR-RCER, Patna, November 13-16, 2017.
- ◆ Sharma SC, Sc. visited M/s Indian Shellac Industries, Khunti and M/s Tajna Shellac, Khunti (Ranchi) under orientation training programme for scientist (Probationer) regarding industrial exposure on lac and lac based products, November 14, 2017.
- ◆ Lohot VD, Sc.; Thamilarsi K, Sc.; Mohanasundaram A, Sc. and Ali M, Sc. attended 5<sup>th</sup> Co-ordination Committee Meeting of Network Project on Conservation of Lac Insect Genetic Resources, Punjab Agricultural University, Ludhiana, November 14-15, 2017.
- ◆ Ghosh J, Sr. Sc.; Mohanasundaram A, Sc.; Yogi RK, Sc. and Rout AK, Sc. visited different models developed under Lac Integrated Farming System (LIFS) project in various farmers fields at Dewgain, Lodma and Kutiyatu under ICRAF project, November 21, 2017.
- ◆ Ghosh J, Sr. Sc. and Mohanasundaram A, Sc. conducted field visit and selected two farmers for adoption of LIFS under ICAR-ICRAF Project. Also participated in *Kisan Ghosti* organized by



Jharkhand State Livelihood Mission & Sahyogi Mahila (NGO) and briefed the importance of lac hosts, lac cultivation, lac integrated farming and scientific lac cultivation on *ber*, *palas* and *kusum*, Panjayat Bhawan, Melan Chowk, Ichagarh block, November 24, 2017.

- ◆ Ghosal S, Pr. Sc. attended meeting convened by Additional Chief Secretary, Paschimanchal Unnayan Parishad for intervention in lac promotional activities of Purulia district (Kolkata), November 24, 2017.
- ◆ Ghosh J, Sr. Sc.; Mohanasundaram A, Sc. and Yogi RK, Sc. conducted field visits and selected one farmer for adoption of LIFS under ICAR-ICRAF Project, Jaipur, November 28, 2017.
- ◆ Yadav SKS, Sc. visited Torpa, Khunti to participate in World Soil Day organized at

Rural Development Society, Mahila Vikas Kendra, Torpa, Ranchi, December 05, 2017.

- ◆ Mohanasundaram A, Sc. visited and provided technical advice to the farmers about scientific lac cultivation on *kusum* and *ber* under 'MGMG' programme, Benyazara, Angara, Ranchi, December 07, 2017.

#### Data Base

- ❖ National level database of the NRGs production and EXIM data has been generated, maintained and updated at NRG Information Cell (NIC), TOT Division, ICAR-IINRG, Ranchi.
- ❖ Block level database of beneficiaries under various trainings during previous 10 years and block wise lac host tree as well as broodlac requirement in the state of Jharkhand has been estimated and its validation is under progress.

#### Radio/TV Talk

Expert	Topics	Date of Recording/ Broadcast/Telecast
<b>Radio Talk</b>		
Dr. J Ghosh, Sr. Sc.	लाख की खेती में सामायिक कृषि कार्य	10.6.2017.
Dr. KK Sharma, Director	Bhartiya Prakritik Raal avam Gond Sansthan – Gatividhian avam uplabdhiyan (Vigyan Bharati programme of AIR, New Delhi)	20.7.2017.
Dr. S Ghosal, Pr. Sc.	September mahine mein lakh sambhandhit samayeik vishoyon par charcha	09.9.2017.
Dr. J Ghosh, Sr. Sc.	स्वादी पलास पर लाख कीटों की सुरक्षा कैसे करें	21.10.2017.
<b>TV Talk</b>		
Dr. KK Sharma, Director	Bhartiya Prakritik Raal avam Gond Sansthan ke prashikshan karyam (Doordarshan, Ranchi)	16.02.2017.
Dr. KK Sharma, Director	Barsat ke mausam mein kusmi fasal prabandhan aur lakh keet sancharan	01.8.2017.
Dr. KK Sharma, Director	Barsat ke mausam mein kusmi lakh keet prabandhan	07.8.2017.
Dr. S Ghosal, Pr. Sc.	Rangeeni lakh ki kheti (Krishi Darshan-Doordarshan, Ranchi)	09.3.2017.
Dr. SC Sharma, Sc.	Chhili lakh Kee bikri avam bhandaran (Krishi Darshan-Doordarshan, Ranchi)	26.9.2017.
Dr. S Ghosal, Pr. Sc.	Lakh ki kheti aur swarojkar (Krishi Darshan-Doordarshan, Ranchi)	17.10.2017.
Dr. S Ghosal, Pr. Sc.	Lakh utpadan taknik avam prashikshan	02.11.2017.





## Participation of Scientists in Conferences / Meetings / Seminars / Symposia / Workshops / Trainings

### By Director

#### Chaired / Convened

- ❖ Dr. KK Sharma, Director chaired the Meeting-cum-Brainstorming Session on 'Role of stakeholders in Market Information System (MIS) for NWFPS' with State / NGO Officials organized by and at ICAR-IINRG, Ranchi, February 08, 2017.
- ❖ Dr. KK Sharma, Director chaired the Techno-Commercial Assessment Committee meeting organized by Agrinnovate India Limited's (AgIn) at New Delhi held on March 16, 2017. Three potential technologies viz. (i) Lac-based Water thinnable Interior Paint, (ii) Lac-based fruit coating formulation for Kinnow and (iii) Lac wax policosanol based PGR formulation were identified for commercialization.
- ❖ Dr. KK Sharma, Director chaired the Technical Committee on Brushware, Polishes, Lac, Lac Products, CHD 23 under the Chemical Division Council of BIS at New Delhi, March 17, 2017.
- ❖ Dr. KK Sharma, Director chaired 77<sup>th</sup> meeting of Institute Joint Staff Council, March 23, 2017.
- ❖ Dr. KK Sharma, Director convened the first meeting of Jharkhand State Coordination Committee for doubling the income of farmers by March 2022 at Birsa Agricultural University, Ranchi, April 06, 2017.
- ❖ Dr. KK Sharma, Director convened the second meeting of Jharkhand State Coordination Committee for doubling the income of farmers by March 2022 at Birsa Agricultural University, Ranchi, April 13, 2017.
- ❖ Dr. KK Sharma, Director chaired Institute Research Committee, May 15-16 & 24, 2017.
- ❖ Dr. KK Sharma, Director chaired the 78<sup>th</sup> meeting of Institute Joint Staff Council, June 27, 2017.
- ❖ Dr. KK Sharma, Director chaired a workshop on J-Gate / CeRA organized for the scientists of the Institute, July 11, 2017.
- ❖ Dr. KK Sharma, Director convened the third

meeting of Jharkhand State Coordination Committee for doubling the income of farmers by March 2022 at Birsa Agricultural University, Ranchi, August 23, 2017.

- ❖ Dr. KK Sharma, Director chaired the 79<sup>th</sup> Institute Joint Staff Council meeting, October 28, 2017.
- ❖ Dr. KK Sharma, Director chaired Management Review Committee meeting, November 08, 2017.
- ❖ Dr. KK Sharma, Director & Project Coordinator chaired 5<sup>th</sup> Coordination Committee meeting of Network Project on Conservation of Lac Insect Genetic Resources at PAU, Ludhiana, November 14-15, 2017.
- ❖ Dr. KK Sharma, Director convened a meeting with VC, Director Research and Assistant Director Research of BAU, Ranchi in connection with finalization of the report on doubling farmers income of Jharkhand State.

#### Participated

- ❖ Dr. KK Sharma, Director participated in the meeting of Directors and Project Coordinators of the Engineering Division with DDG (Engg.) on EFC discussion at New Delhi, March 15, 2017.
- ❖ Dr. KK Sharma, Director participated in a meeting on EFC discussion and presented SFC of IINRG, at New Delhi, March 29, 2017.
- ❖ Dr. KK Sharma, Director participated in the ICAR review meeting of Engineering and Horticultural Divisions on April 20, 2017 at National Institute of Agricultural Economics and Policy Research.
- ❖ Dr. KK Sharma, Director participated in the meeting with Deputy Secretary, EP (CAP) Division, Ministry of Commerce, Udyog Bhawan in connection with discussion on Shellac Safety Study, New Delhi, May 04, 2017.
- ❖ Dr. KK Sharma, Director participated in the meeting with DDG (Engg.) and Chairman, QRT of ICAR-IINRG in connection with constitution of the QRT, New Delhi, May 17, 2017.
- ❖ Dr. KK Sharma, Director conducted, as Nodal Officer, the ICAR's 22<sup>nd</sup> All India Entrance



Examination for admission to U.G., P.G. and Ph.D. degree programmes [AIEEA-UG/PG & AICE-JRF/SRF-(PGS)-2017] in Agriculture and allied science subjects on Saturday, the 10<sup>th</sup> June, 2017 and Sunday, the 11<sup>th</sup> June, 2017, respectively.

- ❖ Dr. KK Sharma, Director participated as member in Research Advisory Committee meeting of Central Tasar Research and Training Institute, Nagri, Ranchi, June 14, 2017.
- ❖ Dr. KK Sharma, Director participated in State Level Unit Cost Committee meeting of NABARD, Ranchi, July 26, 2017.
- ❖ Dr. KK Sharma, Director participated in a meeting on National Mission for Sustainable Agriculture by Development Commissioner of Jharkhand on July 28, 2017. Suggested to include lac in the scheme for land use diversification.
- ❖ Dr. KK Sharma, Director participated in the ICAR-IFAD Interface Workshop, New Delhi, August 03, 2017.
- ❖ Dr. KK Sharma, Director participated in Regional Advisory Group meeting of NABARD, Ranchi, August 17, 2017.
- ❖ Dr. KK Sharma, Director, ICAR-IINRG attended Assessment Committee meeting for CAS at ASRB, New Delhi on September 12, 2017
- ❖ Dr. KK Sharma, Director attended and presented the SFC of IINRG at Krishi Bhawan, New Delhi, September 15, 2017.
- ❖ Dr. KK Sharma, Director attended a meeting chaired by DG, ICAR on doubling farmers income at Krishi Bhawan, New Delhi, October 10, 2017.
- ❖ Dr. KK Sharma, Director participated in Sector Development Plan meeting of NABARD, Ranchi, November 08, 2017.
- ❖ Dr. KK Sharma, Director participated in a meeting with Additional Chief Secretary, West Bengal, Kolkata on November 24, 2017 regarding strengthening of lac in Purulia district of WB. Officials from MSME department and DFO Purulia were also present.

### By Others

- ❖ Er. SK Pandey, Sc. and Dr. A Mohanasundaram, Sc. attended workshop on Social Life of Lac Insect organized by Ambedkar University, Delhi and

PRADAN, NGO, ICAR-IINRG, Ranchi, January 20, 2017.

- ❖ Dr. N Prasad, Pr. Sc. & Head, PPD Division attended meeting regarding lac industry in Jharkhand and revival of farms under Forest Department, Palamu (Jharkhand) for broodlac production, Jharkhand Secretariat, January 23, 2017.
- ❖ Dr. N Prasad, Pr. Sc. & Head, PPD Division attended SFC meeting and presented proposal of continuation of ICAR-IINRG, Ranchi and AINPs on HPVA of NRGs & CLIGR during 2017-2020 period in Engineering Division, ICAR, New Delhi, February 03, 2017.
- ❖ Dr. SKS Yadav, Sc. and Dr. RK Yogi, Sc. attended Mega Trade Fair (Global Investors Summit) - MOMENTUM JHARKHAND, Khelgoan, Ranchi, February 16-17, 2017 and showcased the technologies and research activity through exhibition stall of the Institute.
- ❖ Dr. RK Yogi, Sc. attended Foundation Day-cum-Exhibition program, ICAR-RCER RC, Plandu, Ranchi, February 22, 2017 and showcased the Institute's technologies.
- ❖ Dr. S Srivastava, Pr. Sc. & Member-Secretary, RAC organized XXIV Meeting, ICAR-IINRG, Ranchi, February 27-28, 2017.
- ❖ Dr. MZ Siddiqui, Pr. Sc.; Dr. RK Yogi, Sc.; Dr. A Roy Chowdhury, Sc. participated in City level Hindi Sangosthi on the topic राज्य में भूगर्भ जल की स्थिति एवं जल क्षाजन, ICAR-IINRG, Ranchi, March 01, 2017.
- ❖ Dr. RK Yogi, Sc. attended Business Sub Committee Meeting, JASCOLAMPF, Ranchi, March 16, 2017.
- ❖ Dr. RK Yogi, Sc. participated & also jointly coordinated a workshop on Farmers First Project, ICAR-IIAB and ICAR-IINRG, Ranchi, March 25-26, 2017.
- ❖ Dr. RK Yogi, Sc. attended and jointly coordinated a Training-cum-awareness programme on IPR, Torpa, Khunti, Ranchi, March 31, 2017.
- ❖ Dr. RK Yogi, Sc. participated in State Level Coordination Committee Meeting on doubling the farm income, Birsa Agricultural University, Ranchi, April 13, 2017.
- ❖ Dr. A Roy Chowdhury, Sc. attended workshop on Promotion of lac based industry in Jharkhand as



Co-convener, ICAR-IINRG, Ranchi, May 06, 2017.

- ❖ Dr. S Srivastava, Pr. Sc. organized a meeting to demonstrate process know-how for the preparation of *gulal* to 50-60 participants from Lesliganj, Kundri block, Palamu (Jharkhand), May 10, 2017.
- ❖ Dr. SC Sharma, Sc. organized and attended a meeting regarding finalization of price of Integrated Small Scale Lac Processing Unit and technology fee, June 05, 2017.
- ❖ Dr. N Prasad, Pr. Sc. & Head, PPD Division attended Indian Grain Storage Working Group Meeting, NASC Complex, ICAR, New Delhi, June 11-12, 2017.
- ❖ Dr. RK Yogi, Sc. participated in State Level Unit Cost Committee Meeting, NABARD, Ranchi, July 06, 2017.
- ❖ Dr. RK Yogi, Sc. attended district level Planning Committee Meeting conducted by Deputy Commissioner, Khunti, Ranchi, July 07, 2017.
- ❖ Er. SK Pandey, Sc. participated in ICAR-IFAD interaction workshop on integrating renewable energy technologies for small holder agriculture in India organized by Agricultural Engineering Division, ICAR- NASC complex, New Delhi, August 03, 2017.
- ❖ Dr. RK Yogi, Sc. participated in the online UN FAO survey on wildlife and protected area management, August 16, 2017.
- ❖ Dr. NK Sinha, Pr. Sc. attended a meeting with Institute Advisory Committee (IAC) regarding ICAR-funded Farmer FIRST project entitled 'Enhancing Food, Nutritional and Livelihood Security of Marginal and Small Farmers in Jharkhand through Need Based Agricultural Technologies', ICAR-IIAB, Ranchi, August 18, 2017.
- ❖ Dr. NK Sinha, Pr. Sc. attended a meeting with Site Plan Implementation Group (SPIG) regarding ICAR-funded Farmer FIRST project entitled 'Enhancing Food, Nutritional and Livelihood Security of Marginal and Small Farmers in Jharkhand through Need Based Agricultural Technologies', ICAR-IIAB, Ranchi, August 19, 2017.
- ❖ Dr. RK Yogi, Sc. participated in the interactive session with 80 *Mukhiya* from Bokaro district of the State Level Coordination Committee under

the Chairmanship of Vice-Chancellor, Birsa Agricultural University, Ranchi on doubling the farm income, August 23, 2017.

- ❖ Dr. RK Yogi, Sc. participated in the 7th meeting of the Pricing cell to review the Minimum Support Price (MSP) for lac (rangeeni and kusmi), gum karaya, palas flower, kusum seed, etc. under the scheme of MSP for MFPs, TRIFED, New Delhi. He also participated in a short meeting cum panel discussion to review the detailed data analysis, Meeting Hall, Forestry and Biodiversity Division, The Energy and Resources Institute (TERI), New Delhi, August 29, 2017.
- ❖ Dr. MF Ansari, Sr. Sc. and Dr. SKS Yadav, Sc. participated and attended a training programme on Advances in Applications of Nanotechnology, ICAR-CIRCOT, Mumbai, September 11-15, 2017.
- ❖ Dr. A Roy Chowdhury, Sc. attended a state level Focus Group Discussion for Fixing Minimum Support Price for Minor Forest Produce in the state of Jharkhand in collaboration with TERI, New Delhi, ICAR-IINRG, Ranchi, September 15, 2017.
- ❖ Dr. RK Yogi, Sc. participated in the sector-wise Brainstorming sessions of the State Level Coordination Committee under the Chairmanship of Vice-Chancellor, Birsa Agricultural University, Ranchi on doubling the farm income, October 25-27, 2017.
- ❖ Er. SK Pandey, Sc. participated in meeting of Forest Based Micro enterprise (FBME) regarding finalizing policy with Forest Department, Jharkhand, Govt. of Jharkhand, Van Bhawan, Ranchi, October 30, 2017.
- ❖ Dr. N Prasad, Pr. Sc. & Coordinator; Dr. MZ Siddiqui, Pr. Sc. & PI and Sri N Thombare, Sc. participated in 9th Annual Workshop of Network Project on HPVA of NRGs, Indira Gandhi Krishi Vishwavidyalaya, Raipur (Chhattisgarh), November 01-02, 2017.
- ❖ Dr. RK Yogi, Sc. participated in a meeting for interaction on Area Development Schemes related to lac sector with a targeted period over 5 years (2018-2023), November 16, 2017.

### Human Resource Development

- ❖ Er. Pawan Jeet, Sc. completed three months' Foundation Course for Agricultural Research



Service-105 (FOCARS-105), ICAR-NAARM, Hyderabad, January 05 to April 04, 2017.

- ❖ Dr. RK Yogi, Sc. participated in second workshop of Nodal Officers of ICAR Research Data Repository for Knowledge management initiatives, ICAR-IASRI, New Delhi, January 24-25, 2017.
- ❖ Dr. Thamilarasi K, Sc. participated in Centre for Advance Faculty Training (CAFT) on Computational approaches for next generation sequencing data analysis in agriculture, ICAR-IASRI, New Delhi, February 08-28, 2017.
- ❖ Dr. MZ Siddiqui, Pr. Sc. & Nodal Officer (HRD) attended training programme on Competency enhancement programme for effective implementation of training functions by HRD Nodal Officers of ICAR, ICAR-NAARM, Hyderabad, February 23-25, 2017.
- ❖ Er. Pawan Jeet, Sc. completed three months' Professional Attachment Training, ICAR-IASRI, New Delhi, June 01 to August 31, 2017.
- ❖ Dr. RK Yogi, Sc. participated in CAFT programme on Recent developments in statistical modeling and forecasting in agriculture, ICAR-IASRI, New Delhi, December 28, 2017 to January 17, 2018.

## Honours, Awards and Recognitions

### By Director

- ❖ Dr. KK Sharma, Director was invited as Guest of Honour in the Foundation Day programme of ICAR-RCER, Patna organized at its Research Station, Ranchi, February 22, 2017.
- ❖ Dr. KK Sharma, Director acted as External expert in the Selection Committee for recruitment of Assistant Professor (Specialization: Crop / Plant Protection) at Ranchi Faculty Center of Ramakrishna Mission Vivekananda University, Ranchi, April 17, 2017.
- ❖ Dr. KK Sharma, Director chaired the Workshop on Promotion of Lac based Industry in Jharkhand jointly organized FJCCI and ICAR-IINRG, May 06, 2017.
- ❖ Dr. KK Sharma, Director was invited as Chief Guest by the *Jaukandhai Bahaghara Utsav* Committee in the Ceremony of *Jaukandhai Bahaghara* at Balasore (Odisha), May 22, 2017.
- ❖ Dr. KK Sharma, Director was invited as Chief Guest

in the Workshop on, 'Status of Seed Sector in Jharkhand' organized by ICAR-Research Complex for Eastern Region, Research Center, Ranchi, August 08, 2017.

- ❖ Dr. KK Sharma, Director was invited as Guest of Honour on Foundation Day of ICAR-Indian Institute of Agricultural Biotechnology, August 25, 2017.
- ❖ Dr. KK Sharma, Director was invited as Guest of Honour by the *Riddhi Siddhi Prathmik Lah Utpadak Sahyog Samiti*, Kundri, Palamu in one day workshop on, 'Swarozgar avam jivikoparjan hetu Kundri lah bagan sthit palas vrikshon ka patta par aadharit sangrakshan avam dohan', August 28, 2017.
- ❖ Dr. KK Sharma, Director was invited as Panelist in a panel discussion on 'How to make agriculture profitable?' in the seminar organized by *Dainik Jagran* at BAU, Ranchi, December 23, 2017.
- ❖ Dr. KK Sharma, Director nominated as Expert Member of Research Advisory Committee of Central Tasar Research and Training Institute, Ranchi for three years (2017-20).

### By Others

- ❖ Dr. MZ Siddiqui, Pr. Sc. was Member for selection of JRF under SERB-EMR (Individual Centric, 2016-2017) sponsored Project entitled, 'Phenyloxazoline Synthetase Inhibitors as Anti-tubercular Agents (POSIAA), Department of Pharmaceutical Sciences & Technology, BIT, Mesra, Ranchi, January 11, 2017.
- ❖ Dr. J Ghosh, Sr. Sc. was conferred 'Excellence in Research Award', International Seminar on Agriculture and Food for Inclusive Growth and Development, NBRI, Lucknow, January 14-15, 2017.
- ❖ Dr. MZ Siddiqui, Pr. Sc. continued as Member, Editorial Board, World Journal of Pharmaceutical Sciences, since January, 2013.
- ❖ Dr. A Mohanasundaram, Sc. was conferred Best Poster Award for Study of biological attributes of lac insects collected from three distinct agro ecological regions in India in National Symposium on Recent Trends in Biopolymers, ICAR-IINRG, Ranchi, February 17-18, 2017.
- ❖ Dr. MZ Siddiqui, Pr. Sc. Continued as Member,





Technical Editorial / Advisory Board of 'Krishak Vandana'-a highly reputed monthly Hindi Magazine on Agriculture & Farming, published from Jabalpur (M.P.), Since March, 2012.

- ❖ Dr. MZ Siddiqui, Pr. Sc. continued as Member, Editorial Board and Reviewer Research Journal of Chemistry and Environment, an International Monthly Online NAAS Indexed Journal, since June, 2014.
- ❖ Dr. MZ Siddiqui, Pr. Sc. reviewed a research manuscript titled, 'Comparison of chemical composition and biological activity of *Boswellia serrata* Roxb. oleo gum resin essential oil extracted through supercritical fluid carbon dioxide and two other traditional extraction methods' (Manuscript ID: LJPF-2017-1004) for International Journal of Food Properties, a NAAS Indexed International Journal, August 31, 2017.
- ❖ Dr. MZ Siddiqui, Pr. Sc. was Expert Member in a Selection Committee for JRF under SERB-EMR (Individual Centric, 2017-18) Project titled, 'Design & synthesis of substrate based peptide inhibitors of DENV protease for the treatment of Dengu viral infections', Department of Pharmaceutical Sciences, BIT, Mesra, Ranchi, September 15, 2017.
- ❖ Dr. RK Yogi, Sc. was awarded Distinguished Worker (Scientific Category) Award for the year 2017, ICAR-IINRG, Ranchi, September 20, 2017.
- ❖ Dr. MZ Siddiqui, Pr. Sc. bagged First Prize in Hindi Speech during Rajbhasha Celebrations, ICAR-IINRG, Ranchi, September 25, 2017.
- ❖ Dr. MZ Siddiqui, Pr. Sc. continued as Vice-President of Society for Advancement of Natural Resins & Gums (SANRAG), Ranchi, since October 19, 2016.
- ❖ Dr. A. Mohanasundaram, Sc. Chaired one of the technical sessions during an International Conference & Expo on Agriculture & Veterinary Sciences: Research & Technology, Professor Jayashankar Telangana State Agricultural University, Hyderabad, October 23-25, 2017.
- ❖ Dr. MF Ansari, Sr. Sc. was an External Expert for selection of JRF in DST sponsored project in Department of Chemical Engineering, Birla Institute of Technology, Mesra Ranchi, October 24, 2017.
- ❖ Dr. Sanjay Srivastava, Pr. Sc.; Dr. RK Yogi, Sc. and

Er. Ranjit Singh, Sc. attended a National Summit on Leadership Awards by ASSOCHAM and The Leadership Award was conferred to ICAR-IINRG, Ranchi in the field of Agriculture, October 31, 2017.

- ❖ Dr. NK Sinha, Pr. Sc. acted as an Observer for Stenographer Grade III Examination conducted by ASRB, New Delhi, Ranchi, October 29, 2017.
- ❖ Sri Nandkishore Thombare, Sc. was conferred Best Oral Presentation Award for paper entitled, 'Guar gum based moisture retaining hydrogels for water stress management in agriculture', 3rd International Conference on Bioresource and Stress Management, Jaipur (Rajasthan), November 08-11, 2017.
- ❖ Sri Nandkishore Thombare, Sc. acted as Convener in Poster Session (NRM) & Co-convener in Oral Session (Stress Management), 3rd International Conference on Bioresource and Stress Management, Jaipur (Rajasthan), November 08-11, 2017.
- ❖ Dr. MZ Siddiqui, Pr. Sc. was Member for Selection of JRF under DBT-BIO-CARE Project, Lac production Division, ICAR-IINRG, Ranchi, November 20, 2017.
- ❖ Dr. NK Sinha, Pr. Sc. was Member for selection of SRFs, ICAR-IIAB, Ranchi, December 18, 2017.
- ❖ Sri Nandkishore Thombare, Sc. was conferred 'IPNI Scholar Award-2017' (Certificate of honor and cash prize \$2000) for the Ph.D. work on 'Synthesis and evaluation of cross-linked guar gum hydrogels for environmental and agricultural applications' by International Plant Nutrient Institute, USA.
- ❖ Dr. SC Sharma, Sc. reviewed a manuscript (PHE-56/17) entitled, 'Performance evaluation of cashew nut shelling machine: Hand-cum-pedal operated and automatic shelling machine' Journal of Agricultural Engineering, 2017.
- ❖ Dr. J Ghosh, Sr. Sc. served as a member of Research Advisory Committee for Forest Genetics at Institute of Forest Productivity, Ranchi, 2017.
- ❖ Dr. J Ghosh, Sr. Sc. acted as Subject Expert (Tree Improvement) to evaluate the project completion report (PCR) of ICFRE funded project, IFP, Ranchi, 2017.
- ❖ Dr. RK Yogi, Sc. reviewed more than 15 economics and marketing based papers, did moderation of



papers for two graduate courses in NARS system and also participated as an expert for interview panel for State/District level coordinators (Agricultural Marketing) conducted by the Government of Jharkhand during 2017.

- ❖ Dr. RK Yogi, Sc. continued as Member, Editorial Board of three International Journals viz. Journal of Agricultural Economics and Rural Development, International Journal of Agricultural Sciences and Journal of Agricultural Science and Technology A during 2017.

### Capacity Building / Lectures / Talk Delivered

- ❖ Following lectures were delivered during 6<sup>th</sup> Winter Students Workshop on Natural Resins & Gums to M.Sc. (Zoology) students from Ewing Christian College, Allahabad and SHIATS, Allahabad, January 09-18, 2017, ICAR-IINRG, Ranchi:
  - ◆ Dr. S Ghosal, Pr. Sc. & Head, LPD Division delivered a lecture on Management of lac hosts, January 10, 2017.
  - ◆ Dr. Vaibhav D Lohot, Sc. delivered a lecture on Collection and conservation of lac insect and host plant biodiversity, January 11, 2017.
  - ◆ Dr. MZ Siddiqui, Pr. Sc. delivered a lecture on Medicinal importance of oleo-resins, January 12, 2017.
  - ◆ Dr. MF Ansari, Sr. Sc. delivered a lecture on Diversified uses of lac and also demonstrated surface coating applications and diversified uses of lac, January 13, 2017.
  - ◆ Er. SK Pandey, Sc. delivered a lecture on Lac-based technologies for entrepreneurship, January 16, 2017 and also demonstrated pilot plant and machineries in PD Unit, January 18, 2017.
  - ◆ Dr. SC Sharma, Sc. delivered a lecture on Tapping techniques and tools for resins and gums, January 18, 2017.
  - ◆ Dr. RK Yogi, Sc. delivered two lectures viz. Economics and marketing of NRGs & Success stories in lac farming, January 09-18, 2017.
  - ◆ Dr. A Mohanasundaram, Sc. delivered three lectures viz. Lac insect life cycle, crop cycle and lac related terminology; *Rangeeni* lac cultivation on *palas* tree and Impact of climate change on lac production, January 09-18, 2017.
- ❖ Dr. A Mohanasundaram, Sc. delivered lectures on Lac cultivation and uses of lac related products among Forester/Forest Guards/JEM Members at Forester Training School, Ranchi, January 18 and 25, 2017.
- ❖ Dr. A Mohanasundaram, Sc. delivered lecture on Lac insect life cycle, crop cycle and lac related terminology during one day workshop organized by Ambedkar University, Delhi and PRADAN, NGO, ICAR-IINRG, Ranchi, January 20, 2017.
- ❖ Dr. A Mohanasundaram, Sc. delivered two lectures on Lac cultivation and uses of lac related products among Forester/Forest Guards/JEM Members at Forester Training School, Ranchi, February 01, 2017.
- ❖ Dr. SC Sharma, Sc. delivered a lecture on Small scale lac processing unit and production of seedlac to the farmers from Meghalaya Institute of Entrepreneurship, Govt. of Meghalaya, under the Scientific Method of Lac Cultivation, Processing and Uses, ICAR – IINRG, Ranchi, February 06-11, 2017.
- ❖ Dr. SC Sharma, Sc. delivered a lecture on Improved machinery for lac processing to the beneficiaries sponsored by Chhattisgarh State Minor Forest Produce Co-operative Federation Limited, under the training programme, ICAR – IINRG, Ranchi, February 20-25, 2017.
- ❖ Dr. MF Ansari, Sr. Sc. transferred the technologies of air-drying type insulating varnish and shellac emulsion paint for interior surface to Mr. Deepak Keshri of M/s Aadhya International, Mumbai. Process know-how and preparation of the products were demonstrated to the entrepreneur, February 23-24, 2017. Institute earned revenue of ₹ 14,000/- in the process.
- ❖ Sri Nandkishore Thombare, Sc. imparted 10 days training on Characterization and modification of tamarind kernel powder using modern Instruments to Ms. Sangareswari Nagajothi, Ph.D. scholar, TNAU, Coimbatore, February 20 to March 01, 2017.
- ❖ Dr. MZ Siddiqui, Pr. Sc. presented research activities/highlights of the Institute during XXIV RAC Meeting, ICAR-IINRG, Ranchi, February 27-





28, 2017.

- ❖ Er. SK Pandey, Sc. demonstrated plant and machineries of PD Unit to team of NABARD, March 02, 2017.
- ❖ Dr. SC Sharma, Sc. imparted training on Lac processing (preparation of seedlac from sticklac) to 19 participants sponsored by Trinetra Padum Krushi and Gramin Bahuddeshiya Shikshan Sanstha (TRINETRA), Bhandara (Maharashtra), March 20 -25, 2017.
- ❖ Dr. Thamilarsi K, Sc. imparted project training to one M.Sc. (Biotechnology) student from Ranchi University, Ranchi on the topic, 'Cloning and expression profiling of geranyl pyrophosphate synthase, A putative key gene in resin biosynthesis of the Indian lac insect, *Kerria lacca* (Kerr)', April 06, to October 06, 2017.
- ❖ Following lectures were delivered during 10<sup>th</sup> Summer Workshop on Natural Resins and Gums, to M.Sc. (Zoology) students from Department of Zoology, P.K. Roy Memorial College, Dhanbad (Jharkhand), May 02 to 16, 2017, ICAR-IINRG, Ranchi:
  - ◆ Dr A Mohanasundaram, Sc. delivered three lectures viz. Lac insect life cycle, crop cycle and lac related terminology; Lac associated insect fauna and pest management in lac & Impact of climate change on lac production, May 02, 03 and 05, 2017, respectively.
  - ◆ Er. SK Pandey, Sc. delivered a lecture on Lac-based technologies for entrepreneurship, May 08, 2017 and also demonstrated pilot plant and machineries in PD Unit, May 15, 2017.
  - ◆ Dr. MF Ansari, Sr. Sc. delivered a lecture on Industrial applications of lac, May 09, 2017.
  - ◆ Dr. A Roy Chowdhury, Sc. delivered a lecture cum demonstration on Characterization techniques of natural resins and gums, May 09, 2017.
  - ◆ Dr. RK Yogi, Sc. delivered two lectures viz. Economics and marketing of NRGs & Success stories in lac farming, May 02 to 16, 2017.
  - ◆ Dr. SC Sharma, Sc. delivered a lecture on Processing of lac at small scale – village level entrepreneurship, May 02-16, 2017.
- ❖ Sri Nandkishore Thombare, Sc. delivered a talk on Lac dye based natural alta in workshop on Promotion of lac based industry in Jharkhand organized by ICAR-IINRG Ranchi and Agri Horticultural and Agrorural Industries Committee, Ranchi and sponsored by FICCI, New Delhi, May 06, 2017.
- ❖ Following lectures were delivered during 11<sup>th</sup> Summer Workshop on Natural Resins and Gums, to B.Sc. (Ag.) students, Institute of Agriculture, Banaras Hindu University (U.P.), May 22 to 31, 2017, ICAR-IINRG, Ranchi:
  - ◆ Dr. A Mohanasundaram, Sc. delivered two lectures on Lac insect life cycle, crop cycle and lac related terminology & Lac associated insect fauna and pest management in lac, May 22 and 24, 2017, respectively.
  - ◆ Dr. S Ghosal, Pr. Sc. & Head, LPD Division delivered a lecture on Raising and management of lac hosts, May 23, 2017.
  - ◆ Dr. Thamilarsi K, Sc. delivered a lecture on Role of Biotechnology in lac production, May 25, 2017.
  - ◆ Dr. MF Ansari, Sr. Sc. delivered lecture on Diversified uses of lac, May 25, 2017.
  - ◆ Dr. A Roy Chowdhury, Sc. delivered a lecture cum demonstration on Characterization techniques of natural resins and gums, May 31, 2017.
  - ◆ Dr. RK Yogi, Sc. delivered two lectures on Economics and marketing of NRGs & Success stories in lac farming, May 22-31, 2017.
  - ◆ Dr. SC Sharma, Sc. delivered two lectures on Processing of lac at small scale – village level entrepreneurship & Tapping techniques and tools for resins and gums, May 22-31, 2017.
- ❖ Dr. RK Yogi, Sc. & Nodal Officer, *Krishi* Portal delivered a talk on Data Management of ICAR Research Data Repository for Knowledge Management, ICAR-IINRG, Ranchi, May 24, 2017.
- ❖ Er. SK Pandey, Sc. imparted training on Dewaxed bleached lac to eight persons/entrepreneurs of Tulin, Purulia (West Bengal), June 12 - 21, 2017.
- ❖ Er. SK Pandey, Sc. imparted training on Aleuritic acid and Dewaxed decolourised lac (DDL) to an entrepreneur Mr. Himanshu Agrawal from



Chhattisgarh, July 03 - 13, 2017.

- ❖ Dr. MF Ansari, Sr. Sc. transferred the technology of lac based nail polish 'Natural Nail shine' to Mr. Ronak Rathod from Jamshedpur. Process Know-how of the product was demonstrated to the entrepreneur, July 10, 2017. Institute earned revenue of Rs.10,000/- in the process.
- ❖ Dr. MF Ansari, Sr. Sc. transferred the technology of water thinnable shellac emulsion paint to Mr. Pradeep Pardhi from Balaghat (MP). Process Know-how and preparation of the product was demonstrated to the entrepreneur, August 08-10, 2017. Institute earned revenue of Rs. 10,000/- in the process.
- ❖ Dr. S Ghosal, Pr. Sc. & Head, LPD Division delivered two lectures on Factors affecting lac yield for mukhias participating from different parts of Jharkhand under the programme Doubling farmer's income, Birsa Agricultural University, August 23, 2017 & August 27, 2017.
- ❖ Dr. J Ghosh, Sr. Sc. delivered a lecture on Scientific kusmi lac cultivation on fruit ber varieties and rangeeni lac cultivation on pigeon pea during Field Day, Baijnathata, Angarha, Ranchi, August 28, 2017.
- ❖ Dr. J Ghosh, Sr. Sc. delivered a lecture on Lac cultivation of fruit ber varieties, Jardih, Gutidih Ranchi, September 08, 2017.
- ❖ Dr. MZ Siddiqui, Pr. Sc. presented research activities/highlights of the Institute during 52<sup>nd</sup> Meeting of IMC, ICAR-IINRG, Ranchi, October 06, 2017.
- ❖ Sri Nandkishore Thombare, Sc. delivered a talk on Natural gum based hydrogels: Biomaterials for diverse applications during 52<sup>nd</sup> Meeting of IMC, ICAR-IINRG, Ranchi, October 06, 2017.
- ❖ Dr. A Mohanasundaram, Sc. conducted an On-farm training programme about lac cultivation technique to forty five farmer sunder Network project on Conservation of Lac Insect Genetic Resources in collaboration with cooperating center PJTSAU, Adilabad, Telangana, October 26, 2017.
- ❖ Dr. NK Sinha, Pr. Sc. organized Hands-on-training on mushroom production (under ICAR-funded Farmer FIRST Project), ICAR RCER, RC, Ranchi, October 28, 2017.
- ❖ Dr. MZ Siddiqui, Pr. Sc. & Nodal Officer (HRD) organized five days' training programme on Computer Applications for Skilled Supporting Staff (SSS), ICAR-IINRG, Ranchi, October 30-November 3, 2017.
- ❖ Dr. A Roy Chowdhury, Sc. delivered a lecture on Laboratory/field safety measures to the Skilled Supporting Staff (SSS) of Institute, ICAR- IINRG, Ranchi, November 01, 2017.
- ❖ Dr. MZ Siddiqui, Pr. Sc. presented research activities/highlights of the Institute before Sri Rajan Agarwal, CVO, ICAR, New Delhi, November 13, 2017.
- ❖ Dr. J Ghosh, Sr. Sc. and PI of ICAR-ICRAF Project along with team members organised Kisan gosthis at Ichagarh, Saraikela Kharsawa, November 24, 201 & Torpa, Khunti, November 28, 2018.
- ❖ Dr. J Ghosh, Sr. Sc. briefed the importance of adoption of agriculture as career to XIth standard students of Kendriya Vidyalaya, Namkum, Ranchi on the eve of Krishi Shiksha Diwas-2017, ICAR-IINRG, December 04, 2017.
- ❖ Dr. J Ghosh, Sr. Sc. briefed the importance of adoption of agriculture as career to XIth standard students of Kendriya Vidyalaya, Namkum, Ranchi on the eve of Krishi Shiksha Diwas-2017, ICAR-IINRG, December 04, 2017.
- ❖ Dr. S Ghosal, Pr. Sc. & Head, LPD Division delivered a lecture on Organic farming and addressed kisan gosthi on the occasion of World Soil Day, ICAR-IINRG, Ranchi, December 05, 2017.
- ❖ Dr. SC Sharma, Sc. imparted training on Lac processing (preparation of seedlac from sticklac) to 13 participants sponsored by Udyogini, Ranchi (Jharkhand), December 11 -16, 2017.
- ❖ Dr. MF Ansari, Sr. Sc. transferred the technology of lac based nail polish 'Natural Nail shine' to Mr. Anurag Nilesh Soy from M/s Tofs Magnacraft Enterprises, Ranchi. Process Know-how and preparation of the product was demonstrated to the entrepreneur, December 13-14, 2017. Institute earned revenue of Rs.10,000/- in the process.
- ❖ Dr. J Ghosh, Sr. Sc. imparted training to three students of B.Sc. (Biotechnology) on Influence of





lac insect (*Kerria lacca* Kerr.) on pigeon pea, ICAR-IINRG, Ranchi, December 15, 2016 to January 31, 2017.

- ❖ Dr. S Ghosal, Pr. Sc. & Head, LPD Division delivered a lecture on Strengthening lac cultivation with technological interventions for motivating lac growers, kisan gosthi organized by Chakriya Bikas Sansthan, Hesatu, Ormanjhi, Ranchi, December 16, 2017.
- ❖ Dr. VD Lohot, Sc. conducted 30 days training on Influence of lac insect (*Kerria lacca* Kerr) on biochemical changes in pigeon pea (*Cajanus cajan* L.) germplasm to two B. Sc. (Biotechnology) students from Department of Biotechnology,

Ranchi Women's College, Ranchi for partial fulfillment of the degree, 2017.

- ❖ Dr. VD Lohot, Sc. conducted five months training to B.Sc. (Biotechnology) student from Department of Molecular & Cellular Engineering, Jacob School of Biotechnology & Bioengineering, Sam Higginbottom University of Agriculture, Technology and Sciences, Allahabad (U.P.) on Influence of lac insect (*Kerria lacca* Kerr) on physiology of *Flemingia semialata* (Roxb) for partial fulfillment of the degree, 2017.
- ❖ Dr. SC Sharma, Sc. delivered, below mentioned, lectures on improved equipments for lac

processing and demonstrated Small Scale Lac Processing Unit to beneficiaries (268 Nos.) in 10 batches under training programme on 'Improved Method of Lac Cultivation and Uses', ICAR-IINRG, Ranchi :

Sl. No.	Duration		No. of Participants	Place	Sponsored by
	From	To			
1.	20.02.2017	25.02.2017	22	Chhattisgarh	Chhattisgarh State Minor Forest Produce (Trading & Development) Co-operative Federation Ltd., Raipur
2.	27.02.2017	04.3.2017	29	Chatra, Deoghar	-
3.	14.3.2017	18.3.2017	50	Dumka, simaria (Chatra), Khunti and Gumla	Forest Department
4.	27.3.2017	01.4.2017	16	Mola, Godda, Pakur, Simdega and Chala	Forest Department
5.	03.4.2017	07.4.2017	19	Ram Krishna mission	Torpa Rural Development Society, Torpa, Khunti
6.	17.4.2017	22.4.2017	21	Chauparan and Barkagaon	Forest Department Barhi and Chauparan, Hazaribagh
7.	24.4.2017	29.4.2017	20	Hazaribagh, Saraikela and Chatra	-
8.	05.6.2017	09.6.2017	46	Chhattisgarh, Khunti, Gumla, Bundu and Harzaribagh	-
9.	06.11.2017	10.11.2017	28	Kanker (Chhattisgarh)	-
10.	27.11.2017	01.12.2017	17	Pakur and Giridih	ATMA, Pakur and Forest Department Giridih



## Events-2017

### Meeting-cum-Brainstorming Session on Role of Stakeholders in Market Information System (MIS) for NWFPs

A Meeting-cum-Brainstorming Session on Role of Stakeholders in Market Information System (MIS) for Non Wood Forest Products (NWFPs) was convened at the Institute on February 08, 2017 under the Chairpersonship of Dr. KK Sharma, Director, ICAR-IINRG, Ranchi. Representatives from *Institute of Forest Productivity, Ramakrishna Mission Vivekananda University, IRTDM Faculty Centre, Jharkhand State Agriculture Marketing Board (JHAMCOFED), National Bank for Agriculture and Rural Development (NABARD), Tribal Cooperative Marketing Development Federation of India Limited (TRIFED), Jharkhand State livelihood Promotion society (JSLPS), Jharkhand State Co-operative Lac Marketing & Procurement Federation Ltd (JASCOLAMPF), Udyogini an NGO and ICAR-IINRG* participated in the meeting.

At the outset, the Chairperson welcomed the members. He briefed about the agenda note of this event. Issues related to MIS for NWFPs like haat-wise trade quantity and grade-wise prices, crop condition, crop season, traders, wholesalers, etc. were discussed and the recommendations emerged out of the discussion are as follows:

- ◆ Procurement of NWFPs at MSP is very poor particularly in case of lac and there is need to design a strategic approach for better coverage of the scheme. TRIFED is nodal agency to announce the MSP of NWFPs; State government agencies like JASCOLAMPF and JHAMCOFED should develop the infrastructure for procurement as well as value addition of the identified NWFPs.
- ◆ For value addition in the lac sector, available technologies should be promoted through subsidy to grass root level organizations like SHGs, FPOs as well as individual rural entrepreneurs.
- ◆ To develop any strategy for marketing a NWFPs market database of the state is a pre-requisite condition. For scientific database mapping of all *haats*/markets, a

proformaneds be prepared for preparation of the database.

- ◆ To conduct the survey for database development, internship programmes for the students (UG & PG) may be initiated through MoUs by academic organizations with research & development institutes/ departments.
- ◆ Veg Fed may be invited to join the next meeting expected to be convened in first week of April, 2017.
- ◆ Collection of market based information has been initiated by JASCOLAMPF in Latehar, Gumla, Palamu, Ranchi, Khunti, Garhwa, Saraikela-Kharsanwa, Simdega and West Singhbhum districts of the state. Similarly, JHAMCOFED would cover Ramgarh, Hazaribag, Chatra, Dumka and Godda. Rest of the districts may be covered with the help of JSLPS, JTDS, PRADAN and UDYOGINI.

### Kisan Mela-cum-Technology and Machinery Exhibition-2017

The Annual *Kisan Mela*-cum-Technology and Machinery Exhibition-2017 of ICAR-IINRG, Ranchi was organised on 10th February. The *Mela* was inaugurated by Her Excellency Smt. Droupadi Murmu, Hon'ble Governor of Jharkhand. Sri Ram Tahal Choudhary, Hon'ble Member of Parliament (Lok Sabha), Shri Mahesh Poddar, Hon'ble Member of Parliament (Rajya Sabha), Sri Ram Kumar Pahan, Hon'ble Member of Legislative Assembly as the Special Guest were also present on this occasion. More than 800 farmers and other stakeholders participated in the *Mela*.

Hon'ble Governor of Jharkhand briefed about the importance of lac in the economic upliftment of the farming community including forest dwellers, lac growers and small scale entrepreneurs. In her address, she also appreciated the research and training activities of this Institute. She also expressed her happiness for the intervention of scientific lac production and processing technologies. During her visit at Processing and Demonstration Unit (PDU) of the Institute, she





appreciated hand operated Small Scale Lac Processing Unit. Primary level processing units may be helpful to get better prices. She also honoured progressive lac farmers for their achievement in lac production.

Sri Ram Tahal Chaudhary, Hon'ble Member of Parliament (Lok Sabha) emphasized that lac production is an important source of livelihood security for the lac growers. He asserted that the efforts taken by Institute to generate awareness among the farmers for undertaking scientific cultivation of lac is yielding good results.

Shri Mahesh Poddar, Hon'ble Member of Parliament (Rajyasabha) pointed out the price fluctuation problem in lac sector and suggested for the policy intervention. He opined that market support both forward and backward, is an essential activity to encourage the lac growers.

Dr. KK Sharma, Director, ICAR-IINRG, Ranchi in his welcome address threw light on research achievements, activities and various programmes of the Institute for the welfare of lac farmers.

A *Kisan Gosthi* was also organized wherein experts of the various organizations i.e. ICAR-IINRG, Birsa Agricultural University (BAU), ICAR Research Complex for Eastern Region, Regional Centre (ICAR-RCER RC) and CRURRS, Hazaribagh interacted with farmers and provided solutions to problems faced by farmers in lac cultivation and other agricultural crops.

An exhibition comprising of 24 stalls from different organizations was inaugurated by the Hon'ble Governor. Awards were given to farmers/Lac production entrepreneurs/executive for production and promotion of lac.



Address by the Hon'ble Governor during the inaugural session



Award conferred to different stakeholders for lac promotion by the Chief Guest



Participants in *Kisan Mela-cum-Technology and Machinery Exhibition 2017*



Visit of exhibition stall pavilion by Hon'ble Governor and dignitaries



## National Symposium on 'Recent Trends in Biopolymers'

Two days National Symposium on 'Recent Trends in Biopolymers' was organized jointly by ICAR-IINRG and Society for Advancement of Natural Resins and Gums (SANRAG), at IINRG, Ranchi, February 17-18, 2017.

The symposium was inaugurated by Sri Sudarshan Bhagat, Hon'ble Minister of State for Agriculture and Farmers Welfare, Govt. of India. Sri Bhagat in his inaugural speech appreciated the initiative of the Institute in organizing seminar on topics of importance and hoped that deliberations during the two days event would lead to fruitful recommendations. He exhorted the scientists to make all efforts in doubling the income of farmers. He also released the Souvenir of the symposium during the inaugural session.

Sri Prabhakar Behra, GM NABARD and Sri Sanjay Sen, Chairman, Institute of Engineers (India), Jharkhand State Centre were the Guests of Honour. Er. Sanjay Sen in his address briefed about the activity of Institute of Engineers. He further emphasized on role of agricultural engineers in production, processing and value addition of biopolymers. Sri Prabhakar Behra also addressed the inaugural session and briefed about the activity of NABARD and dwelt on possible collaboration with research organizations in development of biopolymer sector in India.

Dr. KK Sharma, Director, ICAR-IINRG and President, SANRAG while welcoming the distinguished guests and participants briefed about the objective of the symposium and the achievements of the Institute.

The National Symposium was attended by 77 participants from different parts of the country. The presentations were made by distinguished invited scientists followed by oral and poster presentations by participants. 62 oral, 21 poster presentation and 8 invited lectures were delivered during the National Symposium. The oral presentations were made in five technical sessions under five thematic areas as i) Approaches in Production of Biopolymers; ii) Modern Techniques of Synthesis and Characterization; iii) Advancement in Processing and Value Addition; iv) Bio-technological/ Nano-technological interventions and v) Applications of Green and Sustainable Polymers.

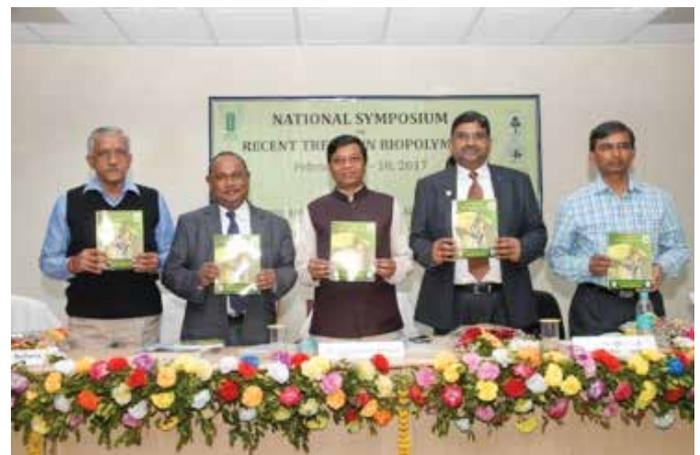
Major recommendations that emerged during the

deliberations were:

- ❖ Shellac based hydrogel can also be utilized in biomedical field of research and found to be suitable for targeted drug delivery for colon specific applications.
- ❖ Polysaccharides may serve as Gels and Associating Polymers in biomedical applications due to their excellent properties such as biodegradability, biocompatibility, non-toxic nature, renewability and availability in abundance.
- ❖ Water Soluble Polymers (WSPs) show tremendous applications especially in the areas like toothpaste, soap and detergent, food, leather etc. due to their properties to act as thickening agent, stabilizing agent, moisture retention agent and flocculating agent.



Hon'ble Minister of State addressing the delegates



Release of the Souvenir by the dignitaries





Inauguration of the Symposium by the Chief Guest



Delegates during the Technical Session

### Workshop for District Development Officers of NABARD

A workshop on 'Lac Cultivation, Processing & Economic Model' for District Development Officers of National Bank for Agriculture and Rural Development (NABARD) was organized on 2nd March, 2017 at ICAR-IINRG, Ranchi. In the inaugural session, Chief General Manger, NABARD, in his Key note address, emphasized that high value crops like lac should be priority area to promote rural entrepreneurship and farmers' share in consumer rupee need to be increased for their betterment. He also informed about the exposure visits conducted for the officials of NABARD to update the knowledge. He suggested that lac farming may be a potential sector for the state as 29 % areas under forest and 26% population belongs to tribal community.

Dr. KK Sharma, Director in his welcome address threw light on research achievements, activities and various programmes of the Institute for the welfare of lac

farmers as well as women empowerment through lac based women friendly activities like handicraft making, scrapping of lac, bundling of broodlac, Lac Integrated Farming System (LIFS), etc. He mentioned that despite lac being a remunerative source of income, farmers switch over from the lac cultivation to other activities due to wide price fluctuation. He advised the official to make the farmers aware on this aspect.

During the Technical Session, Dr. RK Yogi, Sc. discussed on Economics of Lac Cultivation and Bankable Models. He presented a total of six lac based models for livelihood security. Dr. SS Bhat demonstrated to the participants, the principles and practices of lac cultivation on major hosts like *semialata*, *ber*, *kusum* and *palas*, besides the lac integrated farming system approach. Economics of the lac cultivation on different hosts and the integrated approach of lac cultivation with different vegetables and fruits were also discussed. In this regard, field visit to the Institute Research Farm was conducted for the participants and in-field information delivered. During the visit in museum, stakeholders got the overview about the production, processing and value addition aspects of lac with the special emphasis on its major application areas. Later, in an exposure visit to the Product Demonstration Unit of the Institute, Er. SK Pandey, Sc. and Dr. SC Sharma, Sc. demonstrated the use of various lac processing machineries, the integrated processing unit and the pilot plant on aleuritic acid. Also, exposure visit to ICAR-Indian Institute of Agricultural Biotechnology Ranchi was coordinated, where Dr. VP Bhadana, Pr. Sc. explained the different activities carried out at the Institute.

Two technical bulletins on Bankable projects and Lac Integrated Farming System were distributed among the participants. A total of 23 officials including General Manager (GM) and District Development Managers (DDMs) participated in the programme.



Interaction with participants by the dignitaries





Visit of participants with dignitaries at the Institute Museum



Inaugural Session : Participants of the Workshop

### 1<sup>st</sup> Meeting of Jharkhand State Coordination Committee on Doubling of Farmers' Income

Jharkhand State Coordination Committee Meeting on Doubling of Farmers' Income by, 2022 was held at Birsa Agricultural University, Ranchi (Jharkhand) on April 06, 2017.

Dr. KK Sharma, Director, ICAR-IINRG, Ranchi and Convener of the meeting briefed about the objectives of the meeting and outlined the major areas and their scope to prepare concrete action plan.

Dr. P Kaushal, Vice-Chancellor, Birsa Agricultural University, Ranchi and Chairperson of the Committee emphasized to focus on major field and horticulture crops, fisheries, Non Wood Forest Products and dairy

sectors, value addition/post harvest management, integrated farming systems, agri- entrepreneurship and region specific technologies needs for doubling the farmer's income in the state of Jharkhand.

A broad framework under four categories viz., (i) Research and development; (ii) Policy interventions; (iii) Infrastructure development and (iv) technology transfer to the stake holders was prepared for developing action plan.

Official of State Government, representatives from State Agricultural University, other ICAR Institutes, Tasar Research Institute and Line Departments from Jharkhand participated in the meeting.

### 2<sup>nd</sup> Meeting of Jharkhand State Coordination Committee for Doubling of Farmers' Income

Jharkhand State Coordination Committee Meeting for Doubling of Farmers' Income by March, 2022 was held on 13<sup>th</sup> April, 2017 at Birsa Agricultural University, Ranchi (harkhand).

Vice-Chancellor, Birsa Agricultural University, Ranchi and Chairperson of the Committee briefed about the role of Line Departments in developing a road map and its implementation by them to realize the objective in next five years by taking 2016-17 as base year.

Dr. KK Sharma, Director, ICAR-IINRG, Ranchi as Convener presented a concrete action plan including technological and policy interventions for the state. He briefed about the major bottlenecks including scattered land holdings, poor irrigation infrastructure, low input use, acidic soils, open grazing in rabi season, inadequate supply of quality seed and planting material. He also outlined the major crop/enterprise specific interventions needed to get rid of the constraints faced by the farmers of the state and highlighted the major policy issues related to Non-Wood Forest Products like Lac, Tasar, etc.

Enhancing the gross income, reduction in the costs and stabilizing the income in the context of Jharkhand were also discussed in the meeting. The Committee emphasized to focus on major field crops (rice and pigeon pea) and horticulture crops (Mango, Jackfruit, fisheries, Non Wood Forest Products (Lac, Tasar, Tamarind, *Chironjee*, etc.) and dairy sectors, water conservation, value addition/post harvest management and integrated farming systems.

More than 20 members, co-opted members from ICAR-IINRG; ICAR-IIAB, Ranchi; Birsa Agricultural University, Ranchi; National Bank Agricultural and Rural



Development (NABARD); National Dairy Development Board (NDDB); various Line Departments like JASCOLAMPF; Department of Animal Husbandry, Govt. of Jharkhand; NGOs, etc. Dr. Virendra Singh, Directorate of Rice Development and Sri VK Bhalla, Under Secretary, Ministry of Food Processing Industries, New Delhi were also present as Nominee Members.



Committee deliberations under progress

### Summer Students Workshops on 'Natural Resins and Gums'

10<sup>th</sup> Summer Student Workshop on Natural Resins and Gums was organized by ICAR-IINRG during May 02-16, 2017. The fifteen day workshop was especially organized for 20 PG students of M.Sc. (Zoology with Entomology specialization) from PK Roy Memorial College, Dhanbad (Jharkhand). Theme of the Workshop was 'Educational

Training on Natural Resins and Gums'. The workshop was inaugurated by Dr. KK Sharma, Director, ICAR-IINRG, Ranchi on 2<sup>nd</sup> May, 2017. He emphasized that lac insect is the major beneficial insect besides honeybee and silk producing insect. Students were advised to interact with faculties and ask question to clarify their doubts. An interaction session with trainee students and experts was also conducted.

The valedictory function of the workshop was organized on 16<sup>th</sup> May, 2017. Dr. AK Jaiswal, Head, TOT interacted with the students to get their feedback for improvement in the in future programmes. The experts, scientists and staff of the Institute also attended the Valedictory function . Workshop was coordinated by Dr. SKS Yadav, Sc., TOT Division.

11<sup>th</sup> Summer Students Workshop on Natural Resins and Gums was organized by ICAR-IINRG during May 22-31, 2017. The workshop commenced with the interaction of the students and experts on May 22, 2017. The ten-day Workshop was attended by forty five UG B.Sc.(Ag.) students from Institute of Agricultural Sciences, Banaras Hindu University (BHU) Varanasi. The students were from Nepal (5) and the states of Uttar Pradesh (16), Bihar (12), Madhya Pradesh (3), West Bengal (3), Jharkhand (2), Assam (1), Andhra Pradesh (1), Rajasthan (1) and Telangana (1).

The Valedictory function of the workshop was organized on 31<sup>st</sup> May, 2017. Dr. AK Jaiswal, Head, TOT & Convener of the Workshop informed that Institute has strengthened its extension activities and also regularly organizing training programmes for students. Dr. KK Sharma, Director of the Institute interacted with the students to get their feedback for improvement in the future programmes. He was hopeful that students will play a vital role in creating awareness in public about natural resins and gums and work as ambassadors of ICAR-IINRG, Ranchi. The experts, scientists and staff of the Institute also attended the Valedictory function. Dr. AK Singh, Sr. Sc. and Dr. SKS Yadav, Sc. were the Co-convener of the Workshop.





Trainee students of 10<sup>th</sup> Workshop with experts and Director, ICAR-IINRG



Trainees student of 11<sup>th</sup> Workshop during visit to the Product Demonstration Unit of the Institute



Trainee receiving the certificate from the Director, ICAR-IINRG

The theme of the Workshop was 'Educational training on lac production; tapping, processing and applications of natural resins and gums'. Students were educated about processing of natural resins like lac, rosin, oleo-resins and their industrial applications. Training was also imparted about exudates as well as seed gums. Topics on harvesting/tapping, collection, processing, quality control and their value addition and industrial uses were also covered. An industrial visit to expose the students about various processes in refinement of lac, its value addition and extraction of lac dye was also conducted to M/s Indian Shellac Industry, Khunti. Exposure-cum-educational visit to ICAR-Research Complex for Eastern Region Ranchi Centre, Central Tasar Research and Training Institute, Nagri, Ranchi and Honeybee Production Unit of Divyayan Krishi Vigyan Kendra, Ram Krishna Mission Ashram, Mohrabadi, Ranchi was also organized to acquaint them with horticulture, silk, honeybee production and management for biodiversity conservation and ecological security.

### Workshop on 'Promotion of Lac Based Industry in Jharkhand'

A one-day workshop on 'Promotion of Lac Based Industry in Jharkhand' was organized jointly by ICAR-IINRG and Agri-Horticulture & Agro-Rural Industries Committee, Federation of Jharkhand Chamber of Commerce & Industries (FJCCI) on 6<sup>th</sup> May, 2017 at ICAR-IINRG, Ranchi. Fifty stakeholders including industrialists, exporters, officials from Jharkhand State Co-operative Lac Marketing & Procurement Federation Ltd. (JASCOLAMPF), academic institutes like Birsa Agricultural University (BAU), Xavier Institute of Social Service (XISS) and Ramakrishna Mission Vivekananda University (RKMVU) and scientists of ICAR- IINRG, Ranchi participated in the Workshop.

Sri Anand Kothari, Chairperson, Agri-Horticulture & Agro-Rural Industries Committee (FJCCI) Ranchi, in his key note address emphasized that high value crops like lac should be priority area to promote rural entrepreneurship for farmers through the industrial support for value addition. He suggested that lac farming has a good potential for the state as about 8-9 lakh households belonging to tribal community are engaged in lac farming and earning their livelihood. Jharkhand being the largest producer of lac, he exhorted the entrepreneurs to take up lac based industrial activities on large scale.





Dr. KK Sharma, Director in his welcome address threw light on research achievements, activities and various programmes of the Institute for the welfare of lac farmers as well as microenterprise development through lac based eco-friendly activities like handicraft making, Lac Integrated Farming System (LIFS), etc. He also informed that the Institute is actively involved in conducting capacity building programs and has large number of technologies in its basket to offer for entrepreneurship development.

Sri RK Kapoor, Director, MSME, Ranchi briefed about the various schemes for micro, small and medium level enterprises and also assured to include the Small Scale Lac Integrated Processing Unit developed by ICAR-IINRG in their schemes.

During the Technical Sessions, ICAR-IINRG experts delivered presentations on lac cultivation on *Flemingia semialata*; lac processing and value addition related commercializable technologies viz., Integrated Small Scale Lac Processing Unit, Lac dye based natural alta, water soluble lac, water thinning paint & nail polish, natural fruit coating formulation for Kinnow and vegetable/spices coating of the Institute. Discussion on the potential of organized trading was also conducted. During the visit in museum, stakeholders got the overview about the production, processing and value addition aspects of lac with the special emphasis on its major application areas. Three technical bulletins on Recent Technologies at a Glance, Bankable Projects and Lac, Plant Resins and Gums Statistics were distributed among the all the participants.



Director, ICAR-IINRG addressing the participants



Deliberations in progress

### Interaction Meet on 'Research for Development' with DC, Khunti District

An interaction meet on 'Research for development' was organized at the Office of Deputy Commissioner, Khunti on 7<sup>th</sup> July 2017. Dr. Manish Ranjan, DC, Khunti welcomed Director, Dr. KK Sharma, ICAR-IINRG, Ranchi. In his welcome address, Mr. Ranjan briefed about the need of technological interventions for lac cultivation activities in the Khunti district. He asked for the promotion of potential lac areas and the role of ICAR-IINRG may play in this activity. Dr. KK Sharma, Director outlined the available technological interventions and their impact on rural economy of this district. He also briefed about the achievements of a project conducted during 2012-2016 and sponsored by the District Planning Office, Khunti. Possible way outs for the promotion of lac cultivation, processing and value addition in the district were also discussed by him. Action plan for doubling the income of farmers was also discussed with the concerned officials.

During interaction session, Dr. RK Yogi, Sc., ICAR-IINRG, Ranchi delivered a presentation on 'Research for Development' and the possibilities of promotion of lac cultivation activity among the forest dwellers. Dr. Ranjan also agreed to promote the lac cultivation in the district and pointed out to prepare a list of the interested lac cultivators to join the training programme under capacity building at ICAR-IINRG, Ranchi by the next week. Stakeholders including the staff of DC office, Department of Agriculture, NGOs, etc. were present on this occasion. During this visit, a weekly local market was also visited and interacted with lac market functionaries.



### Interaction Meeting of Secretary, DARE and DG, ICAR with NARS Scientists of Jharkhand

Dr. Trilochan Mohapatra, Secretary, DARE & DG, ICAR visited ICAR-IINRG and ICAR-IIAB, Ranchi on July 23, 2017. He visited laboratories and Institute Research Farm of the Institute and interacted with more than 100 scientists and other staff of local ICAR Institutes viz., ICAR-IINRG, ICAR-IIAB, Ranchi; ICAR-RCER-RC, Plandu, ICAR-CRRUHS, Hazaribag, Birsa Agriculture University, Ranchi and Programme Coordinators from various KVKs located at Jharkhand at ICAR-IINRG, Ranchi.

While addressing the scientists, he also emphasized on working for doubling farmer's income. He urged the researchers to prioritize work in order to provide goal oriented results. Intensive and aggregated efforts always lead to better performance with in the available resources, he added. He dwelt upon the various structural and administrative reforms being taken up by the ICAR to increase efficiency of the organization. He also addressed the issues raised by the scientists especially of KVK relating to manpower shortage and recruitment and promotions.

Earlier, Dr. KK Sharma, Director formally welcomed the DG and briefed about the achievements and activities of the Institute. Dignitaries present on the occasion were Dr. BP Bhat, Director, ICAR-RCER, Patna, Dr. P Kaushal, V-C, BAU, Dr. Anjani Kumar, Director, ATARI, Patna and DR. TR Sharma, Jt. Director, ICAR-IIAB, Ranchi.

The Director General, ICAR planted a sapling in the Institute Research Farm of ICAR-IINRG.



DG, ICAR addressing the scientists



DG, ICAR planting a sapling at IRF of ICAR-IINRG

### Parthenium Awareness Week

The ICAR-IINRG observed 12<sup>th</sup> 'Parthenium Awareness Week' during August 16-22, 2017. The programme started with the inaugural address of the Director, Dr. KK Sharma. He illustrated that the objective of organizing this event was to create awareness among the people regarding parthenium, a national weed as well as its ill-effect on human beings, animals, agriculture and available strategies to manage the weed on eco-friendly basis in different situations.

Dr. Sharma stressed for its control by adopting the integrated Cultural, Chemical and Biological Methods. He reiterated to acquaint the people about this obnoxious weed. Thereafter, a presentation was made by Dr. NK Sinha, Sr. Sc. on 'parthenium hysterophorus L.: An obnoxious weed, its spread, menace, utilization and management strategy in India'. For the awareness week, posters containing identification of weed, ill effect caused by parthenium, management through botanicals, Mexican beetle and weed utilization were displayed.

Besides, video documentary film prepared by DWSR, Jabalpur on parthenium giving all information about the weed including management strategies and utilization aspect was also screened. A drive was also launched for uprooting of parthenium within and around the Institute Campus. All officials including scientific, technical, administrative and supporting staff participated in the programme. The event was given wide publicity in local newspapers for generating awareness among the masses. The programme was co-ordinated by Sri Asish Kumar Rout, Sc.



Glimpses of Parthenium uprooting

### Focus Group Discussion on 'Minimum Support Price for NWFPs'

A Focus Group Discussion (FGD) on 'Minimum Support Price for NWFPs' was organized jointly by ICAR-IINRG and The Energy and Resources Institute (TERI), New Delhi on 15<sup>th</sup> September, 2017 at ICAR-IINRG, Ranchi.

Chief Guest, Dr. Sanjay Kumar, IFS Principal Chief Conservator of Forests & Head of the Forest Force (HoFF), Forests, Environment and Climate Change Department, Government of Jharkhand in his keynote address emphasized on social, environmental and economic factors in determination of the Minimum Support Price (MSP). He also suggested considering the interclass conflict issues amongst stakeholders while fixing the MSP and establishing the middleman as market agent with normal profits.

In his welcome address, Director, ICAR-IINRG threw light on the importance of MSP for weaker sections of the society. He also opined that fixing of MSP as well as its efficient execution by the federations is very important.

In his Introductory remarks Dr. JV Sharma, Director, TERI, briefed that MSP for 11 MFPs (Lac including *rangeeni* and *kusmi*, *tamarind* with seed, honey, gum *karaya*, *sal* seed, *mahua* seed, *sal* leaves, *chironjee* pods with seeds, Myrobalam) is already in operation. In addition, FGD will decide Minimum Support Price (MSP) of 14 NWFPs more including *bahera* (*Terminalia bellerica*), *shikakai* (*Acacia concinna*), dried *bael* (*Aegle marmelos*), Nagarmotha (*Cyperus rotundus*), Kalmegh (*Andrographis paniculata*), Dried Shatavari (*Asparagus racemosus*), *Kusum* seeds (*Schleichera oleosa*), Puwad seeds (*Cassia tora*), neem seeds (*Azadirachta indica*), Deseeded Tamarind (*Tamarindus indica*), Hill broome grass (*Thysanolaena maxima*), guggul exudates (*Commiphora mukul*), *palas* flowers (*Butea monosperma*) and Gudmar (*Gymnema sylvestre*). Thus, a total of 25 MFPs are targeted to be covered under the scheme MSP for MFPs.

During the various specific deliberations, commodity based questionnaires were discussed. Deseeded tamarind, *palas* flowers, *bahera* were considered as major MFPs in the state, while Kalmegh, *Kusum* seeds, Puwad seeds, etc. were considered as minor products. JHAMCOFED also proposed new commodities including Kaunch seed, wild mango, *palas* seed and dry plume for inclusion under the MSP scheme.

Other dignitaries present were Dr. SA Ansari, Director, IFP, Officials from TRIFED, JASCOLMPF, JHAMCOFED, JTDS, Scientists, Commodity Experts from ICAR-IINRG,



IFP, RKMVU, JSLPS, TRDS and Resource Persons from the federations, local NGOs and Line Departments along with 30 stakeholders and contributed their part in the focused group discussion during the two technical sessions.



Interaction with participants by dignitaries



Participants in the workshop

## 94<sup>th</sup> Foundation Day

ICAR-IINRG celebrated its 94<sup>th</sup> Foundation Day on September 20, 2017. Chief Guest, Dr. VM Mayande, Vice-Chancellor (Retd.), Dr. Panjabrao Deshmukh Krishi Vidyapeeth (Agricultural University), Akola, Maharashtra delivered 7<sup>th</sup> Ms Dorothy Norris Memorial Lecture in the honor of Founder Director of the erstwhile Indian Lac Research Institute on this occasion. He emphasized upon Role of Farm Engineering in Enhancing Agriculture Production and Farmers Income. He told that any value chain of the agricultural commodity may not be completed without intervention of farm engineering as farm engineering includes various field of engineering i.e. Land and Water Engineering, Irrigation and Drainage

Engineering, Farm Mechanization, Energy Management, Agro-process and Food Engineering and Agriculture Electronics. He emphasized that farm engineering may be incorporated at different stages of agricultural production to enhance productivity and doubling farmers income. Dr. AK Singh, Head, ICAR - Research Complex for Eastern Region, Research Centre, Ranchi who graced the occasion as Guest of Honour opined that Farm Engineering had played and continue to play an important role in production agriculture with improved technology for reducing input cost.

Earlier, while welcoming the guests and audience, Dr. KK Sharma, Director dwelt upon the recent achievement of the Institute. Dignitaries and scientists from ICAR-IIAB, Ranchi; ICAR-RCER; Regional Station of NBPGR, Ranchi and other officials from different organizations participated in the programme. During the programme, MoU for commercial production and sale of Small Scale Lac Processing Unit was also renewed between ICAR - IINRG, Ranchi and M/s National Enterprises, Hatia, Ranchi for a period of five years.

Distinguished workers of the Institute in various categories were felicitated during the function. Dr. RK Yogi (Category: Scientist), Sri Anup Kumar and Sri Binod Kumar (Category: Technical), Sri Ashwini Kumar (Category: Admin.), Sri Madhi Kachhap and Smt. Mariyam (Category: SSS) were awarded with certificates and mementos for their outstanding contributions in their sphere of work. Dr. Niranjana Prasad, Convener proposed vote of thanks. Er. SK Pandey and Dr. SC Sharma were Co conveners of the Foundation Day programme.

A cultural event was organized in the evening where in employees of the local ICAR Institutes along with their family members were present.

Institute also observed open day on 19<sup>th</sup> September, 2017 for the students in which 850 students from nine schools of the city visited the Institute. An exposure-cum-educational visit of Institute Research Farm was organized to show the students different lac hosts and standing crop of lac along with lac insect. They were shown around the NRG Museum and a documentary on lac was screened for them. Students were also educated about the importance of cleanliness and shown the motivational video film on Swachhata.





Dignitaries inaugurating the Foundation day programme



Dr. VM Mayande delivering 7<sup>th</sup> Ms Dorothy Norris Memorial Lecture



Exchange of MoU for commercial production and sale of Small Scale Lac Processing Unit



Open Day for students from different school

### Vigilance Awareness Week

ICAR-Indian Institute of Natural Resins and Gums, Ranchi observed Vigilance Awareness Week on the theme 'My Vision-Corruption Free India' during 30<sup>th</sup> October to 4<sup>th</sup> November, 2017. To begin with, Director, Dr. KK Sharma administered Vigilance Awareness Pledge to all the staff members on 30<sup>th</sup> October, 2017.

A Guest lecture by Sri Sandeep Raj, IRS and Chief Vigilance Officer, CMPDI, Ranchi was delivered on Nov. 02, 2017. Speaking on the occasion he said that awareness paves the way for transparency in every field of society. He said that honesty & devotion towards duty is most important aspect for public servants; it makes us efficient and opens the way of development. He observed that corruption is the biggest obstacle on the way of development and stressed the need to eradicate it by adopting transparency and responsibility in official work. He appreciated the use of technology in combating corruption. In his welcome speech Director (Actg.), Dr. Nirmal Kumar apprised him of the activities of the institute and the vigilance awareness in context of institutional work. All the staff members including divisional and sectional Heads were present in the programme.

Under the MGMG programme, teams of scientists and technical officers conducted different activities at Government Schools of Pithoria, Mangobandh, Tati Singari, Sarjandih, Jaradih, Beniyajara, Hurda and Gutidih villages during the week. The teams contacted the local functionaries and invited them to join the Integrity Pledge at the School. Students and farmers were made aware through lectures and discussions, the importance of the Vigilance Awareness. Respective MGMG Team Leaders read out the Integrity Pledge to be honest and transparent followed by the students and the villagers. It was emphasized during the discussion that corruption impedes the economic growth, distorts completion; adversely impacts the rate of investment and undermines the moral fabric of the society. In order to eliminate corruption there is a need for all stakeholder to work together to develop and implement effective mechanism.

On this occasion quiz competitions were also organized for the Primary, Middle and Senior class students of different Schools and the winner students were honoured with Awards. Scientists also briefed the students and the villages about the importance of sanitation in daily life and *Swacha Bharat Abhiyan*. Villages were also informed about energy efficient



technologies and were encouraged to use LED lights to save energy. On this occasion about 500 stakeholders including the junior, middle and senior school students, villagers, members/officials of local governing bodies from the various villages actively participated.



Director, ICAR-IINRG administering the Integrity Pledge to the employees of the Institute



Dr. Nirmal Kumar welcoming the Chief Guest, CVO, CMPDI



Students and the ICAR-IINRG MGMG Team taking the Integrity Pledge



ICAR-IINRG MGMG Team interacting with the students

### 9<sup>th</sup> Annual Workshop of Network Project on 'HPVA of NRGs'

The 9<sup>th</sup> Annual Workshop of Network Project on Harvesting, Processing and Value Addition of Natural Resins and Gums (NP-HPVA of NRGs) was held on November 01-02, 2017 at Indira Gandhi Krishi Vishwavidyalaya, Raipur (Chhattisgarh) to review the annual progress of the Network Project centres and to discuss the technical programmes for the year 2017-18.

The meeting started with the welcome address by Dr. S Patel, Professor, IGKV, Raipur & PI, Network Project on HPVA of NRG followed by felicitations of the dignitaries present on dais. Dr. N Prasad, Coordinator, Network Project on HPVA of NRG, ICAR-IINRG, presented brief overview of the Network Project. Dr. KK Singh, ADG (Farm Engineering), ICAR, New Delhi and Chief Guest on the occasion delivered presidential address. In his address, he emphasized that the focus should be on the small projects with low cost, high energy efficiency and sparkling output. He stressed that Network Project centres should develop mechanized harvesting system for natural resins & gums (NRGs) and processing and value addition of NRGs so that the small farmers be benefitted. He further added that it is the need of the hour to diversify and intensify the research activities under networking for the benefits of the farmers. Dr. SN Jha, ADG (Process Engineering), ICAR, New Delhi and Guest of Honour on the occasion expressing his concern said that the significant and concrete achievements should be the aim and more networking/collaborations



in this direction are required. He also impressed that beneficiaries contact details be maintained and transmitted to the authorities as & when desired by them. He further added that all Network Project centres should also have more high impact NAAS indexed research publications and patents.

Dr. SS Rao, DRS, IGKVV and Dr. Vinay K Pandey, Dean, SVCAET & RS, IGKVV, Raipur expressed their views and appreciated the efforts and achievements of all the Network Project centres. Dr. KK Sharma, Director, ICAR-IINRG, Ranchi and Guest of Honour on the occasion highlighted the achievements of the Network Project centres and emphasized that the value addition of gums and resins be carried out on larger scale so that the products based on gum and resin are developed. The entire programme was admirably anchored by Dr. Jogdand, IGKVV, Raipur.



9<sup>th</sup> Annual Workshop of NP-HPVA of NRGs

### 5<sup>th</sup> Coordination Committee Meeting of Network Project on 'CLIGR'

5<sup>th</sup> Coordination Committee Meeting of NP-CLIGR (Network Project on Conservation of Lac Insect Genetic Resources) was held on 14<sup>th</sup> and 15<sup>th</sup> November, 2017 at Punjab Agricultural University, Ludhiana. The meeting was chaired by Dr. KK Sharma, PC, NP-CLIGR and Director, ICAR-IINRG, Ranchi. PIs, Co-PIs, RAs and SRFs of the centres attended the meet. In the inaugural address, Dr. PK Chhuneja, Head of Entomology, PAU, Ludhiana stressed on the importance of conservation of lac insects bio-diversity as it is very essential for maintenance and sustenance of the ecosystem. Dr. KK Sharma, PC, NP-CLIGR and Director addressed the gathering by emphasizing the importance of lac in various fields especially in providing livelihood support to tribes and rain fed farming community. Integration of lac cultivation with agriculture and horticulture may increase the income of farmers by 15-20% which would play a significant role in achieving the doubling farmers' income by 2022. In the technical session, PIs of all network centres, i) Punjab Agricultural University, Ludhiana, ii) Assam Agricultural University, Jorhat, Assam, iii) Kerala Forest Research Institute, Thrissur, Kerala, iv) Central Agricultural University, Imphal, Manipur, v) Sher-e- Kashmir University of Agricultural Sciences and Technology, Jammu, vi) Maharana Pratap University of Agriculture and Technology, Udaipur, vii) State Forest Research Institute, Jabalpur and viii) the lead centre, ICAR-IINRG presented the annual progress of research activities and technical programme for the next year. The progress was reviewed positively and recommendations were given to networking partners to improve the performance of the project by the PC, NP-CLIGR. The meeting ended with a vote of thanks by Dr. KS Sangha, PI, PAU Ludhiana centre.





5<sup>th</sup> Coordination Committee Meeting of NP-CLIGR

**DDG (Engg.) visits ICAR-IINRG**

Dr. K Alagusundaram, DDG (Engg.), ICAR, New Delhi visited ICAR-IINRG on November 22-23, 2017. Since, it was his first visit, he was shown around the Institute Research Farm, Museum, Research Laboratories, Product Demonstration Unit and was apprised of the on-going research projects at the Institute.

During his interaction with scientists, technical staff, RAs and SRFs, he emphasized on the need to work on biodegradable plastic films, edible packaging of food and dairy products and advised the scientists to take up the research projects on biopolymers of applied significance. He suggested further widening the mandate of the Institute to include research work on biopolymers of agricultural / international importance.

He was impressed by the fact that natural resins and gums play a vital role in the livelihood and income generation of the downtrodden strata of society and the Institute is smoothly doing good work in this direction.





Glimpses of the DDG's visit to ICAR-IINRG

## कृषि शिक्षा दिवस

भारतीय प्राकृतिक राल एवं गौंद संस्थान द्वारा देश के प्रथम राष्ट्रपति भारत रत्न स्व. डॉ. राजेन्द्र प्रसाद की जन्म तिथि (03 दिसम्बर) के उपलक्ष्य में 04 दिसम्बर 2017 को कृषि शिक्षा दिवस का आयोजन किया गया। संस्थान के निदेशक डॉ. के. के. शर्मा ने इस अवसर को कृषि शिक्षा के प्रोत्साहन दिवस के रूप में मनाए जाने की अपील की। इसके अन्तर्गत केन्द्रीय विद्यालय, नामकुम के प्लस टु विज्ञान के छात्र/छात्राओं के लिए व्याख्यान का आयोजन किया गया। कृषि शिक्षा के महत्व विषय पर जानकारी देते हुए संस्थान के वरिष्ठ वैज्ञानिक डॉ. ज्योतिर्मय घोष ने कृषि में वैज्ञानिक हस्तक्षेप की आवश्यकता पर चर्चा की तथा जीडीपी में कृषि के महत्व के बारे में बताया। उन्होंने प्रवेश परीक्षाओं एवं संस्थानों के बारे में भी जानकारी दी। कृषि विज्ञान केन्द्र, खूंटी के प्रमुख डॉ. समर पाल सिंह ने भारतीय कृषि अनुसंधान परिषद एवं राज्य कृषि विश्वविद्यालयों के पाठ्यक्रमों, प्रवेश परीक्षा व मिलने वाली छात्रवृत्ति की विस्तृत जानकारी दी। उन्होंने आज की चुनौतियों को देखते हुए कृषि शिक्षा को सर्वाधिक महत्वपूर्ण बताया तथा कहा कि शिक्षा के किसी क्षेत्र की तुलना में कृषि शिक्षा में रोजगार की संभावना ज्यादा है। कार्यक्रम में केन्द्रीय विद्यालय की प्राचार्य श्रीमती वीणा तिकी उपस्थित थी। कार्यक्रम का संचालन व विषय प्रवेश डॉ. अंजेश कुमार ने तथा

धन्यवाद ज्ञापन वरिष्ठ शिक्षक श्री आर एन चौधरी ने किया।

## हिन्दी कार्यशाला-सह-व्याख्यान

भारतीय प्राकृतिक राल एवं गौंद संस्थान में 07 दिसम्बर 2017 को अपराह्न 03.00 बजे एक्युप्रेशर एवं वैकल्पिक चिकित्सा विषय पर हिन्दी कार्यशाला सह व्याख्यान का आयोजन किया गया।

अतिथि वक्ता के रूप में उपस्थित श्री अमरनाथ मिश्रा, भारतीय पुलिस सेवा (सेवानिवृत्त) एवं एक्युप्रेशर विशेषज्ञ ने एक्युप्रेशर एवं वैकल्पिक चिकित्साविषयपर बोलते हुए कहा कि मानव शरीर में एक सक्षम प्रतिरक्षण प्रणाली है तथा हमें उस प्रणाली को लगातार और भी सशक्त बनाए रखना चाहिए, ताकि हमारा शरीर स्वस्थ रह सके। एक्युप्रेशर शरीर के विभिन्न स्थानों पर निर्धारित कुछ बिन्दुओं पर दबाव के द्वारा किया जाने वाला एक चिकित्सा पद्धति है, जिससे शरीर के सामान्य रोगों के साथ-साथ जटिल रोगों पर भी नियंत्रण प्राप्त किया जा सकता है। उन्होंने बताया कि वैकल्पिक चिकित्सा के रूप में कुछ ऐसे साधन उपलब्ध हैं, जो प्रचलित इलाज से अलग है तथा इसका शरीर पर कोई हानिकारक प्रभाव नहीं पड़ता है।

संस्थान के निदेशक डॉ. केवल कृष्ण शर्मा ने अपने स्वागत भाषण में कहा कि स्वास्थ्य किसी भी व्यक्ति की सबसे बड़ी पूँजी है तथा स्वस्थ शरीर में स्वस्थ मन का निवास होता है। उन्होंने बताया कि आयुष मंत्रालय के माध्यम से सरकारी स्तर पर भी प्राकृतिक चिकित्सा एवं वैकल्पिक चिकित्सा पद्धति को बढ़ावा दिया जा रहा है। डॉ. शर्मा ने कहा कि हमें केवल औषधि पर ही निर्भर नहीं रहना चाहिए बल्कि अपने को स्वस्थ बनाए रखने के लिए पारम्परिक प्राकृतिक साधनों का भी इस्तेमाल करना चाहिए।

कार्यक्रम का संचालन डॉ. अंजेश कुमार एवं धन्यवाद ज्ञापन प्रौद्योगिकी हस्तांतरण विभाग के अध्यक्ष डॉ. निर्मल कुमार ने किया।

इस कार्यक्रम में संस्थान के सभी अधिकारियों/कर्मचारियों के अतिरिक्त श्री उमेश कुमार सिंह, भारतीय पुलिस सेवा (सेवानिवृत्त आरक्षी महानिरीक्षक) ने भी भाग लिया।



## Meetings of Important Committees

### Research Advisory Committee (RAC)

The XXIV Research Advisory Committee (RAC) meeting of the Institute was held during February 27 to March 01, 2017 under the Chairmanship of Prof. SM Ilyas, Former Director, ICAR-NAARM, Hyderabad, in the Kusmi Conference Hall of the Institute. At the outset, Dr. S Srivastava, Pr. Sc. & Member- Secretary, RAC welcomed the Chairman and Members. The following members were present:

- ❖ Prof. SM Ilyas, Former Director, NAARM, Hyderabad - Chairman
- ❖ Dr. KK Singh, ADG (Farm Engineering), ICAR, New Delhi - Member
- ❖ Dr. DC Joshi, Dean, Anand Agricultural University, Anand, Gujarat - Member
- ❖ Dr. AK Srivastava, Head, FMP Department, JNKVV, Jabalpur - Member
- ❖ Dr. KK Sharma, Director, ICAR-IINRG, Ranchi - Member
- ❖ Dr. S Srivastava, Pr. Sc., ICAR-IINRG, Ranchi - Member-Secretary

### Invited Officials

- ❖ Dr. N Prasad, Head, PPD Division
- ❖ Dr. AK Jaiswal, Head, TOT Division
- ❖ Dr. S Ghosal, Head, LPD Division
- ❖ Dr. MZ Siddiqui, Pr. Sc. & I/c, PME Cell, ICAR-IINRG, Ranchi

### Welcome Address by the Director, ICAR-IINRG

Dr. KK Sharma, Director, ICAR-IINRG welcomed the Chairman and the Members of the RAC. He presented the salient achievements and developmental activities completed during the year. He informed the Members about the Integrated Small Scale Lac Processing Unit developed by the Institute, the characterization work on some of the important natural gums which was not undertaken earlier. He further added that the Institute had organized some important events like National Symposium on Biopolymers, Annual *Kisan Mela*, aleuritic acid training to a Chinese firm, Modular training on Agri-business module and Coordination

Committee meetings of the Network Projects. Director also informed about the new initiatives taken by the Institute especially the proposals on Centre of Excellence on lac, declaring ICAR-IINRG as Registration Authority for lac insects and host plants, introduction of biometric system of attendance and cashless transaction in tune with digital India Programme.

### Opening Remarks by the Chairman and Members, RAC

The Chairman, in his opening remarks, emphasized the need to focus on R&D activities of NRGs, besides lac so that the other natural resins and gums are reflected in the Mission of the Institute. He added that more weightage should be given to the lac hosts and their improvement programme for the enhancement of the sap yield. The Chairman, in regard to the TOT divisional activities suggested that the training modules may also be developed in the other regional languages using multimedia platform for welfare of the stakeholders and the developed module should be updated on regular intervals. The Chairman emphasized on more active collaborative work with other Engineering Institutes in our SMD like ICAR-NIRJAFT, Kolkata for application of lac dye in jute and jute-based products and similarly ICAR-CIPHET, Ludhiana for its food application. Institute should go for custom hiring of lac processing units so that more number of stakeholders can take advantage of the machine developed by the Institute. He emphasized on storage studies on seed viability of major lac hosts for better nursery management.

Dr. KK Singh, ADG and Member felt that Institute should also explore the possibility for including mandate on production aspect of natural resins and gums besides lac, which may be in addition to the mandate of network project on HPVA of NRGs. He further suggested to consolidate the number of research projects into Mega-projects for better visibility and easy monitoring. It was also suggested to develop the complete package of practices for lac host plant under different conditions covering entire value chain. He emphasized on the use of GPS during surveys and remote sensing in the research areas and advised to make use of renewal energy also.



Prof. DC Joshi, Member suggested to reduce the cost of production of Integrated Small Scale Lac Processing Unit by replacing the stainless steel parts of the machine with suitable low cost material. He also suggested to enhance the income of lac or NRG producers through value addition of NRG based products and their further use diversification and applications. He added that pace of research should be increased by making use of information and communications technology (ICT).

Dr. Atul Srivastava, Member suggested that the mechanization of lac cultivation especially the harvesting aspect should be taken up to reduce the labour cost and time. He pointed out the need to develop decision support system for refinement of lac/ NRGs related technologies. He also laid emphasis to initiate the work on women empowerment in the tribal areas through training and development programmes related to lac and NRGs.

### Presentation of Research Programmes of the Institute

Dr. MZ Siddiqui, Pr. Sc. & I/c, PME Cell presented the research progress of the Institute and also list of all on-going institutional and externally funded projects.

### Presentation of ATR of last RAC

Dr. S Srivastava, Pr. Sc. & Member-Secretary presented the ATR. The RAC accepted the ATR and was of the opinion that recommendations of XXIII RAC meeting especially on development of e-content for training material be incorporated in the research activities of the Institute at the earliest available opportunity.

### Progress of Research Divisions

Dr. S Ghosal, Head, Lac Production presented the progress and highlighted the achievements of the LP Division. The House suggested for taking up the detailed study on chemical profiling of sap of lac host plants and make provisions in the upcoming plan for required infrastructure. The total nutritional analysis of sap of lac host and non-lac host plant may be taken up to characterize all the constituents present in the sap. The above information on the sap analysis may be helpful to reveal the cause of attraction of lac insect towards specific hosts.

Dr. N Prasad, Head, PPD Division presented the progress and highlighted the achievements of the Division. The RAC suggested introducing scrapper and drier in Integrated Small Scale Lac Processing Unit and converting it into five operations system in a pilot plant

mode. The Chairman advised to develop economically viable and user friendly machines which may be used by the large number of lac farmers.

Dr. AK Jaiswal, PS & Head, TOT Division presented the progress. The Chairman suggested to conduct impact assessment programme for women empowerment in lac cultivation.

### Network Project on 'Harvesting Processing and Value Addition of Natural Resins & Gums'

The progress was presented by Dr. N Prasad, Pr. Sc. & Project Coordinator.

Network Project on 'Conservation of Lac Insect Genetic Resources'

The progress was presented by Dr. KK Sharma, Project Coordinator & Director.

### Presentation of Completed Projects (RPP-III)

- ❖ Dr. S. Ghosal, Pr. Sc. presented the progress of project entitled, 'Management of stem canker disease of *Flemingia semialata*, a commercial lac host'
- ❖ Dr. AK Singh, Sr. Sc. presented the progress of project entitled, 'Evaluation of lac mud as organic manure'.

The RAC suggested to include the recommendations of the concluded projects in the training programme for wider and early dissemination of the findings.

### Presentation of the New Project

Dr. SC Sharma, Sc. presented the new project entitled, 'Development of pilot plant of *guar* gum derivative for training and demonstration'. The RAC felt that PI should have come with concept diagram of the process and detailed schedule of fabrication of the machines.

### Recommendations of the XXIV RAC Meeting

- ❖ In view of increasing dearth of labour and increasing productivity, mechanization of the lac cultivation operations (both manual and motor operated) and processing of natural resins and gums needs to be promoted and ergonomically designed tools be developed for women empowerment in lac cultivation system,
- ❖ Institute should focus more on basic and strategic researches on NRGs for development of natural gum based technologies,
- ❖ Lac-based farming system needs to be



strengthened more so that total income of the farmers can be increased,

- ❖ Lac scrapper and drier may also be integrated with the Integrated Small Scale Lac Processing Unit. Effort should also be made to reduce its cost for making it economically viable,
- ❖ Institute should conduct impact assessment of technologies passed on to farmers and other stakeholders which will help in devising future strategies for transfer of technologies,
- ❖ Work should be initiated on tree less production of lac as futuristic research,
- ❖ Institute should strengthen its role as repository of information on the production, processing and storage of important natural gums and resins.

In the end, Dr. S Srivastava, Member -Secretary extended sincere thanks to the Chairman and the Members of RAC for their valuable scientific inputs to improve upon the research programme of the Institute.

### Institute Research Council (IRC)

During the period under report, two IRC meetings were held. The first one on May 15, 16 & 24, 2017 and the second one on October, 09, 2017 under the Chairmanship of Dr. KK Sharma, Director, ICAR-IINRG, Ranchi. During the first meeting, the research progress of on-going projects (16), RPP-III (03) and new project proposals (08) were discussed. Whereas, during the second meeting, two new project proposals, two RPP-III and inclusion of PI/Co-PI in on-going research projects were discussed. The following points emerged out:

- ❖ Chairman, IRC was of the strong view that the projects should be discussed first in the respective divisional DRC, and for inter-divisional association in the projects, HODs written consent be forwarded to P MEC,
- ❖ Number of running projects need to be reduced under theme/mega project (not more than four in each division) for better monitoring and impact assessment,
- ❖ Scientist should contribute atleast 25% of their time in the project in which they are associated,
- ❖ It is expected from the Heads of Division/Project Coordinator to devote about 50% of their time in monitoring/supervision of the Division/Project and

- ❖ Each scientist must be involved in atleast one project of his/her Core-discipline.

In the end, Member-Secretary extended sincere thanks to the Chairman for his valuable scientific inputs to improve upon the present research activities of the individual scientist, thereby, Institute as a whole

### Institute Management Committee (IMC)

The 52<sup>nd</sup> Meeting of the Institute Management Committee (IMC) was convened in the *Kusmi* Conference Hall of the Institute on 6<sup>th</sup> October, 2017 at 14:00 Hrs. The following members were present in the meeting:

- ❖ Dr. KK Sharma, Director, ICAR-IINRG, Ranchi - Chairman
- ❖ Dr. KK Singh, ADG (Farm Engg.), ICAR, New Delhi - Member
- ❖ Dr. P Kumar, Emeritus Sc., ICAR-IARI, New Delhi - Member
- ❖ Dr. SN Chattopadhyay, Pr. Sc., ICAR-NIRJAFT, Kolkata - Member
- ❖ Sri R Sahay, Dy. Director (Finance), ICAR HQ, New Delhi - Member
- ❖ Dr. B Das, Sr. Sc., ICAR-RCER RC, Ranchi - Member
- ❖ Sri SK Singh, Sr. AO, ICAR-IINRG, Ranchi - Member- Secretary

### Invited Officials

- ❖ Dr. N Kumar, Head, TOT Division, ICAR-IINRG, Ranchi
- ❖ Dr. S Ghosal, Head, LP Division, ICAR-IINRG, Ranchi
- ❖ Dr. S Srivastava, I/c Head, PPD Division, ICAR-IINRG, Ranchi
- ❖ Dr. MZ Siddiqui, Pr. Sc. & I/c, PME Cell, ICAR-IINRG, Ranchi
- ❖ Dr. MF Ansari, Sr. Sc. & I/c, F & AO
- ❖ Sri N Thombare, Sc., ICAR-IINRG, Ranchi
- ❖ Sri AK Yadav, Security Officer & I/c, Estate Section
- ❖ Sri P Singh, AAO (Purchase & Store)

### Welcome address by the Member -Secretary

The meeting started with the welcome address by the Member-Secretary.

### Introductory remarks by the Chairman



Dr. KK Sharma, Director, ICAR-IINRG welcomed the IMC members and a formal introduction by the members followed thereafter.

### Presentations

#### (a) Research achievements presented by I/c, PME Cell

Dr. (Ms) MZ Siddiqui, Pr. Sc. & I/c, PME Cell presented the research achievements of the Institute and infrastructure development during last one year. She highlighted the core programmes of the different divisions of the Institute. She apprised the members about different projects running at the Institute and presented the details of Field Demonstration, Technical Advisory and Extension activities, HRD, Publication, Honours/Awards/Recognitions/Patents etc. Achievements of the Institute during the period were appreciated by all the members.

#### (b) Presentation on Scientific topic by Sri N Tombare, Sc.

Sri N Thombare presented a talk on 'Natural gum based hydrogel Biomaterials for diverse applications'. The Members appreciated the presentation. One of the members suggested to work out the economies of hydrogel application in agriculture emphasized over the economy factor so that the technology is accessible to farmers. Further, Dr. KK Singh, ADG (Engg.), Member, IMC also suggested to explore the possibilities for use of hydrogel technology in water purifiers.

#### (c) Presentation of Financial Status

The financial status of the Institute as on 30<sup>th</sup> September, 2017 was presented by Finance & Accounts Officer. Expenditure under Capital Head was observed to be satisfactory, however, the ADG, Member, IMC advised to expedite the utilization of available recurring funds. It was also recommended to refund the unutilized budget of the last plan by the coordinating centers of the Network Project to the Council. Further, Sri Rajesh Sahay, Deputy Director (Finance) & Member, IMC advised the F&AO to adopt PFMS for all financial transactions, as per the guidelines of the ICAR/Gol and implement it by the end of October, 2017.

#### (d) Status of Establishment

The details of position of posts under different cadres at the Institute was presented by Sr. A.O. Details of promotion/MACP/Recruitment during the period were also given.

#### (e) Proceedings of the 51<sup>st</sup> Meeting of IMC

The Member-Secretary informed that the approval of the revised proceedings of the 51<sup>st</sup> has not yet been received from the Council. In this regard, the Committee recommended to send the proceedings of both the meetings *i.e.* 51<sup>st</sup> IMC Meeting and 52<sup>nd</sup> IMC Meeting with a common forwarding letter to the SMD for obtaining the approval of the Competent Authority at ICAR.

### Agenda for the 52<sup>nd</sup> IMC Meeting

#### (a) Proposal for obtaining the approval for purchase of equipments

The Committee was informed that in response to a letter from the Council, a proposal for purchase of equipments including (i) Pilot Plant of Dewaxed Decolourised Lac (DDL), (ii) Table Top Centrifuge, (iii) 5 KVA UPS (02 Nos.) & Split ACs (04 Nos.) and (iv) Programmed Autoclave submitted to the Council for approval. Purchase process/installation of the autoclave has already been completed during the last year, but payment could not be made due to budget constraints the last quarter of the financial year. Provision for purchase of these items have been kept in the three years SFC/ EFC. For purchase of the urgently required equipments the approval of SFC / EFC is required from the Council. The Committee recommended the proposal.

In this regard, the Committee suggested to initiate the purchase process of the equipments in anticipation of approval from the Council. However, order for purchase may be placed only after approval is obtained.

### Information regarding IJSC/Grievance Cell

The Sr. Administrative Officer informed that IJSC meetings were called at regular intervals. He also informed that the Grievance Cell of the Institute is presently not functional, as the representatives of the scientists could not be elected, for which no nomination was received. The Committee suggested to nominate scientists in the Grievance Cell to make it functional.

### Any other items with permission of the Chair

#### (a) Extension of medical facilities of few more hospitals/laboratories to the employees/pensioners

It was proposed to recognize few more hospitals/pathological laboratorie, listed below to avail the medical facilities by the employees/pensioners of the Institute. These hospitals have given their consents to



provide the medical facilities on CGHS rates :

1. Maa Kalawati Hospital, Namkum, Ranchi
2. Bhagwan Mahavir Medical Hospital, Booty, Ranchi
3. Sant Barnawas Hospital, Bahu Bazar, Ranchi

In this regard, the Committee recommended the proposal and also suggested to explore the possibilities to authorize more AMAs in different locations of the city

under the provisions of CCS (AMA) Rules. The Committee also recommended to examine the practices adopted by other Central Government offices located in Ranchi and then sent a proposal to the Council, under the relevant provisions/rules.

The meeting ended with vote of thanks by the Member-Secretary.





## Distinguished Visitors

The Institute regularly receives a number of visitors who are briefed about different aspects of natural resins and gums as well as Institute activities. The details of distinguished visitors are as follows:

- ❖ Smt. Droupadi Murmu, Hon'ble Governor of Jharkhand
- ❖ Sri Ram Tahal Choudhary, Hon'ble Member of Parliament (Lok Sabha)
- ❖ Sri Sudarshan Bhagat, Hon'ble Minister of State for Agriculture and Farmers Welfare, Govt. of India
- ❖ Sri Mahesh Poddar, Hon'ble Member of Parliament (Rajya Sabha)
- ❖ Sri Ram Kumar Pahan, Hon'ble Member of Legislative Assembly
- ❖ Dr. Trilochan Mohapatra, Secretary (DARE) & Director General (ICAR)
- ❖ Dr. K Alagusundaram, DDG (Engineering), ICAR, New Delhi
- ❖ Dr. KK Singh, ADG (Farm Engineering), ICAR, New Delhi
- ❖ Dr. SN Jha, ADG (Process Engineering), ICAR, New Delhi
- ❖ Sri R. Agarwal, Director (DARE) & CVO, ICAR, New Delhi
- ❖ Dr. BP Bhat, Director, ICAR-RCER, Patna
- ❖ Dr. P Kaushal, Vice-Chancellor, Birsa Agricultural University, Ranchi
- ❖ Dr. VM Mayande, Vice-Chancellor (Retd.), Dr. Panjabrao Deshmukh Krishi Vidyapeeth (Agricultural University), Akola, Maharashtra
- ❖ Dr. DC Joshi, Dean, Anand Agricultural University, Anand, Gujarat
- ❖ Dr. AK Srivastava, Head, FMP Department, JNKVV, Jabalpur
- ❖ Dr. P Kumar, Emeritus Sc., ICAR-IARI, New Delhi
- ❖ Dr. Anjani Kumar, Director, ATARI, Patna
- ❖ Dr. RK Kapoor, Director, MSME, Ranchi
- ❖ Sri Anand Kothari, Chairperson, Agri Horticulture & Agro Rural Industries Committee (FJCCI) Ranchi
- ❖ Dr. Sanjay Kumar, IFS Principal Chief Conservator of Forest & Head of the Forest Force (HoFF) Forests, Environment and Climate Change Department, Government of Jharkhand
- ❖ Sri Prabhakar Behra, GM NABARD, Ranchi
- ❖ Sri Sanjay Sen, Chairman, Institute of Engineers (India), Jharkhand State Centre
- ❖ Sri Bhuvansh Yadav, IAS, Joint Secretary, Higher Education, Chhattisgarh
- ❖ Dr. SA Ansari, Director, IFP, Ranchi
- ❖ Sri Sandeep Raj, IRS and Chief Vigilance Officer, CMPDI, Ranchi
- ❖ Sri Amarnath Mishra, Retd. SP, Indian Police Services
- ❖ Dr. Sanjay Kumar, IFS, Principal Chief Conservator of Forests & Head of the Forest Force (HoFF), Forests, Environment and Climate Change Department, Government of Jharkhand
- ❖ Dr. JV Sharma, Director, TERI
- ❖ Sri Kusumakar Sharma, ADG (Retd.), ICAR, New Delhi
- ❖ Dr. Sushil Kumar, Former Director & Vice-Chancellor, ICAR-NDRI, Karnal (Haryana)



## Support Services

### Institute Research Farm

#### Resource generation

Broodlac /Sticklac (Rs.)	Fuel wood (Rs.)	Water + Fuel charges (Rs.)	Lac host plant seeds (kg) and seedlings (Nos.)	Other farm produces (Rs.)	Total (Rs.)
2,77,154	14,136	7,000	68,735	11,740	3,78,765

#### Infra-structure development

- ❖ Four compost pits were excavated and bio-composting are being done by utilizing leaves of lac host and cow dung.
- ❖ Created one pathway on existing bio-compost unit at Plot No. 14 to uplift bio-compost and use in nursery preparation.
- ❖ Renovated green net house and two water reservoirs at nursery area for maintenance of lac host seedlings.
- ❖ More than 40 plants of different gum and resin trees viz. *Saja*, *Guggul*, *Moringa*, *Rubber*, Black and white Dammar were added at IRF Farm II.

#### Nursery management

- ❖ *Semialata* (8 kg) and *Bhalia* (4 kg) seeds were produced. *Ber* (8kg), *Galwang* (6kg) and *Kusum* (3.5kg) were collected from different trees.
- ❖ The seedlings of different lac hosts were raised for gap filling and sale in large number.
- ❖ Seeds and seedlings of lac host plants were sold to farmers, KVK and other organizations. Details are as under:

Lac Host Plants	Quantity
<i>Semialata</i> seedlings	10240 Nos.
<i>Khair</i> seedlings	500 Nos.
<i>Kusum</i> seedlings	31 Nos.
<i>Ber</i> seedlings	10 Nos.
<i>Khair</i> seed	7 Kg
<i>Semialata</i> seed	2.75 Kg
<i>Bhalia</i> seed	1.5 Kg
<i>Galwang</i> seed	250 gram

- ❖ 5000 of *semialata* seedlings were transplanted for gap filling.

#### Farm Management

- ❖ Executed experimental works of the scientist of LPD, TOT and PPD including IRF activities as per their requirements.
- ❖ Inputs like fertilizers, farm yard Manure, vermi compost, farm machineries like Tractors with ploughing implements, Power Tiller along with irrigation facilities were provided to the scientists for maintaining their research plots.
- ❖ Identified unused lac host trees and plots for taking of new research and demonstration activities by the scientists.
- ❖ Weeding, cleaning and lime application mixed with chloropyriphos on 7000 (approx.) lac host plants and other trees.

#### Lac culture

- ❖ 2682 kg of *kusmi* brood lac of Simdega, Kulajanga, Gumla, Nawadih, Bandgaon was inoculated on *kusum* (227 Nos.) and *ber* (1122 Nos.) for both summer and winter *kusmi* crops.
- ❖ *Kusmi* broodlac 738kg was sold to farmers and NGOs. Scrapped lac 13.2 quintal was sold and 15 kg was provided to scientists for their experiments.

#### Soil amendment

- ❖ 50 kg each *Dhaincha* and *Sanai* was sown for green manuring in *ber* (Plot Nos. 48-51) and *kusum* (Plot Nos. 45-46).

#### Quality Evaluation Laboratory

During the period under report a total number of 63 customer's letter (41 outside and 22 internal), 198 samples of lac, lac-based products and natural gums have been received from Govt. organizations/Private Industries/various Divisions of the Institute and total 926 (215 outside and 711 internal) tests were carried out and a sum of Rs. 87,008/- was earned from external source and Rs. 2, 91,273/- from internal source. A sum of Rs. 3,78, 281/- was generated as testing charges



through ISO 9001:2008 Certified Quality Evaluation Lab. In addition to the above, the training on testing and analysis of lac samples was imparted to 3 persons w.e.f. 16/05/2017 to 20/05/2017 and Rs. 45,000/- was earned as training charges. The training for determination of bleach index of seedlac sample was imparted to 8 persons w.e.f. 14/6/2017 to 15/6/2017.

### **Prioritization, Monitoring and Evaluation (PME) Cell / Institute Research Information System (IRIS) Cell**

The activities performed by PME Cell / IRIS Cell during the period under report were:

- ❖ Submission of various time-bound reports:
  - i. Cabinet Monthly Report to ADG (FE) by 20<sup>th</sup> of every month
  - ii. Monthly Brief updates on progress to DDG (FE) by 20<sup>th</sup> of every month.
  - iii. Half Yearly Progress Report (HYPM)
  - iv. Quarterly Targets & Achievements
  - v. DARE report, Annually
  - vi. Annual Plan Outcome Budget
  - vii. Preparation & submission of Annual Training Programme for the Year 2017-18 for all the employees of the Institute to the Council.
  - viii. Preparation & submission of Annual Physical and Financial Targets and Achievements (April, 2016 to March, 2017) of all the employees of the Institute to the Council.
- ❖ PME Cell Conducted IRC in May, 2017 & Oct., 2017.
- ❖ Maintenance of Research Project Files: Institute (22), ICAR-Network Projects (02), ICAR-ICRAF (01), ICAR-DBT (01) and Inter-Institutional (ICAR-IIAB & IINRG) (02).
- ❖ Processing of Research Papers & Popular Articles for various Journals submitted by the scientists (30).
- ❖ Processing of papers submitted by the scientists / staff for conferment of Awards/Honours/ Recognitions etc., to them (09).
- ❖ Processing of papers submitted by the scientists for their participation in National/International Conferences/Symposia (18).
- ❖ Coordination for conducting RAC, IMC, Director's

Conference & Regional Committee Meetings.

- ❖ Coordination for HRD Programmes for all the employees (Scientists-07, Technical-08, Administrative-14) of the Institute.
- ❖ PME Cell organized five days' training programme on 'Computer Applications' for Skilled Supporting Staff (SSS) of the Institute from Oct. 30<sup>th</sup> to Nov. 3<sup>rd</sup>, 2017 (12).
- ❖ PME Cell provides different services like:
  - i. LAN and Internet Connectivity to the Divisions & Sections of the Institute
  - ii. E-mail services
  - iii. Annual Maintenance of Computer Systems, Local Area Networking (LAN), EPBAX, Biometric Devices (09) & CCTVs.
  - iv. Maintenance of web-based Data Base for Personnel Management Information System (PERMISNET), Enterprise Resource Planning (ERP) and Project Information Management System (PIMS).
  - v. Regular updating of Institute's website with all general information, events, tenders, interviews etc.
  - vi. Quarterly updating of CIC website with all relevant information/statements as required under the provisions of RTI Act, 2005 and processing of requests received under RTI.
  - vii. Reply of Parliament Questions and any other last minute reply required to be submitted to SMD.

### **Library and Documentation Centre**

The library of the Institute plays an important role in meeting the information needs of the users. Library of the Institute is a repository of scientific and technical information on natural resins and gums. Besides catering to the needs of Institute scientists, it also renders services to other researchers, academicians, technologists and students as well as lac/gums/resins industrialists from other part of the country. The library maintained adequate linkage with leading reference libraries for strengthening the information resources. This library also supplies photocopies of rare research articles to NISCAIR, New Delhi from time to time against payment. Advance/Full Text/Abstracts access of more than 3900 Journals from several publishers have been made



available online through Consortium for e-Resources in Agriculture (CeRA) to our scientists during the year. Our library is also connected with World eBook Library (WEL) facilitated by National Digital Library (NDL), New Delhi from this year.

All regular Institute publications (Annual Reports/ Newsletters/Lac Resins Gums Statistics/Laksha/Dorothy Norris Lecture Series etc.) and Research Articles/ Bulletins, since beginning, are available in PDF form for the internal users.

An amount of Rs. 5,262/-, as revenue, from the sale of publications and Rs. 26,180/- from wastage sale have been generated during the year. The library also continued to exchange of Institute publications with the scientific Institutions in and outside the country.

#### Services provided by the Library to the users

- ❖ E-journals access
- ❖ C.D. Searches
- ❖ Document Delivery Services
- ❖ Reprographic Services
- ❖ Bibliographic Services
- ❖ Current Awareness Services
- ❖ Inter Library Loan Services for resource sharing
- ❖ Sale and distribution of Institute Publications

#### Journals & Periodical subscribed /received

- ❖ Foreign Periodicals (Gratis/exchange) 04
- ❖ Indian Periodicals (Subscribed) 05
- ❖ Indian Periodicals (Gratis/exchange) 09

#### Library holdings (as on 31.12.2017)

Documents	Additions	Total Holdings
Books	07	7960
Bound Journals	184	21845
Annual Report	89	5380
IS-Specification	-	184
Thesis	-	13

#### Estate Section

Estate section is one of the most important units of the Institute which takes care of the following essential services:

- ❖ Security of Institute premises – No major security lapse occurred

- ❖ Water and power supply
- ❖ Infrastructure development work of the Institute
- ❖ Providing assistance in the engineering research work
- ❖ Civil & electrical maintenance of residential quarters and office buildings
- ❖ General maintenance & up-keep of the Institute premises. The work is being outsourced and monitored by the Estate Management Committee.

#### Registration of jobs

Jobs registered in the various job registers during the calendar year 2017 are:

- ❖ Electrical work 692
- ❖ Civil & water supply 350  
(this includes plumbing & other civil works)
- ❖ Carpentry works 358
- ❖ Turners works 507
- ❖ Welders works 165

Most of the above works have been completed satisfactorily, however, some of them could not be done due to scarcity of resources which will be initiated in near future.

Major works carried out during the calendar year 2017 are:

#### Civil works

- ❖ Renovation of quarters Type III (18 to 21) in PDU campus
- ❖ Renovation of quarters Type III (22 to 29)
- ❖ Renovation and roof treatment of quarter Type III/12
- ❖ Renovation of Estate Section
- ❖ Extension of Laboratories of LPD & PPD Division.
- ❖ Renovation of Transformer Room
- ❖ Renovation of IRF building (civil as well as electrical)
- ❖ Renovation of of water reservoir (02 Nos.) in IRF
- ❖ Internal repair & miscellaneous civil work in TOT Division
- ❖ Renovation of Director's Office and PME cell



- ❖ Renovation of Bungalow No.1
- ❖ Renovation of Old Guest House
- ❖ Construction of PCC road from TOT Division to LPD Division and from Guest House to Type IV quarter.

### Electrical works

- ❖ Maintenance of street lights in serviceable conditions throughout the year
- ❖ Maintenance of electrical installation of residential quarters and division/ section in operational condition throughout the year
- ❖ Maintenance of Genset and associated panels, Transformer, overhead LT lines in operational condition throughout the year
- ❖ Installation of 20 Nos. of 45W LED street lights in Main Campus by replacing CFL street lights
- ❖ Restoration of power supply in Main Campus & PDU campus in shortest possible time after power supply breakdown due to storm on 27.5.17 & 12.7.17 after removal of branches from overhead lines and restraining of overhead lines was got done in minimum possible time
- ❖ Painting of all feeder panels
- ❖ Installation of 1125 VA UPS with 150 AH battery in Main Guard Room
- ❖ Electrical connectivity was provided for Wi-Fi, CCTV Cameras and Biometric Devices in Institute premises
- ❖ Periodic maintenance of both 150 KVA & 200 KVA Transformers
- ❖ Installation of 5KVA UPS with complete wiring in PME Cell
- ❖ Rectification of short circuit in PPD Division on 08.8.2017
- ❖ Installation of 90 KW Roof Top Solar Power Grids.

### Health Center

The Institute has a functional Health Center in the campus. Dr. Ashok Kumar and Dr. Kailash Prasad have been functioning as a part time Medical Officers (AMAs) on contractual basis on alternate days in the Center. Most of the medical cases were handled in the Center itself and complicated cases were referred to authorized CGHS hospitals and pathology clinics in the city for

expert diagnosis and treatment. The Health Center is equipped with routine instruments to handle general/minor dressing, first aid, physical examination of patients, measure B.P., pulse, height, weight, blood sugar, etc. In the year 2017, 6164 patients were registered and treated in the Health Center. Around 89 patients were monitored for blood sugar by test strips method in the Center itself as per the advice of AMAs. The Center has a Computerized Inventory System, facilitating retrieval of records like issue of medicines, date of receiving, unregistered patient along with the near date of expiry of medicines, etc. This ultimately helps the AMAs in taking better decision while prescribing medicines. Most of the medicines prescribed by AMAs were made available to the patients from the Health Center itself. Apart from attending to regular employees, pensioners, and contractual staff of various on-going research projects, medical treatment were also provided to trainees and laborers on humanitarian grounds, in case of emergency and casualty.

### IPR/ITMU

- ❖ Participation of ITMU in Institute's Annual *Kisan Mela*-cum-Technology and Machinery Exhibition -2017 and demonstration of technologies.
- ❖ Preparation of details of Institute's technologies for their demonstrations in *Krishi Unnati Mela*-2017 at ICAR-IARI, New Delhi in March, 2017.
- ❖ Filing of complete specification of Lac Wax Policosanol -- A natural plant growth regulator (Application No. 201631013579) was processed through ITMU and filed on 19.4.2017 through M/s Anjan Sen & Associate, Kolkata in Kolkata Patent Office.
- ❖ Audit utilization Certificate (AUC) of ITMU, ICAR-IINRG was prepared and sent.

### Agro-meteorology Unit

Agro-meteorology Unit of the Institute is situated at 23° 23' N latitude, 85° 23' E longitude at 650 m altitude. During the year 2017, different weather parameters were recorded and updated daily as well as weekly at the Institute website. Daily Self Recording Rain Gauge (SRRG) sheets and daily rainfall data for the year was sent to India Meteorological Department (IMD), Kolkata. The monthly mean relative humidity (RH %), mean temperature (°C) and total rainfall (mm) is given in the Table. Weekly analysis of rainfall has been presented in Figure. Analysis of data for these parameters revealed



significant variations amongst months.

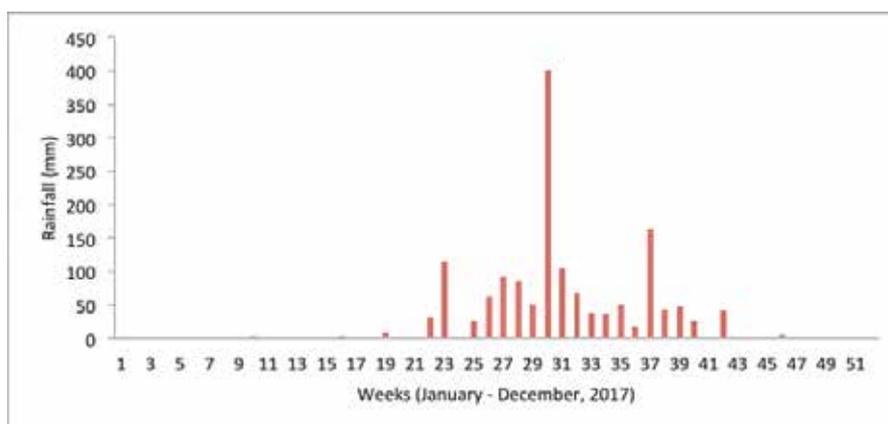
During July, relative humidity (RH) was the maximum at 8:30 hours (92.06%), with 86.06 per cent in the 14:30 hours, while the minimum RH was observed 8:30 hours (61.77), with 53.27 per cent in the 14:30 hours in the month of April. Maximum temperature for the year was recorded on 15<sup>th</sup> April and 4<sup>th</sup>, 5<sup>th</sup> May (41.5 °C), while the minimum temperature was on 13<sup>th</sup> and 15<sup>th</sup> January (2.5 °C). Hottest and coldest months of the year were May

and January with mean monthly temperature 38.88 °C and 7.54 °C, respectively. Total annual rainfall was 1517.60 mm. It is pertinent to say that 26<sup>th</sup> July received maximum daily rainfall *i.e.* 184.00 mm. Maximum monthly rainfall was observed in July (651 mm), whereas no rainfall occurred in the month of February and December of the Calendar Year 2017

**Table : Mean monthly meteorological data recorded at the agro-meteorological unit of the**

### Institute during 2017

Month, 2017	Temperature (°C)		Relative Humidity (%)		Rainfall (mm)
	Min.	Max.	Max.	Min.	
January	7.54	23.77	77.65	66.42	0.60
February	9.04	27.16	72.18	64.36	0.00
March	12.87	31.58	65.61	60.29	3.00
April	19.08	37.74	61.77	53.27	3.90
May	21.78	38.88	63.35	56.68	33.50
June	22.15	33.47	78.77	72.90	208.10
July	21.08	27.38	92.06	86.06	651.00
August	21.40	29.48	85.19	77.19	261.00
September	20.91	30.44	79.53	76.10	283.50
October	17.81	28.89	78.77	70.90	67.60
November	9.84	25.28	73.10	63.97	5.40
December	8.29	24.60	74.13	67.32	0.00
<b>Total Annual Rainfall (mm)</b>					<b>1517.60</b>



Weekly distribution of rainfall for the year, 2017



## KVK, Khunti, ICAR-IINRG

Foundation laid for 23<sup>rd</sup> KVK of Jharkhand at Diyankel, Torpa, Khunti on May 5, 2014. KVK, Khunti is under the administrative control of ICAR-IINRG, Ranchi. Dr. SP Singh, Programme Coordinator, KVK joined at ICAR-IINRG, Ranchi on 1<sup>st</sup> January, 2016. Demarcation work of land for KVK was completed in February, 2016. Trenching on boundary of the KVK land is done. Recruitment of SMS/Scientists and staff for KVK, Khunti is in process. Training programmes / events, mentioned-below, were organized during 2017:

### Farmers' training programme

KVK, Khunti organized a farmers' training programme on awareness about the Protection of Plant Varieties and Farmers' Rights Act, 2001 on 30<sup>th</sup> March 2017 in Torpa at Mahila Vikas Kendra, Torpa, Khunti. The Chief Guest was Sri Jaya Mangal Gudiya, Member of Jila Parishad, Torpa and the Guest of Honour was Ms Roshni Gudiya, Block Pramukh, Torpa.

A training booklet on 'Paudha Kism Aur Krishak Adhikaar Sanrakshan' compiled and edited by Dr. SP Singh was released and distributed among the farmers, stakeholders, scientists and others. About 200 farmers/stakeholders participated.

### New India Manthan-Sankalp Se Siddhi

A programme on New India Manthan-Sankalp Se Siddhi' was organized by KVK, Khunti at Torpa on August 26, 2017. The Chief Guest Hon'ble Member of Parliament, Khunti Sri Kariya Munda inaugurated the programme. Scientists, officers, public representatives along with farmers took the pledge of commitment (resolution) for doubling the income of farmers by 2022.



Oath administration by the Chief Guest



Hon'ble MP Sri Kariya Munda addressing the farmers

Release of booklet by Guest of Honour & the participants in the programme



In his address, Sri Munda ji briefed about the different schemes started by the Government of India to increase the production and income along with livelihood option of the farmers. He emphasized that collective efforts are required for doubling the income of farmers in coming five years. He exhorted the farmers to get insured their crops to protect from the risks under PMFBY. He also distributed implements for inter-culture weeding among the farmers.

Dr. KK Sharma, Director, ICAR-IINRG described the seven formulas for doubling the farmers income. He also advised the farmers for fast adoption of technologies developed by the research Institutes. Dr. TR Sharma, Director, ICAR-IIAB, Ranchi and Dr. N Kumar, Head, TOT Division, ICAR-IINRG also expressed their views. Earlier, Dr. SP Singh, PC, KVK welcomed the Chief Guest, dignitaries along with participants and also introduced the message of Hon'ble Prime Minister. A technical session on improved technologies along with Farmers-Scientists interaction was also conducted after the inaugural session. About 300 farmers participated in the programme.

### **Mahila Kisan Divas**

KVK Khunti celebrated *Mahila Kisan Divas* on October 15, 2017 in village Marcha of Torpa Block. The programme was chaired by Sister Charusila, Director (Acting), TRDS, Torpa. The Chief Guest was Smt. Mayalina Topno, Ex-Chairman, Zila Parishad, Khunti. Different events were organized for the farm women like; debate, question-answer session, cultural programme and role of women in agriculture. About 110 farmers participated in the programme.



Participants in the programme

### **World Soil Day**

The programme on 'World Soil Day' was organized by ICAR-IINRG, KVK, Khunti on Dec. 5<sup>th</sup>, 2017 at Torpa. The chief guest Hon'ble MP, Khunti, Sri Kariya Munda in his inaugural address told that we the people of India are not using the soil properly, due to which the soil health is deteriorating day by day. He suggested farmers to use balanced fertilizers and to increase use of organic manures, bio fertilizer etc. to increase the soil health and productivity. The Guest of Honour Sri Poulush Surin, MLA Torpa, Khunti told that farmers may get more income from Agriculture, if they adopt the scientific technologies developed. He also advised the farmers to get more benefit from the different Schemes of the government to improve their livelihood.

Dr. KK Sharma, Director, ICAR-IINRG and Dr. Nirmal Kumar, Head, TOT described the importance of soil testing, Soil Health Card and use of balance fertilizers. They told that the nutritional value for the food we eat is directly related to the health of soil in which it grows for which integrated soil health management is must.

In Seminar Dr. S Ghosal, Head, LPD & Dr. SP Singh, Sr. Sc. & Head, KVK, Khunti delivered lectures on i) Organic Farming & Soil Health ii) Causes of Soil Health deterioration and measures of its control. Farmers also interacted with scientists.

The Chief Guest distributed the Soil Health Cards to the farmers. A film related with the program was shown to the farmers. Dr. SP Singh welcomed the guests & participants. Dr. SKS Yadav, Sc. delivered the vote of thanks. About 160 farmers, farm women and others participated in the programme.



Inaugural programme & distribution of Soil Health Cards

### Participation in *Kisan Melas/Exhibitions/Workshops* by Head, KVK, Khunti

- ❖ Dr. SP Singh, Sr. Sc. & Head, KVK, Khunti participated in 39<sup>th</sup> Central Sri Ramkrishan Kisan Mela on theme 'Jaivik Kheti-Safal Kisan-Samradhya Kisan' organised by Divyayan KVK, Morabadi, Ranchi at Getalsuth Farm, Angada, Ranchi, January 23-24, 2017. Also, attended *Kisan Gosthi* and replied the questions of farmers in Farmers- Scientists Interactions.
- ❖ Dr. SP Singh, Sr. Sc. & Head, KVK, Khunti attended '*Kisan Mela-Sah-Takneek Avam Machine*

*Pradarshini*, 2017', ICAR-IINRG, Ranchi, February 10,2017.

- ❖ Dr. SP Singh, Sr. Sc. & Head, KVK, Khunti participated in National Symposium on 'Recent Trends in Biopolymers', ICAR-IINRG, Ranchi, February 17-18, 2017.
- ❖ Dr. SP Singh, Sr. Sc. & Head, KVK, Khunti attended a Hindi Sangosthi on '*Rajya mein Bhugarbh Jal Ki Sthiti Avam Jal Chhajan*', ICAR-IINRG, Ranchi & ICAR-IIAB, Ranchi, March 01, 2017.
- ❖ Dr. SP Singh, Sr. Sc. & Head, KVK, Khunti attended 'Farmers First Program', ICAR-IIAB, Ranchi, March 25-26, 2017.
- ❖ Dr. SP Singh, Sr. Sc. & Head, KVK, Khunti participated in 'Annual Zonal Workshop of KVKs of ICAR-ATARI, Kolkata, April 14-16, 2017 & at ICAR-CIARI, Portblair.
- ❖ Dr. SP Singh, Sr. Sc. & Head, KVK, Khunti participated in 'National Workshop on Empowering Farmers of Tribal Areas', Division of Agricultural Extension, ICAR-IARI, NASC Complex, New Delhi, June 07-08, 2017.
- ❖ Dr. SP Singh, Sr. Sc. & Head, KVK, Khunti participated in workshop on 'Status of Seed Sector in Jharkhand', ICAR-RCER, RC, Plandu, Ranchi , August 08,2017.
- ❖ Dr. SP Singh, Sr. Sc. & Head, KVK, Khunti participated in National Seminar on 'Doubling the Farmers Income and Farm Production through Skill Development and Technology Application', BAU, Sabour, Bhagalpur, November 28-30, 2017.
- ❖ Dr. SP Singh, Sr. Sc. & Head, KVK, Khunti delivered a lecture on 'Agricultural Education, Admission Procedures and its scope' on the occasion of '*Krishi Shiksha Diwas*', Kendriya Vidyalaya, Namkum, Ranchi, December, 04, 2017.



## संस्थान के राजभाषा प्रकोष्ठ की गतिविधियां

भारत सरकार के राजभाषा विभाग (गृह मंत्रालय) द्वारा तैयार किए गए वार्षिक कार्यक्रम एवं राजभाषा अधिनियम व नियमों के संबंध में भारतीय कृषि अनुसंधान परिषद, नई दिल्ली से समय-समय पर प्राप्त निर्देशों पर अनुवर्ती कार्रवाई तथा सरकारी कार्य में हिन्दी के प्रयोग को और गति प्रदान करने के लिए संस्थान में राजभाषा प्रकोष्ठ की स्थापना की गई है। इसमें एक वरिष्ठ तकनीकी अधिकारी (रा.भा), एक अंशकालीन टंकक तथा एक अंशकालीन पदचर कार्यरत हैं। संस्थान में राजभाषा संबंधी क्रिया-कलापों की समीक्षा के लिए संस्थान के निदेशक की अध्यक्षता में संस्थान राजभाषा कार्यान्वयन समिति गठित की गई है, जिसमें विभागों/अनुभागों के अध्यक्ष, सदस्य के रूप में शामिल हैं तथा वरिष्ठ तकनीकी अधिकारी (रा.भा.) सदस्य सचिव हैं।

संस्थान 'क' क्षेत्र में है, इसे राजभाषा अधिनियम की धारा 10(4) के अर्न्तगत केन्द्रीय बजट में अधिसूचित किया जा चुका है। संस्थान के सात अनुभागों को शत प्रतिशत कार्य हिन्दी में करने हेतु विनिर्दिष्ट किया गया है एवं प्रवीणता प्राप्त सभी अधिकारियों/कर्मचारियों को अपना-अपना कार्य हिन्दी में करने हेतु व्यक्तिशः आदेश दिये गये हैं। राजभाषा नियम के प्रावधानों के अनुपालन एवं दैनिक कार्य में हिन्दी के प्रयोग में प्रगति लाने तथा इसे सर्वग्राह्य बनाने के लिए राजभाषा प्रकोष्ठ द्वारा निम्नलिखित कार्य सम्पादित होते हैं:

संस्थान राजभाषा कार्यान्वयन समिति की तिमाही बैठकों का आयोजन, कार्यसूची एवं कार्यवृत्त की तैयारी तथा बैठकों में लिए गये निर्णयों पर अनुवर्ती कार्रवाई। वार्षिक रिपोर्ट के हिन्दी संस्करण का प्रकाशन, राजभाषा की वार्षिक पत्रिका लाक्षा का प्रकाशन, कार्यालय आदेश, परिपत्र, ज्ञापन, निविदा इत्यादि एवं पत्राचार हेतु विभिन्न सामग्रियों का आवश्यकतानुसार अनुवाद। हिन्दीतर अधिकारियों और कर्मचारियों को हिन्दी शिक्षण योजना द्वारा आयोजित प्रशिक्षण एवं नगर राजभाषा कार्यान्वयन समिति के सदस्य कार्यालयों द्वारा आयोजित विभिन्न हिन्दी प्रतियोगिताओं एवं कार्यशालाओं में सहभागिता हेतु प्रेरित करना।

संस्थान के दैनिक कार्य में हिन्दी के प्रयोग में प्रगति एवं इसे सरल बनाने के लिए राजभाषा प्रकोष्ठ द्वारा निम्नलिखित

कार्य सम्पादित होते हैं:

- ❖ संस्थान राजभाषा कार्यान्वयन समिति की बैठकों का आयोजन, कार्यसूची एवं कार्यवृत्त की तैयारी एवं बैठकों में लिए गये निर्णयों पर अनुवर्ती कार्रवाई।
- ❖ वार्षिक रिपोर्ट के हिन्दी संस्करण एवं वार्षिक राजभाषा पत्रिका लाक्षा का प्रकाशन, भा.प्रा.रा.गों.सं. समाचार पत्रिका, कार्यालय आदेश, परिपत्र, ज्ञापन, निविदा, सूचना एवं पत्राचार हेतु विभिन्न सामग्रियों का अनुवाद।
- ❖ अधिकारियों और कर्मचारियों को नगर राजभाषा कार्यान्वयन समिति के सदस्य कार्यालयों द्वारा आयोजित विभिन्न हिन्दी प्रतियोगिताओं एवं कार्यशालाओं में सहभागिता हेतु प्रेरित करना।
- ❖ हिन्दी दिवस, हिन्दी चेतना मास एवं योजनानुसार नगर स्तरीय राजभाषा संबंधी, संगोष्ठी एवं कार्यशाला का आयोजन करना।
- ❖ संदर्भ साहित्य, हिन्दी पत्रिका, शब्दकोश एवं तकनीकी शब्दावली के उपार्जन हेतु कार्य।
- ❖ द्विभाषी मुहरों, नामपट्ट के निर्माण अथवा सक्रिय सहयोग करना।
- ❖ प्रचार सामग्रियों के हिन्दी रूपान्तर एवं समारोहों के समाचार संकलन एवं मीडिया प्रबंधन का कार्य।
- ❖ विभागीय विषय पर तकनीकी शब्दावली का निर्माण।
- ❖ हिन्दी में वैज्ञानिक गोष्ठी के साथ साथ प्रशासनिक तथा तकनीकी वर्ग के लिए कार्यशाला का आयोजन।
- ❖ निदेशक महोदय की अध्यक्षता में वर्ष 2017 में संस्थान राजभाषा कार्यान्वयन समिति की चारो तिमाही बैठकों का आयोजन निम्नलिखित तिथियों को किया गया तथा प्रगति की समीक्षा की गई। तिमाही रिपोर्ट एवं कार्यवृत्त परिषद सहित अन्य संबंधित कार्यालयों में प्रेषित की गई :

(क) दिनांक 25.02.2017



(ख) दिनांक 23.05.2017

(ग) दिनांक 25.08.2017

(घ) दिनांक 07.11.2017

जिसके अन्तर्गत निम्नलिखित प्रमुख चर्चायें हुईं तथा सर्वसम्मति से निर्णय लिए गए :

- ❖ संस्थान में हिन्दी में मूल रूप से पत्राचार बढ़ाने के लिए नकद पुरस्कार योजना का अनुपालन।
- ❖ वार्षिक कार्यक्रम 2016-17 एवं 2017-18 के प्रस्ताव पर चर्चा।
- ❖ गृह पत्रिका लाक्षा-2017 का प्रकाशन।
- ❖ वर्ष-2017-18 के लिए नकद पुरस्कार योजना लागू करना एवं वर्ष-2016-17 के प्रतिभागियों के लिए पुरस्कार का निर्धारण।
- ❖ नगर स्तरीय हिन्दी संगोष्ठी/कार्यशाला का आयोजन।
- ❖ स्वास्थ्य संबंधी विषय पर हिन्दी कार्यशाला/व्याख्यान का आयोजन।
- ❖ द्विभाषी मुहरों का निर्माण।
- ❖ द्विभाषी नामपट्ट की व्यवस्था।
- ❖ लाक्षा 2016 के सर्वश्रेष्ठ आलेख का चयन एवं पुरस्कार।
- ❖ हिन्दी दिवस/हिन्दी प्रतियोगिताओं का आयोजन।
- ❖ प्रवीणता प्राप्त सभी अधिकारियों/कर्मचारियों को व्यक्तिशः आदेश जारी करना।
- ❖ सभी कम्प्यूटरों में यूनिकोड या गुगल हिन्दी सॉफ्टवेयर की व्यवस्था।
- ❖ अनुवाद के लिए आउटसोर्सिंग।
- ❖ हिन्दी पुस्तकों का उपाजन।
- ❖ जाँच-बिन्दु का निर्धारण।
- ❖ राजभाषा नियम 8(4) के अन्तर्गत संस्थान के आठ अनुभागों को सम्पूर्ण कार्य हिन्दी में करने हेतु विनिर्दिष्ट करना।

## राजभाषा प्रकोष्ठ की उपलब्धियां-2017

- ❖ "प्राकृतिक राल एवं गोंद-भा.प्रा.रा.गों.सं. समाचार पत्रिका" का सम्पूर्ण अनुवाद एवं आउटसोर्सिंग द्वारा सम्पूर्ण वार्षिक रिपोर्ट का अनुवाद कराया गया।
- ❖ संस्थान की वार्षिक हिन्दी पत्रिका लाक्षा-2017 का प्रकाशन किया गया।
- ❖ संस्थान के आगत-निर्गत पत्रों का विस्तृत (अनुभाग/विभाग व क्षेत्रवार) विवरण तैयार कर विहित प्रपत्र में तिमाही रिपोर्ट तैयार की गयी तथा परिषद् समेत सभी संबंधित कार्यालयों को प्रेषित की गयी।
- ❖ वैज्ञानिक उपकरणों से जुड़े कम्प्यूटरों को छोड़कर संस्थान के कुछ अन्य कम्प्यूटरों में हिन्दी फॉन्ट लगा दिये गये हैं तथा ज्यादातर कम्प्यूटरों में यूनिकोड/गुगल हिन्दी सॉफ्टवेयर डाला गया है।
- ❖ समय-समय पर हिन्दी के प्रयोग को प्रोत्साहित करने के लिए विभिन्न प्रकार की हिन्दी प्रतियोगिताओं का आयोजन किया गया।
- ❖ हिन्दी में श्रुतिलेखन (डिक्टेशन) देने के लिए पुरस्कार योजना संस्थान में लागू की गई है।
- ❖ लाक्षा-2016 के सर्वश्रेष्ठ आलेख के चयन के लिए कमिटी गठित कराई गई तथा सर्वश्रेष्ठ आलेख का चयन कर लेखकों को पुरस्कार प्रदान किया गया।
- ❖ सरकारी काम काज मूल रूप से हिन्दी में करने हेतु संस्थान में नकद पुरस्कार योजना लागू की गई, इसमें तकनीकी एवं प्रशासनिक वर्ग के कुल 10 अधिकारियों/कर्मचारियों को पुरस्कार प्रदान किए गए।

## हिन्दी चेतना मास/हिन्दी दिवस समारोह-2017

संस्थान में राजभाषा अधिनियम के अनुपालन एवं कार्यालय कार्य में राजभाषा हिन्दी के प्रयोग में उत्तरोत्तर वृद्धि के लिए दिनांक 01.09.2017 से 30.09.2017 तक हिन्दी चेतना मास का पालन किया गया। इसके अन्तर्गत दिनांक 25.09.2017 को अपराह्न 02.15 बजे हिन्दी दिवस समारोह का आयोजन किया गया।



हिन्दी दिवस समारोह के अवसर पर मुख्य अतिथि डॉ श्रीराम दूबे, वरिष्ठ साहित्यकार एवं भा.प्र.से. (सेवानिवृत्त) ने झारखंड के हिन्दी साहित्य परिदृश्य विषय पर बोलते हुए कहा कि हिन्दी भाषा के प्रयोग को मजबूरी नहीं समझना चाहिए। उन्होंने कहा कि राज्य में हिन्दी के क्षेत्र में कई ऐसे साहित्यकार हुए हैं, जिनका राष्ट्रीय स्तर पर सम्मान हुआ है। आज भी झारखंड में स्तरीय साहित्य का सृजन हो रहा है। डॉ दूबे ने द्वारिका प्रसाद, राधाकृष्ण, बालेन्दु शेखर तिवारी, श्रवण कुमार गोस्वामी, रीता शुक्ल इत्यादि जैसे राज्य के प्रसिद्ध साहित्यकारों की चर्चा की। उन्होंने कहा कि हिन्दी हमारी राष्ट्रभाषा है, इसके माध्यम से कई भाषाएं आपस में जुड़ी हुई हैं। भाषाई एकता को संभाले रखना हम सभी का दायित्व है। जहां देश में हर बीस किलोमीटर पर पानी और वातावरण बदल जाता है, वहां हिन्दी भाषा पूरे देश को एकता की डोर में जोड़े रखती है। जब-जब राजनीति लड़खड़ाएगी, हिन्दी साहित्य सहारा का काम करेगा। हिन्दी भाषा में संकट नहीं सरलता है।

इस अवसर पर विशिष्ट अतिथि के रूप में श्री पंकज मित्र, वरिष्ठ साहित्यकार एवं वरिष्ठ कार्यक्रम अधिशासी, आकाशवाणी, राँची ने हिन्दी का बढ़ता बाजार एवं बाजारवाद विषय पर बोलते हुए कहा कि हिन्दी हमारी राष्ट्रभाषा है, लेकिन बढ़ता हुआ बाजारवाद आदमी, समूह, संस्कृति और भाषा को बांटने का काम कर रहा है। सामूहिक पहचान हमें हिन्दी भाषा ही दे सकती है। बाजारवाद सामूहिक संस्कृति पर प्रहार कर रहा है। जीवन, संस्कृति, सभ्यता, समाज के संरक्षण के लिए हिन्दी का संरक्षण जरूरी है।

संस्थान के निदेशक, डॉ केवल कृष्ण शर्मा ने अपने स्वागत भाषण में कहा कि हिन्दी चेतना मास के अन्तर्गत हिन्दी दिवस समारोह का आयोजन किया गया है। संस्थान में लम्बे समय से राजभाषा हिन्दी का प्रयोग होता रहा है। हमारे यहाँ कार्यालय कार्य के साथ-साथ वैज्ञानिक साहित्य में भी हिन्दी का अच्छा प्रयोग हो रहा है। संस्थान द्वारा नियमित अंतराल पर हिन्दी/द्विभाषी पुस्तिकाएं, पत्रक इत्यादि प्रकाशित होते रहते हैं। इस अवसर पर संस्थान की वार्षिक राजभाषा पत्रिका लाक्षा-2017 का अतिथियों द्वारा लोकार्पण भी किया गया।

हिन्दी चेतना मास की अवधि में दिनांक 07-08 सितम्बर 2017 को हिन्दी टिप्पण, प्रारूप लेखन, निबंध, अंताक्षरी,

पर्याय, व्याख्यान एवं विपरीतार्थक शब्द प्रतियोगिताओं का आयोजन किया गया। डॉ एम जेड सिद्धीकी, श्री प्रहलाद सिंह, श्री बिनोद कुमार, श्री अनिल कुमार सिन्हा, श्री कृष्ण मुरारी कुमार, श्री शरत चन्द्र लाल, श्री मान्देश्वर सिंह, श्री बैजनाथ महतो, श्री जलेश्वर महतो, श्री चैतु कच्छप इत्यादि को पुरस्कार प्रदान किया गया। इसके साथ ही समारोह में लाक्षा-2016 में उत्कृष्ट आलेख का पुरस्कार भी प्रदान किया गया।

कार्यक्रम का संचालन डॉ अंजेश कुमार, वरिष्ठ तकनीकी अधिकारी एवं धन्यवाद ज्ञापन डॉ निर्मल कुमार, विभागाध्यक्ष एवं अध्यक्ष हिन्दी दिवस समारोह आयोजन समिति ने किया। इस अवसर पर अन्य संस्थानों के अतिथियों के अतिरिक्त संस्थान के सभी अधिकारियों/कर्मचारियों ने भाग लिया।

## राज्य में भूगर्भ जल की स्थिति एवं जल छाजन विषय पर नगर स्तरीय हिन्दी संगोष्ठी/सह

### कार्यशाला

भाकृअनुप-भारतीय प्राकृतिक राल एवं गोंद संस्थान में 01 मार्च 2017 को पूर्वाह्न 10.00 बजे राज्य में भूगर्भ जल की स्थिति एवं जल छाजन विषय पर एक दिवसीय नगर स्तरीय हिन्दी संगोष्ठी का आयोजन किया गया। मुख्य अतिथि के रूप में संगोष्ठी का शुभारम्भ करते हुए मुख्य डाक महाध्यक्ष झारखण्ड परिमण्डल श्री अनिल कुमार ने कहा कि जल छाजन वर्तमान समय की सबसे बड़ी आवश्यकता बन गयी है। औद्योगिक इकाइयों के पास अगर पर्याप्त जमीन हो तो उन्हें आवश्यक रूप से जल छाजन को अपनाना चाहिए। जिससे वर्षा जल को एकत्रित कर उत्पादन प्रक्रिया के दौरान उपयोग में लाया जा सके। यह समस्या सभी की है तथा प्रत्येक नागरिक को इस समस्या के समाधान के लिए आगे आने की जरूरत है। हम सभी लोग छोटे-छोटे तरीकों को अपनाकर पानी की बचत कर सकते हैं, जिससे हमें पानी की कमी से जूझना नहीं पड़ेगा। उन्होंने तालाबों को भरने पर रोक लगाने और वर्षा जल का संरक्षण करने की बात कही।

समारोह को विशिष्ट अतिथि के रूप में संबोधित करते हुए डॉ कंचन कुमार सिंह, सहायक महानिदेशक, भा.कृ.अनु. परिषद ने कहा कि जल को लेकर हाल के दिनों में उठे विवादों से हमें सबक लेकर वर्षा जल का संचय पर काम



करना होगा। उन्होंने कहा कि जल जीवन के लिए बेहद महत्वपूर्ण है। जल संचय के कारण ही पंजाब चार सौ मिली लीटर वर्षा के बावजूद रिकार्ड पैदावार कर पाता है और पूर्वोत्तर के राज्य चौदह सौ मिली लीटर वर्षा के बावजूद काफी कम पैदावार कर पाते हैं।

समारोह का शुभारंभ मुख्य अतिथि द्वारा दीप प्रज्ज्वलन के साथ हुआ तथा संस्थान के निदेशक डॉ केवल कृष्ण शर्मा ने पुष्पगुच्छ देकर अतिथियों का अभिनंदन किया। अपने स्वागत भाषण में डॉ केवल कृष्ण शर्मा ने मुख्य अतिथि, अन्य अतिथियों, विशेषज्ञों, विभिन्न कार्यालयों से आये हुए प्रतिभागियों, समाचार माध्यम के प्रतिनिधियों के प्रति आभार प्रकट किया तथा संस्थान की गतिविधियों एवं उपलब्धियों की जानकारी दी। उन्होंने बताया कि इस संगोष्ठी के माध्यम से राज्य की एक बड़ी समस्या को चर्चा के लिए लिया गया है। इससे केवल किसान ही नहीं हम सभी प्रभावित हैं। डॉ शर्मा ने कहा कि अच्छी बरसात के बावजूद भी भूगर्भ जल की कमी इस ओर की गई उपेक्षा का परिणाम है।

संगोष्ठी का आयोजन नगर राजभाषा कार्यान्वयन समिति (केन्द्र सरकार के कार्यालय) राँची के तत्वावधान में किया गया एवं भारतीय कृषि जैवप्रौद्योगिकी संस्थान, नामकुम इस आयोजन के सह-प्रायोजक थे। संगोष्ठी के तकनीकी सत्र में झारखण्ड के भूगर्भ जल परिदृश्य एवं पूनर्भरण कि संभावना विषय पर व्याख्यान देते हुए डॉ टी बी एन सिंह, वैज्ञानिक-डी एवं प्रभारी अधिकारी, केन्द्रीय भूमि जल बोर्ड-स्टेट यूनिट, राँची ने जल छाजन के विभिन्न उपाय के बारे में तकनीकी जानकारी उपलब्ध करायी। घरों में रिचार्ज पीट के निर्माण पर जोर दिया तथा बताया कि सरकारी स्तर पर कई एजेंसियां तकनीकी सहायता देने के लिए उपलब्ध है। उन्होंने वर्षा जल के अधिकतम संरक्षण पर जोर दिया।

तकनीकी सत्र के दूसरे वक्ता श्री मधुकर, वरिष्ठ पत्रकार, राँची ने जल संकट एवं समाधान विषय पर व्याख्यान दिया। उन्होंने कहा कि जिस प्रकार जंगलों के कम होने से नुकसान हो रहा है उसी प्रकार हम पहाड़ों को तोड़कर और भी ज्यादा नुकसान कर रहे हैं। जंगल एवं पहाड़ बरसात के एक बड़े कारक हैं। उन्होंने फुटपाथ को कंक्रीट से ढकने की परिपार्ती को गलत बताया तथा कहा कि सरकार को इस दिशा में गंभीरता से विचार करना चाहिए। साथ ही उन्होंने

कहा कि सरकार एवं नागरिक दोनों स्तरों पर इस क्षेत्र में कार्यवाई की जरूरत है।

संगोष्ठी के द्वितीय तकनीकी सत्र में वर्षा जल प्रबंधन तथा जल छाजन के माध्यम से मिट्टी एवं जल संरक्षण विषय पर डॉ डी के रुसिया, प्राध्यापक एवं अध्यक्ष, कृषि अभियांत्रिकी विभाग, बिरसा कृषि विश्वविद्यालय, कांके, राँची ने अपने विचार व्यक्त किए। उन्होंने डोभा निर्माण की आवश्यकता पर प्रकाश डाला। डॉ रुसिया ने विशेष रूप से प्रक्षेत्र जल संरक्षण में जल स्रोत को समृद्ध बनाने व फसलों की सिंचाई के बारे में विस्तार से जानकारी दी।

संगोष्ठी के बारे में जानकारी देते हुए संयोजक एवं प्रधान वैज्ञानिक डॉ एम जेड सिद्दीकी ने कार्यक्रम के उद्देश्यों पर प्रकाश डाला।

संगोष्ठी में राँची स्थित केन्द्र सरकार के 36 कार्यालयों के 118 अधिकारियों/कर्मचारियों ने भाग लिया जिसमें संस्थान एवं भारतीय कृषि जैवप्रौद्योगिकी संस्थान के वैज्ञानिक, अधिकारी भी शामिल थे। समापन सत्र के पूर्व अयोजित खुली चर्चा में मौसम वैज्ञानिक डॉ आर एस शर्मा, भारतीय कृषि जैवप्रौद्योगिकी संस्थान के डॉ बीरेन्द्र कुमार यादव, डॉ निर्मल कुमार, आपदा प्रबंधन विशेषज्ञ कर्नल संजय श्रीवास्तव इत्यादि ने विचार व्यक्त किए। संगोष्ठी का उद्देश्य गिरते भूगर्भ जल स्तर के प्रति लोगों को जागरूक करना एवं जल प्रबंधन कि जानकारी देना था। संगोष्ठी का संचालन आयोजन समिति के सचिव एवं वरिष्ठ तकनीकी अधिकारी डॉ अंजेश कुमार ने तथा धन्यवाद ज्ञापन प्रधान वैज्ञानिक एवं संयोजक डॉ एम जेड सिद्दीकी ने किया।

## संस्थान के हिन्दी/द्विभाषी प्रकाशनों की सूची

- ❖ प्राकृतिक राल एवं गोंद, भा.प्रा.रा.गों.सं. समाचार पत्रिका, अक्टूबर 2016-मार्च 2017, अंको की संख्या- 02 पृष्ठों की संख्या-16 (द्विभाषी)
- ❖ ईयर प्लानर-सह-प्रचार पत्रक 2017 पृष्ठों की संख्या 28 (द्विभाषी)
- ❖ लाक्षा-2017, पृष्ठों की संख्या-112
- ❖ वार्षिक रिपोर्ट-2016-17, पृष्ठों की संख्या-156



# Budget

## Budget allocation and utilization during 2017-18

Name of the Head		Plan (Rupees in lakh)					
Sl. No.		B.E 2017-18	Opening balance on 01.04.2017	Refund during 2017-18 if any	Fund recevd. during 2017-18	Prog. Exp during 2017-18	Closing Balance (4-5+6-7)
1	2	3	4	5	6	7	8
<b>GRANT FOR CREATION OF</b>							
1	<b>Works</b>						
	(A) Land	0.00	0.00	0.00	0.00	0.00	0.00
	(B) Building	0.00	0.00	0.00	0.00	0.00	0.00
	i. Office Building	43.63	0.00	0.00	43.63	43.63	0.00
	ii. Residential Building	0.00	0.00	0.00	0.00	0.00	0.00
	iii. Minor Works	0.00	0.00	0.00	0.00	0.00	0.00
2	Equipments	11.00	0.00	0.00	11.00	11.00	0.00
3	Information Technology	2.00	0.00	0.00	2.00	1.97	0.03
4	Library Books & Journals	0.37	0.00	0.00	0.37	0.37	0.00
5	Vehicle & Vessels	0.00	0.00	0.00	0.00	0.00	0.00
6	Live Stock	0.00	0.00	0.00	0.00	0.00	0.00
7	Furniture & Fixtures	3.00	0.00	0.00	3.00	2.99	0.01
8	Others	0.00	0.00	0.00	0.00	0.00	0.00
	<b>Total Capital (Grants for creation of capital assets)</b>	<b>60.00</b>	<b>0.00</b>	<b>0.00</b>	<b>60.00</b>	<b>59.95</b>	<b>0.05</b>
<b>GRANT IN AID SALARIES (REVENUE)</b>							
1	<b>Establishment Expenses</b>						
	<b>(A) Salaries</b>						
	i. Establishment charges	1280.00	0.00	188.00	1280.00	1091.92	0.08
	ii. Wages	0.00	0.00	0.00	0.00	0.00	0.00
	iii. Over Time Allowance	0.60	0.00	0.00	0.60	0.14	0.46
	<b>Total Estt. expenses (Grant in Aid-Salaries)</b>	<b>1280.60</b>	<b>0.00</b>	<b>188.00</b>	<b>1280.60</b>	<b>1092.06</b>	<b>0.54</b>
<b>GRANT IN AID GENERAL (REVENUE)</b>							
1	<b>Pension &amp; Other Retirement Benefits</b>	302.00	0.00	-32.00	270.00	301.95	0.05
2	<b>Travelling Allowances</b>						
	(A) Domestic TA/ Transfer TA	16.00	0.00	0.00	16.00	15.97	0.03
	(B) Foreign TA	0.00	0.00	0.00	0.00	0.00	0.00
	<b>Total Travelling expenses</b>	<b>16.00</b>	<b>0.00</b>	<b>0.00</b>	<b>16.00</b>	<b>15.97</b>	<b>0.03</b>
3	<b>Research &amp; Operational Expenses</b>						
	(A) Research Expenses	45.00	0.00	9.80	45.00	35.10	0.10
	(B) Operational Expenses	40.00	0.00	20.90	40.00	19.09	0.01
	<b>Total Res. &amp; Operational expenses</b>	<b>85.00</b>	<b>0.00</b>	<b>30.70</b>	<b>85.00</b>	<b>54.19</b>	<b>0.11</b>
4	<b>Administrative Expenses</b>						



	(A) Infrastructure	60.00	0.00	0.15	60.00	59.84	0.01
	(B) Communication	3.00	0.00	0.90	3.00	2.05	0.05
	(C) Repairs & Maintenance						
	i. Equipments, Vehicle & Others	18.00	0.00	0.70	18.00	17.29	0.01
	ii. Office Building	25.00	0.00	0.00	25.00	25.00	0.00
	iii. Residential Building	15.00	0.00	0.00	15.00	15.00	0.00
	iv. Minor Works	0.00	0.00	0.00	0.00	0.00	0.00
	(D) Others Admin. Expenses	75.00	0.00	29.10	75.00	45.84	0.06
	<b>Total Administrative Expenses</b>	<b>196.00</b>	<b>0.00</b>	<b>30.85</b>	<b>196.00</b>	<b>165.01</b>	<b>0.14</b>
5	<b>Miscellaneous Expenses</b>						
	(A) HRD	3.00	0.00	0.15	3.00	2.73	0.12
	(B) Other Items ( Fellowship/ Scholarship etc.	0.00	0.00	0.00	0.00	0.00	0.00
	(C) Publicity & Exhibitions	7.00	0.00	0.70	7.00	6.29	0.01
	(D) Guest House Maintenance	1.00	0.00	0.10	1.00	0.90	0.00
	(E) Other Miscellaneous	52.00	0.00	27.50	52.00	24.44	0.06
	<b>Total Misc. Expenses</b>	<b>63.00</b>	<b>0.00</b>	<b>28.45</b>	<b>63.00</b>	<b>34.36</b>	<b>0.19</b>
	<b>Total Grant in Aid- General</b>	<b>662.00</b>	<b>0.00</b>	<b>58.00</b>	<b>630.00</b>	<b>571.48</b>	<b>0.52</b>
	<b>Total Rev. ( Grant in aid gen. + Salaries)</b>	<b>1942.60</b>	<b>0.00</b>	<b>246.00</b>	<b>1910.60</b>	<b>1663.54</b>	<b>1.06</b>
	<b>TOTAL (Capital + Revenue)</b>	<b>2002.60</b>	<b>0.00</b>	<b>246.00</b>	<b>1970.60</b>	<b>1723.49</b>	<b>1.11</b>
	<b>Non-Plan Schemes-Summer/Winter School</b>	<b>0.00</b>	<b>0.00</b>	<b>0.00</b>	<b>0.00</b>	<b>0.00</b>	<b>0.00</b>
	<b>GRAND TOTAL</b>	<b>2002.60</b>	<b>0.00</b>	<b>246.00</b>	<b>1970.60</b>	<b>1723.49</b>	<b>1.11</b>
	<b>Loans &amp; Advances</b>	<b>10.00</b>	<b>0.00</b>	<b>8.09</b>	<b>10.00</b>	<b>1.92</b>	<b>0.00</b>

**Plan Scheme Expenditure**

Name of Plan Scheme AICRP/Network Project	Source of fund i.e. ICAR H.Q. ICAR Instt. Education Division/NAIP etc.	Release to ICAR Units (List of ICAR Instt. Should be attached.	Up to date Con- solidated Expenditure as reported by implementing Centres of ICAR units	Release to other than ICAR units i.e. SAUs/ NGOs etc.	Actual Ex- penditure incurred by the Institute, if any	Total utili- zation
1	2	3	4	5	6	7(4+5+6)
1. Network Project-HP & VANRG	ICAR	49.8	0	76.35	8.17	84.53
2. Network Project-CLIGR	ICAR	0	0	99	36.24	135.24
3. IPR	ICAR	0	0	0	0.28	0.28
4. KVK, Khunti	ICAR	0	0	0	25.85	25.85

**List of ICAR Institutes under the plan scheme NWP = HP & VANRG**

1. NRCAF, JHANSI      2. CAZRI, Jodhpur      3. ICAR NEH, Barapani

<b>Actual Realization of Revenue Receipts</b>	<b>Target</b>
<b>31.21</b>	<b>0</b>
<b>Head of Institute</b>	<b>Finance &amp; Accounts Officer</b>



## Personnel

Details of scientific, technical, administrative and supporting staff as on December 31, 2017				
Scientific	Sanctioned Strength	In Position	PERSONNEL	
			Dr. KK Sharma	Director
LAC PRODUCTION DIVISION				
RMP	1	1	Dr. S Ghosal, Pr. Sc. & I/c Head	Agronomy
Principal Scientist	6	2	Dr. NK Sinha, Pr. Sc.	Seed Science
Sr. Scientist	15	6	Dr. J Ghosh, Sr. Sc.	Gen. & Plant Breeding
Scientist	26	19	Dr. VD Lohot, Sc.	Plant Physiology
Total	48	28	Dr. (Mrs.)Thamilarasi K., Sc.	Agril Biotechnology
Technical				
Category-I	43	29	Sri Ashish Kr Raut, Sc.	Agril Entomology
Category-II	23	7	Er. SK Srivastava, Sc.	SWCE
Category-III	6	0	Ms Shruti Sinha, Sc.	Agril Biotechnology
Total	72	36	Sri PA Ansari, STO	F/F Tech
Administrative				
Sr. AO	1	1	Sri Bhupal Kumar, STA	F/F Tech
F&AO	1	0	Sri SK Yadav	Private Secretary
AAO	2	2	PROCESSING & PRODUCT DEVELOPMENT DIVISION	
Private Secy.	1	1	Dr. N Prasad, Pr. Sc. & Head	AS & PE
Security Officer	1	1	Dr. Sanjay Srivastava, Pr. Sc.	Agril Chem
JAO	1	1	Dr. MZ Siddiqui, Pr. Sc.	Agril Chem
PA	2	0	Dr. MF Ansari, Sr. Sc.	Agril Chem
Assistant	11	7	Er. SK Pandey, Sc.	Mech Engg
Sr. Clerk	5	4	Dr. SC Sharma, Sc.	FM & Power
Jr. Clerk	6	1	Dr. AR Chowdhury, Sc.	Agril Chem
Steno Gr. III	2	1	Sri N Thombare, Sc.	Agril Chem
Total	33	19	Sri CJ Mate, Sc.	Agril Chem
Skilled Support Staff			Sri Md. Ali, Sc.	Agril Chem
SSS	84	44	Er. Ranjeet Singh, Sc.	AS & PE
			Er. Anamika Thakur, Sc.	AS & PE
Cadre	Sanctioned Post	In position	Sri Ajay Kumar, STA	Lab Tech
			Sri RK Rai, STA	Lab Tech
Scientific	48*	28	Sri Anup Kumar, STA	Lab Tech
Technical	72	36	Sri Binod Kumar, STA	Lab Tech
Administrative	33	19		
Supporting	84	44		
Total	237	127		

\*including RMP





<b>TRANSFER OF TECHNOLOGY DIVISION</b>		<b>ESTATE SECTION</b>	
Dr. Nirmal Kumar, Pr. Sc. & I/c, Head	Agril Extension	Sri AK Yadav, SO	I/c Estate
Dr. SKS Yadav, Sc.	Agril Chem	Sri HL Bhakta, TO	W & Engg
Dr. RK Yogi, Sc.	Agril Economics	Sri Binay Kr., STA	W & Engg
Sri P Pattamajhi, STO	F/F Tech	Sri Arjun Sharma, STA	W & Engg
Sri DK Singh, STO	F/F Tech	Sri RK Ravi, STA	W & Engg
Sri AK Sinha, STO	F/F Tech	Sri K Tirkey, STA	W & Engg
Sri SB Azad, TO	F/F Tech	Sri PVD Tirkey, TA	W & Engg
Sri Madan Mohan, STA	F/F Tech	Sri RK Singh, Sr. Tech	W & Engg
		Sri AK Sharma, Sr. Tech	W & Engg
<b>PME CELL</b>		Sri Mahavir Mahto, Sr. Tech	W & Engg
Dr. MZ Siddiqui, Pr. Sc. & I/c		Sri Sukra Ekka, Sr. Tech	W & Engg
Sri Dipankar Ganguli, ACTO	Lab Tech		
Sri Sunil Kumar, STO	Lab Tech	<b>RAJBHASHA PRAKOSTH</b>	
<b>HEALTH CENTER</b>		Dr. Anjesh Kumar, STO, P & E group	
Dr. Sanjay Srivastava, Pr. Sc. & I/c			
Dr. Ashok Kumar, PMO		<b>LIBRARY</b>	
Dr. Kailash Prasad, PMO		Sri Binod Kumar, STO	
Sri CK Singh, STA			
		<b>ADMIN I SECTION</b>	
<b>QUALITY EVALUATION LAB</b>		Sri Sujit Kr Singh, Sr. Admin Officer	
Dr. Sanjay Srivastava, Pr. Sc. & I/c		Sri SC Lal, Assistant	
Sri BK Singh, STA, Lab Tech		Sri Bandhu Mahto, LDC	
<b>INSTITUTE RESEARCH FARM</b>			
Dr. A Mohanasundaram, Sc. & I/c		<b>ADMIN II SECTION</b>	
Sri Satish Kumar, TO	F/F Tech	Sri Amrendra Kishore, AAO, DDO	
Sri Sunil Kumar Mukherjee, STA	F/F Tech	Sri Arun Tripathi, Assistant	
Sri Jhirga Oraon, STA	W & Engg	Sri RK Toppo, Assistant	
		Sri Samal Kumar, Sr. Clerk	
<b>AUDIT &amp; ACCOUNTS SECTION</b>		Sri KP Kashi, Sr. Clerk	
Dr. MF Ansari, Sr. Sc. & I/c F& AO			
Sri Ashwini Kumar, JAO		<b>ADMIN III SECTION</b>	
Sri RN Mahto, Assistant		Sri Prahlad Singh, AAO	
Sri Arjun Gope, Assistant		Sri KK Deonath, Sr. Clerk	
		Sri KM Kumar, Sr. Clerk	
<b>VEHICLE POOL</b>			
Sri Arvind Kumar, TO	W & Engg	<b>DIRECTOR OFFICE</b>	
Sri J Tewari, STA	W & Engg	Sri Hari Vilas, Steno to Director	
Sri Mandeshwar Singh, STA	W & Engg		
Sri RK Yadav, STA	W & Engg		
Sri Bandi Lakra, STA	W & Engg		



<b>A. JOINING</b>
Dr. Nirmal Kumar has joined the post of Pr. Sc. (Agril Extension) on 01.6.2017.
Dr. NK Sinha has joined the post of Sr. Sc. (Seed Science) on 07.6.2017.
Er. SK Srivastava, Sc. has joined the post of Sc. (SWCE) on 14.7.2017.
Ms. Shruti Sinha has joined the post of Sc. (Agril Biotechnology) on 09.10.2017.
Er. Ranjeet Singh has joined the post of Sc. (AS & PE) on 16.10.2017.
Er. Anamika Thakur has joined the post of Sc. (AS & PE) on 23.10.2017.
<b>B. PROMOTION</b>
Dr. NK Sinha, Sr. Sc. promoted to the next higher grade <i>i.e.</i> Pr. Sc. on 01.12.2017.
<b>C. CLEARANCE OF PROBATION PERIOD &amp; CONFIRMATION</b>
Dr. SS Bhat, Sc. (Forestry) has completed his probation period on 31.12.2014 & Confirmed on 01.01.2015.
<b>D. TRANSFER</b>
Dr. Saurabh Swami, Sc. transferred from ICAR-IINRG, Ranchi to ICAR-CAZRI, Jodhpur on 10.3.2017.
Dr. PC Sarkar, Pr. Sc. transferred from ICAR-IINRG, Ranchi to ICAR-NIRJAFT, Kolkata on 30.6.2017.
Sri Kameshwar Oraon, Assistant transferred from ICAR-IINRG, Ranchi to ICAR-IIAB, Ranchi on 30.6.2017.
Dr. AK Jaiswal, Pr. Sc. transferred from ICAR-IINRG, Ranchi to ICAR-IISR, Lucknow on 07.7.2017.
Dr. Anees K, Sc. transferred from ICAR-IINRG, Ranchi to ICAR-IISR, Calicut on 07.7.2017.
Dr. SS Bhat, Sc. transferred from ICAR-IINRG, Ranchi to ICAR-IGFRI, Jhansi on 13.10.2017.
<b>E. RETIREMENT</b>
Sri Bihari Sahu, Assistant on 31.12.2017.
Sri Ganesh Ram, Assistant on 31.12.2017.
Smt. Fulmani Kachhap, SSS on 31.12.2017.
Sri BS Choudhary, STA on 30.6.2017.
Sri Ravi Shankar, Assistant on 30.9.2017.
Sri Thibu Minz, Assistant on 09.10.2017.





## Appendix

### Annexure-1: Farmers training programmes on Scientific lac cultivation, processing and utilization

Month	Sponsoring Organization	State	Period	M	F	No. of Participants
February	Meghalaya Institute of Entrepreneurship, Govt. of Meghalaya	Meghalaya	06.02.17-11.02.17	09	06	15
	Forest Department, Chhattisgarh	Chhattisgarh	20.02.17-25.02.17	22	-	22
March	Forest Department, Deoghar, Jharkhand	Jharkhand	27.02.17-04.3.17	16	-	16
	Forest Department, Chatra, Jharkhand	Jharkhand	27.02.17-04.3.17	09	02	11
	Forest Department, Dumka, Jharkhand	Jharkhand	15.3.17-18.3.17	12	-	12
	AROUSE, Gumla, Jharkhand	Jharkhand	15.3.17-18.3.17	05	-	05
	Forest Department, Chatra, Jharkhand	Jharkhand	15.3.17-18.3.17	11	-	11
	Forest Department, Chhattisgarh	Chhattisgarh	15.3.17-18.3.17	01	-	01
April	Forest Department, Ramgarh, Jharkhand	Jharkhand	27.3.17-01.4.17	08	-	08
	Forest Department, Sundarpahari, Godda, Jharkhand	Jharkhand	27.3.17-01.4.17	06	-	06
	Forest Department, Boarijor, Godda, Jharkhand	Jharkhand	27.3.17-01.4.17	06	-	06
	Forest Department, Pakur, Jharkhand	Jharkhand	27.3.17-01.4.17	08	-	08
	Forest Department, Chatra, Jharkhand	Jharkhand	27.3.17-01.4.17	13	-	13
	Forest Department, Simdega, Jharkhand	Jharkhand	27.3.17-01.4.17	04	-	04
	Torpa Rural Development Society, (TRDS) Torpa, Jharkhand	Jharkhand	03.4.17-07.4.17	19	-	19
	Forest Department, Hazaribagh, Jharkhand	Jharkhand	19.4.17-22.4.17	17	04	21
	Forest Department, Saraikela-Kharsawan, Jharkhand	Jharkhand	24.4.17-29.4.17	14	-	14
	Forest Department, Hazaribagh, Jharkhand Note: 12516-12521- 06 trainees absent w.e.f. evening of 25.04.2017, Certificate not prepared.	Jharkhand	24.4.17-29.4.17	13	-	13



June	Forest Department, Dharamjaigarh, Chhattisgarh	Chhattisgarh	05.6.17-09.6.17	22	-	22
	Forest Department, Gumla, Jharkhand	Jharkhand	05.6.17-09.6.17	06	-	06
	Forest Department, Khunti, Jharkhand Note: 12557-12558-02 trainees absent w.e.f. 06.6.2017, Certificate not prepared	Jharkhand	05.6.17-09.6.17	09	-	09
	Forest Department, Giridih & Hazaribagh, Jharkhand	Jharkhand	12.6.17-17.6.17	16	17	33
	Forest Department, Dharamjaigarh & Lailunga, Raigarh (Chhattisgarh)	Chhattisgarh	12.6.17-17.6.17	14	-	14
November	CGMFP, Raipur, Chhattisgarh	Chhattisgarh	06.11.17-10.11.17	26	02	28
December	ATMA, Pakur, Jharkhand	Jharkhand	27.11.17-01.12.17	18	-	18
	CGMFP, Surajpur, Chhattisgarh Note: 12734- 01 trainee absent w.e.f. 06.12.2017 Certificate not prepared	Chhattisgarh	04.12.17-08.12.17	30	-	30
<b>Total</b>				<b>334</b>	<b>31</b>	<b>365</b>

**Annexure-2 : Educational programme on Industrial Training on Natural Resins and Gums for M.Sc. (Forestry) students from Guru Ghasidas Central University, Bilaspur (Chhattisgarh) (10/15 days)**

Month	Sponsoring Organization	State	Period	M	F	No. of Participants
January	V <sup>th</sup> Winter Workshop on Natural Resins and Gums (10 days) Sam Higginbottom Institute of Agriculture, Technology and Sciences (SHIATS), Allahabad (U.P.)	U.P.	09.01.17 - 18.01.17	05	05	10
	Ewing Christian College, Allahabad (U.P.)	U.P.	09.01.17 - 18.01.17	03	11	14
May	10 <sup>th</sup> Summer Workshop on Natural Resins & Gums (15 days) Department of Zoology, PK Roy Memorial College, Dhanbad (Jharkhand)	Jharkhand	02.5.17 - 16.5.17	01	19	20
	11 <sup>th</sup> Summer Workshop on Natural Resins & Gums (10 days), Institute of Agriculture, Banaras Hindu University (BHU), U.P. (B.Sc. Ag. Students)	U.P.	22.5.17 - 31.5.17	26	19	45
<b>Total</b>				<b>35</b>	<b>54</b>	<b>89</b>

**Annexure-3 : Short term training program (3 days) - Refresher Course on Forecast Technique of Larval Emergence**

Month	Course No.	Sponsoring Organization	State	Period	M	F	No. of Participants
February	01	Sri Manoj Kumar, Son of Late Brahmdeo Prasad from Village: Naya Toli, Post: Namkum, Block: Namkum, Dist: Ranchi (Jharkhand), attended a Training course on Forecast Technique of Larval Emergence	Jharkhand	16.02.17-18.02.17	01	-	01
<b>Total</b>					<b>01</b>	<b>-</b>	<b>01</b>
<b>Short term training program (3 days) - Rangeeni lac cultivation, processing and utilization</b>							
Month	Course No.	Sponsoring Organization	State	Period	M	F	No. of Participants
October	01	Jharkhand State Livelihood Promotion Society (JSLPS), Jharkhand	Jharkhand	09.10.17-11.10.17	27	13	40
	02	Jharkhand State Livelihood Promotion Society (JSLPS), Jharkhand	Jharkhand	12.10.17-14.10.17	06	31	37
December	03	ATMA, Burhanpur, Madhya Pradesh	M.P.	19.12.17-21.12.17	08	-	08
<b>Total</b>					<b>41</b>	<b>44</b>	<b>85</b>

**Annexure-4 : On-farm training programme on scientific lac cultivation**

District -State	Sponsoring/ Nominating Agency	Venue (Village, Block)	Date	M	F	No. of Participants
Khunti, Jharkhand	Forest Department, Khunti	Rania Kisan Bhawan	21.02.17	150	40	190
Khunti, Jharkhand	Forest Department, Khunti	DFO Office, Khunti	28.02.17	40	-	40
Hazaribagh (E), Jharkhand	Forest Department, Hazaribagh (E)	Alpito Panchayat Bhavan	15.3.17	75	125	200
Hazaribagh (E), Jharkhand	Forest Department, Hazaribagh (E)	Alpito Panchayat Bhavan	16.3.17	100	200	300
Ramgarh, Jharkhand	Forest Department, Ramgarh	Balranga High School	19.3.17	75	80	155
Saraikela, Jharkhand	Forest Department, Saraikela	Ban Chetra Bhavan, Saraikela	23.3.17	115	20	135
Hazaribagh (W), Jharkhand	Forest Department, Hazaribagh (W)	Primary School, Pandavpur, Barkagaon	24.3.17	20	35	55
Dhanbad, Jharkhand	Forest Department, Dhanbad	Range Office, Rajganj, Domchanchi	24.3.17	72	03	75

Dhanbad, Jharkhand	Forest Department, Dhanbad	Forest Nursery, Gadi, Tundi	25.3.17	55	07	62
Hazaribagh (W), Jharkhand	Forest Department, Hazaribagh (W)	Forest Range Office, Barhi	25.3.17	51	-	51
Pakur, Jharkhand	Forest Department, Pakur	Model School, Chota Kolkhipana, Maheshpur	25.3.17	125	70	195
Simdega, Jharkhand	Forest Department, Simdega	Rest House, Simdega	28.3.17	65	-	65
Simdega, Jharkhand	Forest Department, Simdega	Range Office, Kolebira, Simdega	28.3.17	17	-	17
Chatra, Jharkhand	Forest Department, Chatra, North	Kataiya Gramin	17.4.17	100	90	190
Chatra, Jharkhand	Forest Department, Chatra, South	Range office, Semaria	04.5.17	80	37	117
Hazaribagh, Jharkhand	Forest Department, Hazaribagh, East	BD Jaiswal Inter College, Harli	01.6.17	50	100	150
Hazaribagh, Jharkhand	Forest Department, Hazaribagh, East	BD Jaiswal Inter College, Harli	02.6.17	45	105	150
Saraikela- Kharsawan, Jharkhand	Forest Department, Jharkhand	Van Chetna Bhawan, Saraikela	04.11.17	84	04	88
Hazaribagh, Jharkhand	Forest Department, Hazaribagh, East	Alpito, Hazaribagh	14.12.17	25	75	100
Hazaribagh, Jharkhand	Forest Department, Hazaribagh, East	Alpito, Hazaribagh	15.12.17	20	80	100
Raisen, M. P.	NRLM, Raisen	Padashir, Begamganj, Raisen	18.12.17	15	50	65
Raisen, M. P.	NRLM, Raisen	Dhawj, Begamganj, Raisen	19.12.17	15	55	70
				<b>1394</b>	<b>1176</b>	<b>2570</b>

#### Annexure -5: On-farm Motivational/ Supplementary training programme on lac cultivation

District -State	Nominating Agency	Venue (Village, Block)	Date	M	F	No. of Participants
Khunti, Jharkhand	JASCOLAMPF, Ranchi	Centre for Women's Development, Torpa	27.02.17	36	09	45
Khunti, Jharkhand	JASCOLAMPF, Ranchi	Centre for Women's Development, Torpa	01.3.17	35	10	45
Ranchi, Jharkhand	Saktidhar Koiri	Kataritoli, Nagri, Ranchi	22.8.17	20	-	20
Khunti, Jharkhand	Saktidhar Koiri	Silda, Khunti	22.8.17	30	-	30
Khunti, Jharkhand	TRDS, Torpa	Mahila Vikas Kendra, Torpa	23.8.17	30	190	220



Khunti, Jharkhand	TRDS, Torpa	Mahila Vikas Kendra, Torpa	26.8.17	40	139	179
Palamu, Jharkhand	Jan Astha, Palamu	Medininagar, Palamu	29.10.17	10	55	65
Latehar, Jharkhand	Forest Department,	Kundri Farm	30.10.17	50	60	110
Palamu, Jharkhand	Jan Astha, Palamu	Lohara, Sangwar, Lesliganj	30.10.17	02	55	57
				<b>253</b>	<b>518</b>	<b>771</b>

#### Annexure - 6: In-campus One-day Orientation programme on lac cultivation

District - State	Nominating Agency	Date	M	F	No. of Participants
Khunti, Jharkhand	PRADAN, Khunti	04.01.17	30	25	55
Khunti, Jharkhand	PRADAN, Khunti	06.01.17	17	17	34
Ranchi, Jharkhand	ECC Students, Ranchi	09.01.17	-	-	24
Ranchi, Jharkhand	Marwari College, Ranchi	13.01.17	06	23	29
Ranchi, Jharkhand	BAU, Kanke, Ranchi	17.01.17	03	08	11
Ranchi, Jharkhand	R SETI BOI (Progressive farmers)	21.01.17	20	01	21
Ranchi, Jharkhand	RK Mission, Ranchi	15.02.17	18	-	18
Raigarh, Chhattisgarh	Forest Department	20.02.17	16	-	16
Ranchi, Jharkhand	St. Xavier college, Ranchi	08.3.17	04	-	04
Khunti, Jharkhand	St. Joseph's College, Torpa	17.3.17	03	15	18
Ranchi, Jharkhand	RK Mission University, Ranchi	17.3.17	23	10	33
Ranchi, Jharkhand	JSLPS, Ranchi	22.3.17	01	15	16
Ramgarh, Jharkhand	KVK, Ramgarh	24.3.17	-	45	45
Ranchi, Jharkhand	Sai Nath University, Ranchi	11.4.17	18	10	28
Hazaribagh, Jharkhand	Forest department, Barkagaon	19.4.17	09	04	13
Ranchi, Jharkhand	M. Sc. Zoology	25.4.17	03	17	20
Hazaribagh, Jharkhand	Forest department, Barhi	25.4.17	27	-	27
Chhattisgarh	OXFAM India & Partners	05.5.17	28	10	38
Purulia, W.Bengal	ATMA Purulia	16.5.17	19	04	23
Ranchi, Jharkhand	KGVK, Angara, Ranchi	25.5.17	20	22	42
Ranchi, Jharkhand	KGVK, Angara, Ranchi	26.5.17	02	42	44
Deoghar, Jharkhand	Progressive farmers	30.5.17	07	09	16
Giridih, Jharkhand	Progressive farmers	23.6.17	07	11	18
Palamu, Jharkhand	Progressive farmers	23.6.17	15	05	20
Ranchi, Jharkhand	RK Mission, Ranchi	24.6.17	17	-	17
Ranchi, Jharkhand	RK Mission, Ranchi	27.6.17	13	-	13
Ranchi, Jharkhand	Sapphire International School, Ranchi	01.7.17	20	31	51
Ranchi, Jharkhand	Kendriya Vidyalaya Sangathan, Jharkhand & Odisha (through KV Namkum)	21.7.17	-	168	168
Ranchi, Jharkhand	Progressive farmers	07.8.17	-	12	12
Ranchi, Jharkhand	CTR & TI, Nagri, Ranchi	23.8.17	09	15	24

Ranchi, Jharkhand	Udyogini, Ranchi	24.8.17	02	06	08
Ranchi, Jharkhand	Women's College, Ranchi	29.8.17	-	05	05
Ranchi, Jharkhand	Chakriya Vikash Sansthan, Ormanjhi	29.8.17	04	06	10
Ranchi, Jharkhand	SPP School, Ranchi	19.9.16			66
Ranchi, Jharkhand	Sachidanand Gyan Bharti Model School, Doranda, Ranchi	19.9.16			81
Ranchi, Jharkhand	Xavier Institute of Polytechnic Technology, Bargawan, Namkum	19.9.17			124
Ranchi, Jharkhand	Central School, Namkum	19.9.17			170
Ranchi, Jharkhand	Govt. Buniyadi School, Khijri	19.9.16	18	14	32
Ranchi, Jharkhand	Carmel Girls High School, Samlong	19.9.17	-	204	204
Ranchi, Jharkhand	KGBV, Namkum	19.9.17	02	52	55
Ranchi, Jharkhand	Central Academy, Bariatu, Ranchi	19.9.16	20	61	81
Ranchi, Jharkhand	Carmel School, Samlong	19.9.17	-	15	15
Ramgarh, Jharkhand	Agriculture Department, Ramgarh	22.9.17			48
Ranchi, Jharkhand	RK Mission, Ranchi	22.9.17	35	15	50
Ranchi, Jharkhand	RK Mission, Ranchi	13.10.17	30	20	50
Ranchi, Jharkhand	BAU, Kanke, Ranchi	17.10.17	07	13	20
Ranchi, Jharkhand	BAU, Kanke, Ranchi	31.10.17	17	24	41
Ranchi, Jharkhand	BAU, Kanke, Ranchi	02.11.17	49	01	50
Ranchi, Jharkhand	Training Centre, Hehal, Ranchi	03.11.17	21	05	26
Varanasi, U.P.	Hari Om Seva Sansthan, Chandauli, U.P.	08.11.17	34	-	34
Ranchi, Jharkhand	RK Mission, Ranchi	10.11.17	18	08	26
Ranchi, Jharkhand	BAU, Kanke, Ranchi	10.11.17	25	-	25
Hazaribag, Jharkhand	SUPPORT, Mandu, Hazaribag, Jharkhand	16.11.17	02	11	13
Ranchi, Jharkhand	XISS, Ranchi	21.11.17	38	36	74
Ranchi, Jharkhand	Oxford Public School, Ranchi	27.11.17	41	44	85
Ranchi, Jharkhand	Oxford Public School, Ranchi	27.11.17	33	46	79
Ranchi, Jharkhand	Oxford Public School, Ranchi	27.11.17	-	43	43
Pakur, Jharkhand	ATMA, Pakur	27.11.17	18	-	18
Ranchi, Jharkhand	Bridgefords School, Tupudana, Ranchi	29.11.17			284
Ranchi, Jharkhand	Oxford Public School, Ranchi	29.11.17			280
Ranchi, Jharkhand		30.11.17			10
Ranchi, Jharkhand	CTR&TI, Nagri, Ranchi	04.12.17	06	09	15
Burnia, Assam	State Forest Service (Govt. of India) Burnia, Assam	09.12.17	20	07	27
Ranchi, Jharkhand	Udyogini, Kamdara, Ranchi	11.12.17	06	04	10
Hazaribag, Jharkhand	Jan Sahyog Kendra, Hazaribag	13.12.17	12	-	12
Ranchi, Jharkhand	Udyogini, Namkum, Ranchi	15.12.17	-	18	18
Ranchi, Jharkhand	St. Anthony's School, Doranda	20.12.17	-	-	87
					<b>3174</b>


**Annexure -7: Lac based product demonstration training**



Sl.	Name & Address	Sponsoring Agency	Duration	Subject
1.	Sri Deepak Kumar	M/s Aadhya International, Mumbai	23.2.17-25.2.17	Air drying type insulating varnish. Shellac Emulsion Paint for internal coating
2.	Sri Raju, Son of Sri Punatri Bisen	ATMA, Bhandara, Maharashtra	20.3.17-25.3.17	Lac Processing
	Sri Lokesh, Son of Sri Dayaram BiSayamsen	ATMA, Bhandara, Maharashtra	20.3.17-25.3.17	Lac Processing
	Sri Sandip, Son of Sri Ratiram Madavi	ATMA, Bhandara, Maharashtra	20.3.17-25.3.17	Lac Processing
	Sri Vijay, Son of Sri Mohan Puram	ATMA, Bhandara, Maharashtra	20.3.17-25.3.17	Lac Processing
	Sri Shamkumar, Son of Sri Purushottam Kumbhare	ATMA, Bhandara, Maharashtra	20.3.17-25.3.17	Lac Processing
	Sri Kapil, Son of Sri Sampat Pardhi	ATMA, Bhandara, Maharashtra	20.3.17-25.3.17	Lac Processing
	Sri Vilash, Son of Sri Gopichand Bavankar	ATMA, Bhandara, Maharashtra	20.3.17-25.3.17	Lac Processing
	Sri Pradip, Son of Sri Eswardayal Sarnagate	ATMA, Bhandara, Maharashtra	20.3.17-25.3.17	Lac Processing
	Sri Mukesh, Son of Sri Husan Raut	ATMA, Bhandara, Maharashtra	20.3.17-25.3.17	Lac Processing
	Km. Prafullata, Daughter of Sri Pralhad Koche	ATMA, Bhandara, Maharashtra	20.3.17-25.3.17	Lac Processing
	Smt. Bhogiratha, W/o of Sri Yograj Jambhulkar	ATMA, Bhandara, Maharashtra	20.3.17-25.3.17	Lac Processing
	Sri Abhiman, Son of Sri Pundalik Tembhurkar	ATMA, Bhandara, Maharashtra	20.3.17-25.3.17	Lac Processing
	Sri Roshan Lal, Son of Sri Kumbhakaran Savatwan	ATMA, Bhandara, Maharashtra	20.3.17-25.3.17	Lac Processing
	Sri Kanti Kumar, Son of Sri Gajanan Ninave	ATMA, Bhandara, Maharashtra	20.3.17-25.3.17	Lac Processing
	Sri Girdhari, Son of Sri Motiram Jambhulkar	ATMA, Bhandara, Maharashtra	20.3.17-25.3.17	Lac Processing
	Sri Sanjay, Son of Sri Ramdas Kapgate	ATMA, Bhandara, Maharashtra	20.3.17-25.3.17	Lac Processing
Sri Shripat, Son of Sri Antu Kokode	ATMA, Bhandara, Maharashtra	20.3.17-25.3.17	Lac Processing	
Sri Ajay, Son of Sri Sukdeo Kawate	ATMA, Bhandara, Maharashtra	20.3.17-25.3.17	Lac Processing	
Sri Adesh, Son of Sri Ashok Uikey	ATMA, Bhandara, Maharashtra	20.3.17-25.3.17	Lac Processing	
3.	Sri Mohd Bilal	M/s Tata Steel Ltd., Jamshedpur (Jharkhand)	16.5.17-20.5.17	Testing and Analysis of Lac
	Sri Amit Kumar	M/s Tata Steel Ltd., Jamshedpur (Jharkhand)	16.5.17-20.5.17	Testing and Analysis of Lac
	Sri Pankaj Mahalle	M/s Tata Steel Ltd., Jamshedpur (Jharkhand)	16.5.17-20.5.17	Testing and Analysis of Lac



4.	Sri Panchanan Dey, Son of Sri Samir from Village: Tulin Benapara, Post: Tulin, Block: Jhalda-1, Dist: Purulia (W.B.)	DIC, Purulia, West Bengal	12.6.17-16.6.17	De-waxed Bleached Lac
	Sri Sumit Poddar, Son of Sri Badal from Village: Tulin Uporpara, Post: Tulin, Block: Jhalda-1, Dist: Purulia (W.B.)	DIC, Purulia, West Bengal	12.6.17-16.6.17	De-waxed Bleached Lac
	Sri Simanta Mahto, Son of Sri Bidyadhar from Village: Tulin Uporpara, Post: Tulin, Block: Jhalda-1, Dist: Purulia (W.B.)	DIC, Purulia, West Bengal	12.6.17-16.6.17	De-waxed Bleached Lac
	Sri Sonachand Chandra, Son of Late Ram Renu from Village: Tulin Benapara, Post: Tulin, Block: Jhalda-1, Dist: Purulia (W.B.)	DIC, Purulia, West Bengal	12.6.17-16.6.17	De-waxed Bleached Lac
	Sri Uttam Kr. Dutta, Son of Sri Lalbehari from Village: Tulin Benapara, Post: Tulin, Block: Jhalda-1, Dist: Purulia (W.B.)	DIC, Purulia, West Bengal	12.6.17-16.6.17	De-waxed Bleached Lac
	Sri Binoy Kr. Majhi, Son of Sri Dindayal from Village: Tulin Uporpara, Post: Tulin, Block: Jhalda-1, Dist: Purulia (W.B.)	DIC, Purulia, West Bengal	12.6.17-16.6.17	De-waxed Bleached Lac
	Sri Rajesh Chell, Son of Sri Sadhan from Village: Tulin Uporpara, Post: Tulin, Block: Jhalda-1, Dist: Purulia (W.B.)	DIC, Purulia, West Bengal	12.6.17-16.6.17	De-waxed Bleached Lac
	Sri Pintu Bhui, Son of Sri Tinkari from Village: Tulin Uporpara, Post: Tulin, Block: Jhalda-1, Dist: Purulia (W.B.)	DIC, Purulia, West Bengal	12.6.17-16.6.17	De-waxed Bleached Lac
5.	Sri Kamlesh Kumar Singh, S/o Late Brahamdeo Singh from M/s Riddhi Siddhi Prathmik Lakh Utpadak Sahyog Samiti, Kundri, Lesliganj, Palamu (Jharkhand)	Forest Department, Palamu, Jharkhand	04.5.2017	Preparation of Gulal from Palas Flowers
6.	Sri Ronak Rathor, Shri Niketan, 20, E Road, Air Base Colony, Kadma, Jamshedpur, Jharkhand 91657-2307700, 9031931540	Self	10.7.17	Natural Nail Polish
7.	Sri Himanshu Agrawal, S/o Shri Chandra Prakash Agrawal from M/s Singhaniya Lakh Industry, Industrial Area, Katghora, Korba 93890-59596	M/s Singhaniya Lakh Industry, Industrial Area, Katghora, Korba (Chhattisgarh)	03.7.17-12.7.17	Aleuritic Acid & De-waxed De-colourized Lac
8.	Sri Praveen Pardhi, S/o Sri C L Pardhi from M/s C. K. Lac Industry, 96 Mangejhari, Waraseoni (Madhya Pradesh) 74893-68432	M/s CK Lac Industry, 96 Mangejhari, Waraseoni (Madhya Pradesh)	08.8.17-10.8.17	Shellac Emulsion Paint for Internal Coating
9.	Sri Anurag Nilesh Soy	M/s Tofs Magnacraft Enterprises, 139 Naya Toli, Tupudana, Ranchi (Jharkhand)	13.12.17-04.12.17	Natural Nail Polish





10.	Smt. Prabha Devi, Wife of Sri Nilu Singh Village: Jaria, Post: Kamdara, Block: Kamdara, Dist: Gumla (Jharkhand)	Self	11.12.17- 16.12.17	Lac Processing & Value Addition
	Smt. Kumulina Topno, Wife of Sri Umblen Topno, Village: Kotbo, Post: Kamdara, Block: Kamdara, Dist: Gumla (Jharkhand)	Self	11.12.17- 16.12.17	Lac Processing & Value Addition
	Smt. Bahalen Topno, Wife of Sri Gledson Topno from Village: Kotbo, Post: Kamdara, Block: Kamdara, Dist: Gumla (Jharkhand)	Self	11.12.17- 16.12.17	Lac Processing & Value Addition
	Smt. Vencensia Topno, Wife of Sri Maties Topno from Village: Ramtolya, Post: Ramtolya, Block: Kamdara, Dist: Gumla (Jharkhand)	Self	11.12.17- 16.12.17	Lac Processing & Value Addition
	Smt. Monika Topno, Wife of Sri Marshal Topno from Village: Turundu, Post: Pokla, Block: Kamdara, Dist: Gumla (Jharkhand)	Self	11.12.17- 16.12.17	Lac Processing & Value Addition
	Smt. Shanti Devi, Wife of Sri Sulendra Singh from Village: Gara, Post: Gara, Block: Kamdara, Dist: Gumla (Jharkhand)	Self	11.12.17- 16.12.17	Lac Processing & Value Addition
	Smt. Anima Topno, Wife of Sri Ajit Soreng from Village: Nawatoli, Post: Shurhu, Block: Kamdara, Dist: Gumla (Jharkhand)	Self	11.12.17- 16.12.17	Lac Processing & Value Addition
	Smt. Suchita Kerketta, Wife of Sri Silbhansh Soreng from Village: Nawatoli, Post: Shurhu, Block: Kamdara, Dist: Gumla (Jharkhand)	Self	11.12.17- 16.12.17	Lac Processing & Value Addition
	Sri Narayan Sahu, Son of Late Bhushan Sahu from Village: Kamdara, Post: Kamdara, Block: Kamdara, Dist: Gumla (Jharkhand)	Self	11.12.17- 16.12.17	Lac Processing & Value Addition
	Sri Shashi Bhushan Sahu, Son of Sri Kabilas Sahu from Village: Kedli Pakartoli, Post: Mamarla, Block: Basiya, Dist: Gumla (Jharkhand)	Self	11.12.17- 16.12.17	Lac Processing & Value Addition
	Sri Rajesh Kumar, Son of Late Kamakhya Narayan Singh from Village: Chund, Post: Brambhy, Block: Mandar, Dist: Ranchi (Jharkhand)	Self	11.12.17- 16.12.17	Lac Processing & Value Addition
	Sri Baliram Bediya, Son of Sri Jageswar Bediya from Village: Jaradih, Post: Tati, Block: Angara, Dist: Ranchi (Jharkhand)	Self	11.12.17- 16.12.17	Lac Processing & Value Addition
	Sri Shankar Bediya, Son of Sri Pandu Bediya from Village: Jaradih, Post: Tati, Block: Angara, Dist: Ranchi (Jharkhand)	Self	11.12.17- 16.12.17	Lac Processing & Value Addition
				<b>Total 49</b>

**Annexure-8: Kisan gosthi/ Workshop/ Educational programme on lac cultivation**

District –State	Nominating Agency	Venue (Village, Block)	Dated	No. of Participants	Name of programme
Ranchi, Jharkhand	Pratibha Darshan Mahotsav	Khel Gaon, Lagam, Silli	04.02.17	325	Kisan gosthi

Ranchi, Jharkhand	Forest Department	Range Office, Bundu	14.02.17	105	<i>Kisan gosthi</i>
Gumla, Jharkhand	Udogini	Mission Ground, Kamdara	22.3.17	179	<i>Kisan gosthi cum-kisan-Mela</i>
Khunti, Jharkhand	KVK Khunti	Mahila Vikas Kendra, Torpa	26.8.17	179	New India Manthan-Sankalp Se Siddhi programme
				<b>788</b>	

### Annexure-9: Method Demonstration, Treatment of broodlac with pesticide for pest management and gum tapping

District-State	Venue (Village, Block)	Demonstrated technology	Critical inputs used	Dated	Associated Expert/Officer	No. of Participants
Ranchi, Jharkhand	Sarai Tola, Bayangdih, Namkum	Motivate farmers for broodlac dipping	Fipronil and Hexaconazole	05.01.17	Sri AK Sinha	21
Ranchi, Jharkhand	Sarai Tola, Bayangdih, Namkum	Kusmi broodlac treatment with pesticide	Fipronil and Hexaconazole	28.01.17	Sri AK Sinha, Sri M Mohan	08
Jaipur, Rajasthan	Parpad, Jaipur	Gum tapping	Ethephon	06.11.17	Dr. RK Yogi, Sri NK Thombre	20
Jaipur, Rajasthan	Bansari, Jaipur	Gum tapping	Ethephon	06.11.17	Dr. RK Yogi, Sri NK Thombre	15
Jaipur, Rajasthan	Shiplpura, Jaipur	Gum tapping	Ethephon	06.11.17	Dr. RK Yogi, Sri NK Thombre	15
						<b>79</b>

### Annexure-10: Lac Crop Surveillance conducted

Village (block)	District-State	Date	Crop	Observation
Hurde (Namkum Block)	Ranchi, Jharkhand	24.4.17	<i>kusmi</i> crop on <i>S. oleosa</i> & <i>Rangeeni</i> lac <i>B. monosperma</i>	<i>Kusmi</i> crop on <i>kusum</i> ( <i>Jethwi</i> 2017) was in very good condition and <i>rangeeni</i> on <i>palas</i> was also in good condition
Patratoli, Sogod (Namkum Block)	Ranchi, Jharkhand	27.4.17	<i>Kusmi</i> crop on <i>S. oleosa</i>	<i>Jethwi</i> 2017 on <i>kusum</i> trees were surviving well
Saraitoli, (Namkum Block)	Ranchi, Jharkhand	27.4.17	<i>Kusmi</i> crop on <i>S. oleosa</i>	35 kg. <i>kusmi</i> lac has been inoculated in two <i>kusum</i> trees was in good condition (broodlac inoculated after dipping)
Ambatand, (Semaria Block)	Chatra, Jharkhand	04.5.17	<i>Rangeeni</i> lac <i>B. monosperma</i>	Lac on <i>palas</i> surviving well, inoculated in Nov 1 <sup>st</sup> week, few mortality seen.
Beniafara, (Angara Block)	Ranchi, Jharkhand	08.8.17	<i>Kusmi</i> crop on <i>S. oleosa</i> & <i>Z. mauritiana</i>	<i>Aghani</i> 2017-18 on <i>kusum</i> and <i>ber</i> was surviving well but farmers do not have proper knowledge on lac cultivation. Therefore, a brief knowledge on lac cultivation was imparted them on their farming site
Hahap, (Namkum Block)	Ranchi, Jharkhand	16.8.17	<i>Kusmi</i> crop on <i>S. oleosa</i> & <i>Z. mauritiana</i>	<i>Kusmi</i> lac on <i>ber</i> and <i>kusum</i> surviving well. Male emergence just started. Crop condition is very good
Saheda, (Namkum Block)	Ranchi, Jharkhand	02.9.17	<i>Kusmi</i> crop on <i>Z. mauritiana</i>	<i>Kusmi</i> lac cultivation on <i>ber</i> was found very good condition. Male emergence closed

**Annexure -11: Participation in Exhibition/Kisan Mela**

Name of the programme with venue	Duration	No. of Participants	Participated by
Annual Flowers & Vegetable Show/ <i>Kisan Mela</i> -2017, Ghato, Mandu, Ramgarh (Jharkhand)	12-12 January, 2017	600	Sri P Patmajhi & Sri K Saran
Annual Kisan Mela, RK Mission, Getelsud, Angara, Ranchi	23-24 January, 2017	900	Sri P Patmajhi & Sri M Mohan
Annual Kisan Mela, Behrajara, Rahe, Sonahatu (Jharkhand)	27 <sup>th</sup> January, 2017	800	Sri P Patmajhi & Sri K Saran
<i>Kisan Mela</i> –cum- Machinery Exhibition	10 <sup>th</sup> February 2017	565	Sri Ashish Raut, Sri AK Sinha, Sri BK Singh
Momentum Jharkhand - Global Investors Summit, Khel Gaon, Ranchi	16-17 February, 2017	20000	Dr. SKS Yadav, Dr. RK Yogi, Sri P Patmajhi & Sri K Saran
Foundation Day-cum-Exhibition, ICAR-RCER Research Centre, Palaandu	22 <sup>nd</sup> February, 2017	300	Dr. AK Singh, Sri M Mohan and Sri K Saran
Agrotech 2017, BAU, Kanke, Ranchi	20-22 <sup>nd</sup> March, 2017	3000	Sri AK Sinha and Sri K Saran
Lac farmers exhibition – cum mela, Churchu, Hazaribagh	8 <sup>th</sup> November, 2017	900	Dr. SKS Yadav, Sri P Patmajhi & Sri K Saran
Prajatiya Khadyotsav and Agroforest Food Diversity Exhibition, Nowamundi Sports Complex, W. Singhbhum	10 <sup>th</sup> November, 2017	725	Sri P Patmajhi & Sri K Saran
		<b>27790</b>	

**Annexure - 12: Details of the activities of NIC and MOTAS under One to One programme (OTOP)**

Country/State	District	Category	Number
1. Andhra Pradesh	Tirupati	Researcher	1
	Others	Entrepreneur	4
2. Bangladesh	Nawabganj	Entrepreneur	1
3. Chhattisgarh	Bijapur	Extension worker	1
	Kanker	Farmer	1
	Mahasamund	Farmer	1
	Raigarh	Processor	1
	Raipur	Farmer	1
		Extension worker	1
4. Delhi	Delhi	Researcher	3
	Chandni chauk	Retailers	2
	Chandni chauk	Wholesalers	1
	Chandni chauk	Traders	1
Gujarat	Surat	Exporter	1
		Farmer	1
Jharkhand	Chatra	Extension worker	1
	Deoghar	Researcher	1
	Dhanbad	Researcher	1



Jharkhand	Garwa	Farmer	1
		Entrepreneur	1
	Jamshedpur	Entrepreneur	1
	Khunti	Extension worker	2
		Entrepreneur	1
		Trader	1
	Hazaribag	Entrepreneur	1
	Ranchi	Researcher	5
		Farmer	3
		Progressive Farmer	3
		Processor	
		Social worker/Policy Makers	4
		Extension worker	9
		Entrepreneur	3
Others	2		
Simdega	Processor	1	
West Singhbhum	Farmer	1	
Kerala	Thrissur	Researcher	1
Madhya Pradesh	Jabalpur	Extension worker	1
Maharashtra	Pune	Processor	1
		Extension worker	1
Mizoram	Kolasib	Extension worker	1
Nagaland	Kohima	Farmer	1
Odisha	Bhubaneswar	Extension worker	1
	Kalahandi	Entrepreneur	1
Rajasthan	Jaipur	Traders	2
		Handicrafts man	5
		Processor	3
		Others	2
	Udaipur	Trader	5
Tamil Nadu	Coimbatore	Researcher	1
		Extension worker	1
Uttar Pradesh	Lucknow	Extension worker	2
	Varanasi	Researcher	1
West Bengal	Purulia	Extension worker	1
		Exporter	1
		Farmer	1
		Handicrafts man	1
<b>Total</b>			<b>97</b>



**Annexure-13: Industrial liasioning and technical guidance and advisory to different Institutions/ Stakeholders**

<b>Stakeholder(s)</b>	<b>Nature of Advisory</b>
Sri Rajesh Kumar and Meenakshi Sahu, KGVK, Ranchi	Training on Lac Cultivation and Processing
Sri DP Bose, DIC, Purulia, West Bengal	De-waxed Bleached Lac
M/s Chirag Damani, Mumbai, Maharashtra	Aleuritic Acid and Effluent Disposal
Sri Aditay Kr. Sahu, Kalebira, Simdega	Processing and Value Addition of Lac
Ashish Keshari, Keshari Shellac Industries, Mumbai	Value Addition of Lac
Sri Enam Dodray, Vill. Tirlo, Khunti	Lac Cultivation
Sri Masnsingh Pahan, Vill. Kudda, P.O. Sayko, Khunti	Lac Cultivation
M/s Aadhya International, Mumbai	Air drying type Insulating Varnish, Shellac Emulsion Paint for internal coating
M/s ATMA, Bhandara, Maharashtra (19 Persons)	Lac Processing
M/s Tata Steel Ltd., Jamshedpur, Jharkhand (3 Persons)	Testing and Analysis of Lac
Forest Department, Palamu, Jharkhand	Preparation of Gulal from Palas Flowers
Sri Ronak Rathor, Sri Niketan, 20, E Road, Air Base Colony, Kadma, Jamshedpur, Jharkhand	Natural Nail Polish
M/s Singhaniya Lakh Industry, Industrial Area, Katghora, Korba (Chhattisgarh)	Aleuritic Acid & De-waxed De-colourized Lac
M/s CK Lac Industry, 96, Mangejhari, Waraseoni (Madhya Pradesh)	Shellac Emulsion Paint for Internal Coating
M/s Tofs Magnacraft Enterprises, 139, Naya Toli, Tupudana, Ranchi (Jharkhand),	Nail Polish, Dewaxed Decolourized Lac
Udyogini, Khunti, Jharkhand (13 Persons)	Lac Processing & Value Addition

