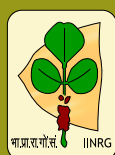
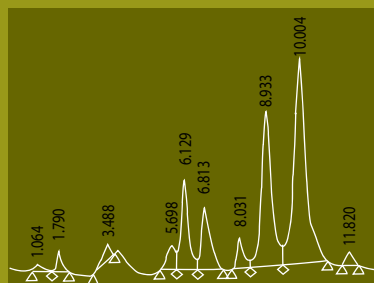


वार्षिक प्रतिवेदन 2010-11 annual report 2010-11



भारतीय प्राकृतिक राल एवं गोंद संस्थान
भारतीय कृषि अनुसंधान परिषद
नामकुम, राँची - 834 010 (झारखण्ड)

INDIAN INSTITUTE OF NATURAL RESINS AND GUMS
(Indian Council of Agricultural Research)
Namkum, Ranchi - 834 010 (Jharkhand)

ISSN : 0974-2999

Published by

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Director

Compiled, Edited and Produced by

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Design and Layout

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Cover Page

Top-HPLC Chromatogram of yellow dye of *Kerria lacca*, (Left to right) Lac encrustation on *Albizia procera*, Yellow lac insect, Lac insect on *Hibiscus chinensis*, Guar gum splits, Pine resin tapping by bore hole method, Spices coated with lac formulation. Back cover-Lac Integrated Farming System

Correct Citation

IINRG Ann. Rep. 2010-11
Indian Institute of Natural Resins and Gums
Namkum, Ranchi – 834 010 (Jharkhand)

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Printed at

Kailash Paper Conversion Pvt. Ltd.
Ranchi - 834 001

July 2011

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Mandate of the Indian Institute of Natural Resins and Gums

- To plan, conduct and promote researches on lac production technologies.
- To conduct basic and applied researches on processing natural resins (including lac), natural gums and gum-resins for farmers and industries.
- To develop value added products of commercial use from natural resins, gums and gum-resins, leading to pilot plant demonstration.
- To act as repository and provider of information on lac production and processing, product development, utilization of all natural resins, gums and gum-resins.
- To transfer the technologies to farmers, entrepreneurs and processors.

Preface

India is endowed with an enviable range of agro-climatic conditions, which is agriculturally challenging, providing nonetheless excellent opportunities for varied agricultural crops. Gum and resin yielding plants are no exception to this, ranging from Western Himalayan Region for pine resin production, Western Dry Region for guar gum, Plateau and Hill Regions for lac resin, dry deciduous forests of Central India for gum ghatti, Central Indian Hill Regions for karaya gum production, and so on. The climatic conditions influence the quality and yield of the gums produced by the different plant species and production base needs to be judiciously harnessed for promoting suitable gum/resin yielding plants for varied agro-climatic regions of the country.

India is currently the largest producer of lac, guar and karaya gums; it also produces a large number of other minor gums, which find their application in a number of areas. Some of the gums like guggul gum contains steroidal compounds showing biological activities influencing lipid metabolism, hormone homeostasis, etc. enabling their use in medicine. The total export of NRG during 2009-10 was 189 thousand tons valued at ₹1262 crores. This sector is also important from socio-economic and ecological standpoints. In seventy out of 150 disadvantaged districts, identified by the Planning Commission, natural resins and gums are important source of subsidiary income to the farmers.

A close examination of the current gum industrial scenario reveals a very strong demand in several application areas. Guar gum, which is a seed gum, forms a very large chunk of the gums produced domestically. Industrial sources indicate sizeable shortfall of guar gum supply especially from petroleum industry. Similarly, the current demand for exudate gums appears to outstrip the supply. Therefore, there is need to fully tap the production potential of exudate gum trees available in the country. This requires standardizing and adopting scientific tapping and primary processing techniques for underutilized and unutilized gum-yielding trees of the country. Industrial processing of gums and resins needs to be geared for value-added products. Development of indigenous process know-hows for guar gum derivatives, process improvement for higher yield of aleuritic acid and isoambrettolide from aleuritic acid are some areas in this direction.

Opportunities apart, Indian agriculture is taking the brunt of climate change and lac production has suffered severely due to extremely unfavourable post-monsoon to pre-summer months. The lac crop generation extending through summer extends from six to eight months, depending on the lac insect strain. The *rangeeni* summer crop (*baisakhi*) remains highly vulnerable during pre-summer months. As the lac insects remain permanently attached to plant host, cannot therefore, resort to avoidance behavior towards direct sunlight, heat, rains, etc. Being parasitic on the plant, their survival is also dependent on the health of the plant, which in turn is affected of climatic vicissitudes. The lac crops are continuum, comprising of the two generations and unlike field crops, 'the seed' cannot be stored. Therefore, any dip in production leaves an adverse impact on the subsequent crop due to low availability of broodlac, the seed material for lac production. Adverse climatic pattern, for three successive years has taken heavy toll on lac production. Regular failure of summer *rangeeni* crop during this period has thrown up new challenges for sustaining the production. Several experiments encompassing changes in biotic and abiotic factors during the vulnerable developmental stages of lac insects by the team of scientists at the Institute has revealed emergence of hitherto inconsequential parasites of lac insects as the main culprit of lac crop failures.

Planned experiments were conducted to study the probable causative factor(s) of pre-summer *rangeeni* lac insect mortality at the Institute; samples from farmers' fields in Jharkhand and West Bengal were also periodically obtained for examination. The lac insect populations on the host *bhalia* showed unusual mortality

in January and analysis of the affected populations showed about 57% mortality; closer examination of the living insects revealed 57.6% parasitization with the endoparasite, *Aprostocetus purpureus*. Further, examination of other affected samples from four different locations including the Institute farm showed an average parasitization of 54.3%. This parasitoid emerged at an unbelievable rate of 248 - 364 in January and at 416 - 573 in March per 10 cm length of lac encrustations, which is indicative of very high level of parasitization leading the collapse of lac insect populations. These observations reveal that how changes in weather conditions could lead to a flare of certain insect populations with devastating effects.

The impact of R&D would be enhanced if the scientists work hand in hand with the stakeholders. A paradigm shift is envisaged in the forthcoming Plan period for a participatory-mode research with the stakeholders. This would involve production enhancement through scientific methods of production/tapping and industrial processing for enhancement of efficiency, quality and value-addition. Society for Advancement of Natural Resins and Gums, a para-official body mooted recently, to bring together the stakeholders of the sector is expected to provide fillip to the production and industrial sectors alike.

Interaction with stakeholders provides valuable inputs for sectoral development and research planning. The stakeholders' conference on the issues related to lac production, organized by the Institute on its 87th foundation day has led to valuable recommendations which can form the framework for chalking out a roadmap for development of lac in the country as well as key issues, which need to be addressed under current scenario. The recommendations related to increasing the income of growers and rural employment stressed on enhancing investment in lac production through private participation by contract farming, credit support to farmers and value-addition at village level. Methodology for contract farming of lac was elaborated in one of the presentations of the meet, which outlined how farmer's risk would be minimized in such systems. Another important recommendation of this conference was strengthening domestic consumption, which should include value addition at growers' level and lac-based cottage industry development for rural employment.

Inputs from stakeholders related to lac production and industries engaged in natural resins and gums through meets and consultations have been instrumental in shaping up of the XII Plan as well as the Vision 2030 documents on a sound footing.

I express my gratitude to Dr S Ayyappan, Secretary DARE and Director-General ICAR for his guidance and support during his visit to the Institute. I am also grateful to Dr MM Pandey, DDG (Engg) and Dr NPS Sirohi, ADG for their constant monitoring and guidance in research execution and administration of the institute. I also acknowledge the Chairmen and members of various committees of the Institute for the review and inputs in different fronts of R&D activities of the Institute. I also thank all the staff of Institute for their support and cooperation in my endeavours. I also acknowledge the Publication Committee for their efforts for bringing out this report.

We have to think bold and new to achieve breakthroughs in research. 'No one is less ready for tomorrow than the person who holds the most rigid beliefs about what tomorrow will contain'- Walker *et al.*, 1999.

June, 2011
Namkum, Ranchi

R Ramani
Director

कार्यकारी सारांश



1. लाख कीट एवं परिपालक सुधार

- नये विकसित कुसमी पीले किस्म के लाख कीट का जीजीफस मौरीसीयाना (बेर), श्लेइचेरा ओलिओसा (कुसुम), फ्लेमिंजीया सेमियालता, फाइकस क्यूनिया (पोरहो) एवं अल्बीजीया प्रोसेरा (सफेद सिरीस) पर बहुगुणन एवं मूल्यांकन किया गया। बेर, कुसुम एवं सेमियालता से बहुत अच्छी कटाई हुई, जबकि पोरहो से संतोषजनक एवं सफेद सिरीस से नाममात्र की कटाई हुई।
- राष्ट्रीय लाख कीट जननद्रव्य केन्द्र के गमले में लगे फ्लेमिंजीया मैक्रोफाइला के पौधों पर 70 लाख कीट किस्मों के 1750 संवर्द्धों का संरक्षण किया जा रहा है। रा.ला.की.ज.के. में आगरा (उ.प्र.) से एक, बनखेरी (मध्य प्रदेश) से एक, इम्फाल (मणिपुर) से एक, नांगल एवं रोपर (पंजाब) से दो समेत पाँच नये संग्रह जोड़े गये। इन संग्रहों का मूल्यांकन के लिए बहुगुणन किया जा रहा है। लाख कीट संवर्द्ध को नुकसान पहुँचा रही एक चींटी प्रजाति की पहचान फिजोलोजेटन एफिनीस के रूप में की गई।
- फसल के दोनों ऋतुओं में बीहनलाख की उत्पादकता के लिए पाँच रंगीनी लाख कीट किस्मों का मूल्यांकन किया गया। इनका परिणाम ऋतु आधारित रहा। राँची एवं अजमेर संग्रह से ग्रीष्म एवं वर्षा ऋतु फसलों के दौरान क्रमशः अधिकतम बीहनलाख का उत्पादन हुआ। ग्रीष्म ऋतु में राजस्थान से संग्रह किये गए दोनों संग्रहों की प्रजनन क्षमता उच्चतर थी तथा अन्य की तुलना में उल्लेखनीय रूप से बेहतर थी, जबकि कांकर संग्रह की कम थी। परिपक्व मादा के ताजा एवं शुष्क कोशिकाओं के वजन से अनुरूप परिणाम प्राप्त किया गया। वर्षा ऋतु की फसल के दौरान प्रक्षेत्र परिस्थितियों में मूल्यांकन से परिपालक आधारित परिणाम का पता चलता है। राँची एवं अजमेर संग्रह के पलास एवं बेर पर क्रमशः सबसे अच्छी उपज हुई।
- केरिया में सी ओ आइ जीन के 650 बीपी क्षेत्र के विस्तारण के लिए विशिष्ट प्रारंभकों की अभिकल्पना की गई। के लैका एवं के शारदा किस्मों से भारत में थाईलैंड से क्रमबद्ध आंकड़े पर आधारित विकासमूलक वृक्ष से के चीनेनसीस को पूरी तरह अलग किया गया। डेन्डोग्राम से केन्द्रीय, पश्चिमी एवं उत्तरी भारत के आठ भौगोलिक नस्लों को अलग किया गया।
- जंगली किस्म के किरमिजी एवं पीले उत्परिवर्ती लाख कीट प्रजातियों के बीच शरीर के रंग वर्णक की गुणात्मक भिन्नता का अध्ययन किया गया। किरमिजी लाख कीट किस्म में 525–527 एन एम एवं 291–294 एन एम के बीच कम से कम दो उभार पाया गया। पीले लाख कीट में किरमिजी लाख कीट से स्पष्ट रूप से भिन्न दो उभार देखा गया, जो 422–429 एन एम एवं 310–319 एन एम के बीच रिकॉर्ड किया गया।
- ग्रीष्म कालीन लाख फसल 2009–10 की अवधि में चार समूहों में लाख कीट किस्मों के स्थापन घनत्व में स्पष्ट भिन्नता देखी गई। थाईलैंड एवं मेघालय के कुसमी प्रजाति के लाख कीट संग्रहों एवं कर्नाटक तथा केरल की किस्मों में रंगीनी किस्म की तुलना में स्थापन घनत्व स्पष्ट रूप से उच्चतर रहा। अन्य तीन समूहों की तुलना में रंगीनी किस्मों में स्थापन के क्षेत्र बहुत विस्तृत थे। ग्रीष्म ऋतु की फसल में स्थापन घनत्व उल्लेखनीय रूप से उच्चतर है। ग्रीष्म ऋतु की फसल की तुलना में वर्षा ऋतु की फसल में आरम्भिक मरणशीलता ज्यादा थी। ग्रीष्म ऋतु की फसल में वर्षा ऋतु की फसल की तुलना में लिंग अनुपात की दृष्टि से नर उल्लेखनीय रूप से ज्यादा था।
- प. बंगाल, छत्तीसगढ़, झारखंड एवं गुजरात के पाँच जिलों का सर्वे किया गया। पत्ती के आकार के आधार पर पलास परिवर्त की पहचान की गई। नये परिवर्त की पहचान संस्थान अनुसंधान फार्म (आई आर एफ) में फ्लेमिंजीया चैप्पर एवं एफ ब्रैक्टियाटा के फॉलिएज लक्षणों के आधार पर की गई।
- ग्रीष्म ऋतु में गर्मी सहने के साथ-साथ नियंत्रण में एफ सेमियालता की चुनी हुई किस्म की लाख उत्पादन क्षमता एवं वृद्धि का मूल्यांकन किया गया।

चयन की गई किस्म में 22 से.मी. की लाख पपड़ी बन गई तथा नियंत्रण में लाख बिल्कुल ही नहीं हुआ।

- लगातार तीन वर्ष कुसमी लाख के उत्पादन के आधार पर 96 बेर (जेड मौरीसीयाना) जीनी संरचनाओं में से पाँच की पहचान आगे के अध्ययन के लिए की गई। पाँच चुनी गई जीनी संरचनाओं का लाख उपज अनुपात, उच्छिष्ट लाख उपज अनुपात तथा पपड़ी की मोटाई का औसत मान क्रमशः 5.73, 1.81 एवं 0.63 मि.मी. की तुलना में 9.8 से 15.74, 0.71 से 3.39 एवं 0.6 से 0.77 का अन्तर पाया गया।

2. लाख फसल प्रबन्धन

- क. अरहर (कैजेनस कजन) की तीन किस्मों जैसे जल्दी परिपक्व होने वाला, मध्यम एवं देर से परिपक्व होने वाले पर रंगीनी लाख की खेती से मध्यम एवं देर वाली किस्मों पर उत्पादन/निवेश अनुपात क्रमशः 3.57:1 एवं 5.09:1 रहा जिससे सिंचाई की स्थिति में लाख की खेती के लिए अरहर का उपयोग आशाजनक प्रतीत होता है।
- बीहनलाख उत्पादन के लिए फसल की दो पंक्तियों (एकल पंक्ति एवं दोहरी पंक्ति) की तुलना की गई। ऐसा देखा गया कि बीहनलाख का कुल उत्पादन अनुपात में बहुत उल्लेखनीय अन्तर नहीं था। खराब गुणवत्ता के बीहनलाख का अनुपात एकल पंक्ति में 12.5 प्रतिशत ज्यादा था।
- भालिया, पलास एवं बेर पर संचारित किये गए लाख संवर्द्ध पर गरमी के पूर्व रंगीनी लाख कीट की बड़े पैमाने पर मरणशीलता के प्रेक्षण को रिकार्ड किया गया। प्रभावित नमूने में 54 प्रतिशत लाख कीट परजीवीग्रस्त पाया गया जबकि सामान्य संवर्द्ध में 25 प्रतिशत परजीवीग्रसण देखा गया। लाख कीट की उत्तरजीविता प्रभावित नमूनों में 20 प्रतिशत तथा सामान्य संवर्द्ध में 62 प्रतिशत पाई गई। कीट मरणशीलता के लिए परजीवीग्रसण महत्वपूर्ण कारक है, हालांकि एकमात्र कारण नहीं है।
- शरद ऋतु की कुसमी लाख फसल पर मासिक अंतराल पर तीन बार कैन्टाफ (हेक्साकोनाजोल) 0.5 मि.ली./लीटर पानी के साथ छिड़काव से काली फफुंद में अधिकतम कमी तथा लाख फसल में उच्चतम वृद्धि देखी गई।
- कवच (क्लोरोथैलोनील) भी काली फफुंद के प्रबन्धन में प्रभावी पाये गए तथा 0.5 ग्रा./लीटर पानी के साथ मात्रा अनुकूलतम है।
- अल्वीजीया प्रोसेरा वृक्ष की छँटाई जनवरी की जगह पर जुलाई में करने से प्रारंभिक प्ररोहों की वृद्धि बेहतर होती है। छँटाई के 12 महीने बाद द्वितीय प्ररोह उपलब्ध होते हैं। छँटाई एवं संचारण के बीच सबसे अधिक उपयुक्त बहनीय (गेस्टेशन) अवधि 18 माह है, जिसमें अपेक्षाकृत ज्यादा उत्पादन होता है।
- नियंत्रण की तुलना में प्रति वृक्ष 150 ग्रा. की दर से पोटेशियम के प्रयोग से उत्पादन अनुपात में 32 प्रतिशत की वृद्धि होती है। इसी तरह के रुझान यष्टिलाख से वीहनलाख तथा यष्टिलाख से यष्टिलाख अनुपात में देखा गया। फास्फोरस एवं चुना देने से उपज पर नकारात्मक प्रभाव पड़ता है, परन्तु बहुत उल्लेखनीय दुष्प्रभाव नहीं होता। हालांकि नाइट्रोजन के उपयोग का प्रभाव बहुत उल्लेखनीय नहीं था।
- पलास पर वर्षा ऋतु की रंगीनी फसल पर पोटेशियम के प्रयोग से लाख उत्पादन में वृद्धि हुई। प्रति वृक्ष 500 ग्रा. पोटेशियम ऑक्साइड के प्रयोग से नियंत्रण की तुलना में लगभग तीन गुणा ज्यादा लाख उत्पादन हुआ। पोटेशियम के प्रयोग से मोटे प्ररोहों की लाख वहन क्षमता में उल्लेखनीय वृद्धि हुई।
- एफ सेमियालता के स्थापित बागान में संचारण के पश्चात 01 कि.ग्रा./हे. की दर में ग्लाइफोसेट के प्रयोग के परिणामस्वरूप 223.64 ग्रा./झाड़ी या 17.89 कि.ग्रा./हे. यष्टिलाख का उत्पादन हुआ जो नियंत्रण की तुलना में 59.6 प्रतिशत उच्चतर है। हाथ से सफाई सहित खरपतवार नियंत्रण के अन्य उपचारों की तुलना में एफ सेमियालता पर ग्लाइफोसेट के प्रयोग से प्रति रूपया निवेश पर शुद्ध लाभ ₹ 2.10 तथा उच्चतम शुद्ध लाभ ₹ 64,736/हे. हुआ।
- बैसाखी फसल 2010 के बेर एवं पलास के छाल एवं पत्ती के रस के जैवरासायनिक विश्लेषण से बेर के मामले में लाख की कीट उत्तरजीविता एवं प्रोलाइन अंश के बीच नकारात्मक सहसंबंध का

पता चलता है। सिंचाई एवं फूल हटाने से बेर में सकारात्मक सहसंबंध दर्शाता है। बेर में 50 पीपीएम की दर से एन ए ए का उपयोग कर फूल हटाने की विधि विकसित की गई। बैसाखी 2010 की अवधि में जल का नियमित छिड़काव के द्वारा उच्च सापेक्ष आर्द्रता एवं हवा से बचाव लाख कीट की उत्तरजीविता में सहायक होती है।

- ग्रीष्म ऋतु के दौरान जेठवी फसल में कुसुम पर 1322 कि.ग्रा. बीहनलाख का उत्पादन किया गया। 1073 कि.ग्रा. बीहनलाख (₹ 1,28,708 मूल्य का) को संस्थान की परियोजनाओं को विक्रय/उपलब्ध किया गया तथा 249 कि.ग्रा. बीहनलाख (₹ 29,880 मूल्य) किसानों को विक्रय किया गया।
- ग्रीष्म ऋतु की फसल की अवधि में कुसुम पर दो जल्दी परिपक्व होने वाली (कुलाजंगा एवं गुमला स्टॉक), एक मध्यम (बेर स्टॉक) एवं दो देर से परिपक्व होनेवाले लाख किस्म का रखरखाव एवं मूल्यांकन किया गया। जल्दी परिपक्व होने वाली किस्म का परिणाम देर से परिपक्व होने वाली किस्म से बेहतर पाया गया।
- गुजरात में लाख उत्पादन गतिविधियों के अन्तर्गत मालेगाँव (डुंगर्दा क्षेत्र) में ग्रीष्म कुसुमी लाख 2010 के लिए बीहनलाख उत्पादन अनुपात (उत्पादन:उपयोग) 3.21:1 रिकार्ड किया गया। कुल उत्पादित बीहनलाख में से लगभग पूरा या 110 कि.ग्रा. बीहनलाख का शरद ऋतु लाख फसल के लिए मुख्य रूप से बेर और कुसुम पर संचारण किया गया; भारी परजीवी ग्रसन के कारण लगभग सम्पूर्ण फसल नष्ट हो गई।

3. संश्लेषण एवं उत्पाद विकास

- एल्यूरिटिक अम्ल से संश्लेषित किये गए आठ यौगिकों का कवकरोधी, हाइपोग्लाइसेमिक एवं एन्टीनेमिक गुणों के लिए परीक्षण किया गया। कवकरोधी गुणों के लिए मानक यौगिकों की तुलना में सभी संश्लेषित यौगिक कम सक्रिय हैं। 2-इथाइलफेनाइलथायोसेमिकार्वाजाइड एवं 2-ब्रोमोफेनाइलथायोसेमिकार्वाजाइड 1000 पीपीएम पर 100 प्रतिशत अवरोध दर्शाता है। 2-इथाइल-फेनाइलथायोसेमिकार्वाजाइड एवं 2-मिथाइलफेना-इलथायोसेमिकार्वाजाइड से नर चूहे के रक्त में शर्करा की मात्रा में 220-230 मि.ग्रा./डीएल तक कमी आई।

मिथाइलफेनाइलसेमिकार्वाजाइड के 500 पीपीएम स्तर पर 100 प्रतिशत मरणशीलता देखी गई। एल्यूरिटिक अम्ल के हाइड्रोजाइड, थायोसेमिकार्वाजाइड, 4-क्लोरोफेनाइलसेमिकार्वाजाइड, 2-ब्रोमोफेना-इलसेमिकार्वाजाइड एवं 2-क्लोरोफेनाइलथायोसेमिकार्वाजाइड 1000 पीपीएम पर 100 प्रतिशत मरणशीलता दर्शाता है।

- वैकल्पिक मिथाक्राइलेट के साथ रूपान्तरण द्वारा एकेसिया गोंद का उपयोग कर हाइड्रोजेल तैयार किया गया। हाइड्रोजेल की इक्वीलिब्रियम स्वेलिंग (%) ~4100 प्रतिशत एवं ~3670 प्रतिशत पाया गया। हाइड्रोजेल की इक्वीलिब्रियम रिस्वेलिंग (%) कमरे के तापमान पर 24 घंटे, 48 घंटे एवं 72 घंटे के अंतराल के बाद तय की गई एवं क्रमशः 3296 प्रतिशत, ~3503 प्रतिशत, ~3975 प्रतिशत रिकार्ड की गई।
- बोस्वेलिया सेराटा एवं कॉमिफोरा मुकुल के निःस्राव से चुहे में नियंत्रण की तुलना में उल्लेखनीय ज्वलनरोध दिखता है जो मानक औषधि शल्लकी से भी बेहतर है। कॉमिफोरा विघटि एवं सी मुकुल से चूहों के कोलेस्ट्रॉल नियंत्रण में रखे दल की तुलना में बहुत उल्लेखनीय (पी 0.01), प्रदर्शन किया तथा उच्चतर एच डी एल एवं शारीरिक वजन, कुल कोलेस्ट्रॉल एवं ट्राइग्लिसराइड में कमी आई।

4. सतहलेपन एवं उपयोग विविधिकरण

- कमरे के तापमान पर दो वर्ष के भंडारण के बाद चपड़ा-गंधराल संमिश्र का अध्ययन किया गया। चपड़ा नमूने (100 प्रतिशत) के बहाव में 65 प्रतिशत तक उल्लेखनीय कमी देखी गई, जबकि चपड़ा-गंधराल के 70:30, 50:50 एवं 40:60 अनुपात के संमिश्र में क्रमशः 50 प्रतिशत, 31 प्रतिशत, 18 प्रतिशत कमी आई।
- लाख आधारित सुत्रण के अनार पर प्रयोग के प्राथमिक परीक्षण से चमक में सुधार हुआ, जबकि पी एल डब्ल्यू में कमी तथा संचित सड़ण प्रतिशत देखी गई है।

5. प्रसंस्करण एवं भंडारण

- कच्चा लाख (नमक मिश्रित (5 प्रतिशत) एवं नियंत्रण) का दो वर्ष तक भंडारण के पश्चात

अध्ययन किया गया। नमक मिश्रित लाख से चौरी की कम प्राप्ति (72 प्रतिशत) की तुलना में बिना नमक वाले लाख से प्राप्ति 80 प्रतिशत थी। परन्तु गर्म अल्कोहल में अधुलनशील प्रतिशत, बहाव, रंग सूचकांक एवं छनन की दर जैसे भौतिक रासायनिक गुण (ताप के अन्तर्गत आयु) नमक मिश्रित लाख में बेहतर थी।

6. क्षमता निर्माण गतिविधियाँ

- लाख की वैज्ञानिक खेती, प्रसंस्करण एवं उपयोग पर किसानों, प्रशिक्षकों एवं छात्रों के लिए सघन प्रशिक्षण कार्यक्रम आयोजित किये गए। एक सप्ताह के कृषक एवं गृहिणी प्रशिक्षण कार्यक्रम के अन्तर्गत झारखंड, ओडीशा, छत्तीसगढ़, प. बंगाल, मध्यप्रदेश एवं बिहार जैसे राज्यों के 14 जिलों से कुल 941 कृषकों को प्रशिक्षित किया गया। अधिकतम सहभागिता झारखंड (353) की रही, उसके बाद छत्तीसगढ़ (199) ओडीशा (186), प.बंगाल (138), मध्य प्रदेश (44) एवं महाराष्ट्र (18) का स्थान रहा।
- वैज्ञानिक लाख उत्पादन, प्रसंस्करण एवं उपयोग पर प्रशिक्षक प्रशिक्षण कार्यक्रम के अन्तर्गत 346 प्रशिक्षकों के लिए 11 पाठ्यक्रम आयोजित किये गए।
- दो विश्वविद्यालयों के कृषि स्नातक के छात्रों के लिए प्राकृतिक राल एवं गोंद के उत्पादन, प्रसंस्करण एवं उपयोग संबंधी एक सप्ताह के शैक्षणिक कार्यक्रम का आयोजन किया गया, जिसके अन्तर्गत कुल 118 छात्रों को प्रशिक्षण दिया गया।
- प्रक्षेत्र से बाहर की गतिविधियों के अन्तर्गत झारखंड, छत्तीसगढ़ एवं महाराष्ट्र के अन्य संस्थाओं के सहयोग से 37 शिविर आयोजित किये गए, जिसके अन्तर्गत महाराष्ट्र के गोन्दिया, यवतमाल, बुल्दाना एवं अमरावती, झारखंड के खूंटी, लातेहार, लोहरदगा एवं राँची तथा छत्तीसगढ़ के धमतरी एवं रायगढ़ नामक कुल 10 जिले लिए गए। कुल 2834 कृषक इस कार्यक्रम से लाभान्वित हुए। इसके अतिरिक्त झारखंड लाख विकास योजना जे एल डी एस के अन्तर्गत सिमडेगा, प. सिंहभूम, पलामू, गुमला, डालटेनगंज एवं खूंटी जिले 74 प्रक्षेत्र शिविर आयोजित कर 2017 लाभुकों को प्रशिक्षित किया गया।

- विभिन्न राज्यों के सरकारी और गैरसरकारी संगठनों के सहयोग से प्रक्षेत्र में 15 प्रोत्साहन। पूरक प्रशिक्षण कार्यक्रम आयोजित किये गए। इसके अन्तर्गत महाराष्ट्र, आन्ध्र प्रदेश, छत्तीसगढ़ एवं झारखंड के नौ जिलों के 100 ग्रामों के 3512 व्यक्तियों मुख्यतः कृषकों को प्रशिक्षण दिया गया।
- संस्थान अनुसंधान प्रक्षेत्र में प्रक्षेत्र प्रशिक्षण हॉल का निर्माण किया गया। संस्थान द्वारा विकसित लाख प्रसंस्करण मशीन को प्रशिक्षुओं/कृषकों के बीच प्रदर्शन के लिए हॉल में स्थापित किया गया है।

7. प्रौद्योगिकी मूल्यांकन, परिष्करण एवं प्रसार

- 40 कि.ग्रा. अगात कुसमी लाख का उपयोग कर 1202 झाड़ीदार परिपालक पौधों (सेमियालता) पर खरसीदाग ग्राम में लाख की सघन खेती का प्रदर्शन किया गया। वहाँ अच्छी फसल हुई तथा 333 कि.ग्रा. बीहनलाख तथा 45 कि.ग्रा. छिली लाख प्राप्त हुआ।
- दो जिले के तीन ग्रामों में उत्पादक कुसमी किस्मों की खेती का प्रदर्शन किया गया। मांगोबांध में 20 कि.ग्रा. बीहनलाख के उपयोग पर अच्छी फसल हुई तथा कुलाजंगा का 191 कि.ग्रा. बीहनलाख, नावाडीह का 207 कि.ग्रा. एवं 174.5 कि.ग्रा. की कटाई पिछात किस्म से की गई, इसके अतिरिक्त 33 कि.ग्रा. यष्टिलाख (क्रमशः 12, 9, 12 कि.ग्रा.) भी प्राप्त हुआ। अन्य दो स्थानों के किस्मों का परिणाम ऐसा ही रहा, लेकिन उपज थोड़ा कम हुआ।
- नये पहचान किये गए रासायनिक कीटनाशियों इन्डोक्साकार्ब, स्पीनोसाड एवं फिप्रोनील तथा जैवकीटनाशी हाल्ट डब्ल्यू पी (बी टी फॉर्मूलेशन) का संस्थान अनुसंधान प्रक्षेत्र एवं कृषकों के खेतों में परिणाम की जाँच के लिए बड़े पैमाने पर परीक्षण किया गया जिससे उत्साहजनक एवं संतोषप्रद परिणाम प्राप्त हुआ। लाख की फसल को बिना क्षति पहुँचाए लाख कीट परभक्षियों को कम करने में यह कीटनाशी काफी प्रभावी रहा। लाख की खड़ी फसल पर इन कीटनाशियों के प्रयोग से बीहनलाख की गुणवत्ता एवं लाख की उपज में अच्छी वृद्धि देखी गई।
- केरिया लैका लाख लगी श्लेइचेरा ओलिओसा (कुसुम) वृक्ष पर पहली बार नई क्राइसोपा

प्रजाति क्राइसोपा जैस्ट्रोवी, एरैबिका हेनरी इत्यादि (न्यूरोप्टेरा:क्राईसोपिडी) की उपस्थिति देखी गई। वृक्षों पर पहली बार ड्रोसीचा प्रजाति (हेमिप्टेरा:मार्गारोडीडी), कुर्कूलियोनीड्स जैसे माइलोसेरस डिसकोलर, पेल्टोट्रेचेलस प्रजाति, हाइपोलिक्सस प्रजाति एवं क्लीओनस प्रजाति, क्राइसोमेलाइडी बीटल उकैसीडा पुडिबंडा भी पाया गया। पहली बार हेमिप्टेरन कीट फाइसोमेरस ग्रासीप्स (हेमिप्टेरा:कोराइडी) कुसुम वृक्ष की पत्तियों के निचले सतह पर जमा हुआ देखा गया।

- छत्तीसगढ़ के 15 जिलों और 27 वन प्रमंडलों के लाख से संबंधित गतिविधियों/परियोजनाओं (गत पाँच वर्ष की अवधि में) का प्रलेखीकरण किया गया। वर्ष 2004-05 से 2008-09 तक की अवधि में छत्तीसगढ़ के कुल 18 जिलों/32 वन प्रमंडलों में लाख उत्पादन, प्रशिक्षण एवं प्रसंस्करण से संबंधित 79 परियोजनाएं/गतिविधियां कार्यान्वित की गई। लाभुकों की कुल संख्या 33,271 तथा स्वीकृत बजट ₹ 1756.19 लाख था। छत्तीसगढ़ के कांकर जिले के लाख उत्पादकों का सामाजिक आर्थिक अध्ययन किया गया। लाख के निर्यातकर्ताओं, आयातकर्ताओं एवं निर्माताओं के अनुसार सम्प्रति चौरी एवं अन्य मूल्यवर्द्धित उत्पादों की मांग 17000-18000 टन है। अगर लाख के मूल्य और उत्पादन में स्थिरता

हो तो मांग 25-30000 टन तक बढ़ सकती है। कांकर जिले में लाख विपणन के मूल्यों के विश्लेषण से पता चलता है कि उपभोक्ता मूल्य में लाख उत्पादकों का हिस्सा 85.30 प्रतिशत है। छत्तीसगढ़ में लाख उत्पादकों के सफलता की दो कहानी का प्रलेखीकरण एवं प्रकाशन किया गया।

8. प्रौद्योगिकी का वाणिज्यीकरण

- 20 सितम्बर 2010 के चार वर्ष की अवधि के लिए एक प्रतिष्ठान सर्वश्री एम डी एम कारपोरेशन, दिल्ली के साथ लाख आधारित बहुरंगी दंतपट्टी आधार के वाणिज्यिक उत्पादन के समझौता ज्ञापन पर हस्ताक्षर किया गया। इसके लिए प्रतिष्ठान प्रत्येक वित्तीय वर्ष के अन्त में उत्पाद के विक्रय के आधार पर 02 प्रतिशत की दर से रॉयल्टी का भुगतान करेगा।
- लाख आधारित दो उत्पाद स्पिरिट रहित लकड़ी वार्निस (एम एस वी 005) एवं बहुदेशीय चमकदार वार्निस को एक प्रतिष्ठान सर्वश्री पी एन पी कारपोरेशन, मुंबई, महाराष्ट्र द्वारा "एक्सट्रा ग्लॉस" एवं "गेल्वो" ब्रांड नाम से बाजार में उतारा गया है। तैयारी एवं वाणिज्यिक स्तर पर उत्पाद को जारी करने के संबंध में प्रतिष्ठान को लगातार सुझाव एवं परामर्श दिया गया है।

EXECUTIVE SUMMARY



1. Lac Insect & Host Improvement

- Newly developed *kusmi* yellow variety of lac insect was multiplied and evaluated on *Ziziphus mauritiana* (*ber*), *Schleichera oleosa* (*kusum*), *Flemingia semialata*, *Ficus cunia* (*porho*) and *Albizia procera* (*safed siris*). The crop yield was very good on *ber*, *kusum* and *semialata*, satisfactory on *porho* but poor on *safed siris*.
- 1750 cultures of 70 lac insect lines are being conserved live at National Lac Insect Germplasm Centre on potted plants of *Flemingia macrophylla*. Five new insect stocks have been added to NATLIGEC; one from Agra (UP), one from Bankhedi (MP), one from Imphal (Manipur) and two from Nangal & Ropar (Punjab). The stocks are being multiplied for evaluation. An ant species, found damaging lac insect cultures has been identified as *Pheidologeton affinis*.
- Five *rangeeni* lac insect lines were evaluated on *bhalia* for broodlac productivity during both the crop season. The performance was dependent on the season. The Ranchi and Ajmer collections provided maximum broodlac yield during summer and rainy season respectively. The fecundity of both collections from Rajasthan was highest and significantly superior over others during summer crop, while that of Kanker collection was the least; corresponding results were obtained for fresh and dry cell weight of mature females. Evaluation in field condition during rainy season crop revealed host dependent performance; Ranchi and Ajmer stocks gave best yields on *palas* and *ber* respectively.
- Specific primers have been designed for amplification of 650 bp region of COI gene in *Kerria*. Amplification of COI gene was done and evolutionary tree based on sequence data clearly separated *K. chinensis* from India and Thailand from *K. lacca* and *K. sharda* lines.

The dendrogram also segregated the eight geographic races from central, western and northern India.

- Qualitative variation of body colour pigments, between the wild type crimson and yellow mutant lac insect lines was studied. Crimson lac insect lines showed at least two peaks in the range of 525-527 nm and 291-294 nm. In yellow lac insects, two peaks clearly distinct from crimson lac insects in the range of 422-429 nm and 310-319 nm were recorded.
- Observations on density of settlement during summer season crop 2009-10 clearly differentiated different lac insect lines into four groups. Lac insects lines belonging to *Kusmi*, Thailand & Meghalaya and those from Karnataka and Kerala showed distinctly higher density of settlement than *rangeeni* lines. Range of settlement is much wider in *rangeeni* lines in comparison to other three groups. Density of settlement is significantly higher during summer season crop. Initial mortality was significantly higher during rainy season crop than summer season crop. Sex ratio tended to be significantly higher in favour of males during summer season crop than rainy season crop.
- A survey was undertaken in five districts of West Bengal, Chhattisgarh, Jharkhand and Gujarat. *Palas* variants based on leaf shape have been indentified. New variants have been identified based on foliage characteristics in *Flemingia chappar* and *F. bracteata* at Institute Research Farm (IRF).
- Evaluation for lac producing potential and growth performance of selected line of *F. semialata* for summer sustainability *vis-à-vis* control was done during summer season. Encrustation of 22 cm living lac was procured in the selected line, while the control line could not produce lac at all.

- Based on data recorded over three consecutive years for lac yield performance, five out of 96 *ber* (*Z. mauritiana*) genotypes were identified for further study. Lac yield ratio, rejected lac yield ratio and encrustation thickness of the five selected genotypes varied from 9.8 to 15.74; 0.71 to 3.39 and 0.6 to 0.77 mm as against the mean value of 5.73, 1.81 and 0.63 mm respectively.

2. Lac Crop Management

- Rangeeni* lac cultivation on three varieties of *arhar* (*Cajanus cajan*) viz. early maturing, middle and late maturing gave an output : input ratio of 3.57:1 and 5.09:1 respectively on medium and late maturing varieties of broodlac showing the promise of utilizing *arhar* for lac cultivation under irrigation.
- Two crop geometries (single-row and paired-row) were compared for broodlac yield. It was observed that though total yield of the broodlac was not significantly different, proportion of bad quality broodlac was about 12.5% more in single-row planting.
- Observations on pre-summer large scale *rangeeni* lac insect mortality were recorded on lac cultures inoculated on *bhalia*, *palas* and *ber*. 54 % lac insects were found parasitized in the affected samples while 25% parasitization was recorded in the apparently normal cultures. Percentage survival of lac insects was only 20 % in affected samples and 62 % in the apparently normal cultures. Parasitization was observed to be the major factor, though not the only one, causing insect mortality.
- Cantaf (Hexaconazole) 0.5 ml/ liter of water sprayed thrice at monthly interval on winter *kusmi* lac crop in *ber* resulted in maximum reduction of sooty mould and highest increase in lac yield.
- Kavach (Chlorothalonil) was also effective in management of sooty mould and the optimal dose was 0.5 g/ liter of water.
- The growth of primary shoots was better if *Albizia procera* trees were pruned in January rather than July. The secondary shoots were available after 12 months of pruning. The most suitable gestation period between pruning and inoculation was found to be of 18 months with relatively more productivity.
- Potassium application @150 g per tree in *ber* could increase yield ratio to the tune of 32% over control. Similar trend was observed for sticklac to broodlac and sticklac to sticklac ratio. Liming and phosphorus have been found to influence yield ratio negatively but not significantly. However, effect of nitrogen application was found to be non significant.
- Application of potassium increased lac production in rainy season *rangeeni* crop on *palas*. Application of 500g K₂O per tree produced almost three times more broodlac compared to control. Lac bearing ability of thicker shoots increased significantly due to potassium application.
- Application of glyphosate @ 1 kg ai/ha dose, resulted in sticklac yield of 223.64 g/ bush or 17.89 q/ ha which was 59.6% higher than control in established plantation of *F. semialata*. The highest net return (₹ 64,736/ha) and net return (₹ 2.10) per rupee investment were accrued in *F. semialata* with glyphosate as compared to other weed control treatments including manual weeding.
- Biochemical analysis of bark and leaf extracts of *ber* and *palas* for *baisakhi* crop, 2010 revealed a negative correlation between proline content and lac insect survival in case of *ber*. Irrigation and flower removal showed a positive correlation in *ber*. A method was developed for flower removal using NAA@50ppm in *ber*. Both wind protection and high relative humidity maintained through regular water spraying helped in better survival of lac insect during *baisakhi* 2010.
- During summer season, 1322 kg broodlac was produced on *kusum* as *jethwi* crop. 1073 kg of broodlac (worth ₹ 1,28,708) was sold / provided to Institute projects and 249 kg broodlac (worth ₹ 29,880) has been sold to the farmers.

- Two early maturing (Kulajanga and Gumla stocks), one medium (*Ber* stock) and two late maturing breeds of lac insect were maintained and evaluated on *kusum* during summer season crop. Performance of early maturing breeds was found superior in comparison to late maturing breeds.
- Broodlac yield ratio (produced: used) of 3.25:1 was recorded for 2010 summer *kusmi* lac production at Malegaon (Dungerda Range) under lac promotional activities in Gujarat. Out of total broodlac produced, nearly 1100 kg was inoculated for winter season lac production mainly on *ber* and *kusum* at several places; heavy parasite infestation led to nearly complete crop mortality.

3. Synthesis and Product Development

- Eight compounds, synthesized from aleuritic acid were tested for their antifungal, hypoglycemic and antinemic properties. All synthesized compounds were less active against standard compound for antifungal property. 2-Ethylphenyl-thiosemicarbazide and 2-bromophenyl thiosemicarbazide showed 100% inhibition at 1000 ppm. 2-Ethyl phenylthiosemicarbazide and 2-methylphenylthiosemicarbazide lowered the blood glucose level upto 220-230 mg/dl in male rats. 4-Methylphenylthiosemicarbazide showed 100% mortality at 500ppm. Hydrazide, thiosemicarbazide, 4-chlorophenylthiosemicarbazide, 2-bromophenyl thiosemicarbazide and 2-chlorophenyl thiosemicarbazide of aleuritic acid showed 100% mortality at 1000ppm.
- Hydrogel was prepared using Gum *acacia* through modification with substituted methacrylate. Equilibrium swelling (%) of the hydrogel is found to be ~ 4100% and ~3670%. Equilibrium re-swelling (%) of the hydrogel is determined after the interval of 24h, 48h and 72h at room temperature and recorded as ~ 3296%, 3503%, 3975% respectively.
- Exudates of *Boswellia serrata* and *Commiphora*

mukul showed significant anti inflammatory activities as compared to control group, better than standard drug Shallaki, in rats. Exudates of *Commiphora wightii* and *C. mukul* exhibited highly significant ($p < 0.001$) higher HDL and lower body weight, total cholesterol and triglycerides as compared to cholesterol control group in rats.

4. Surface Coating and Use Diversification

- Shellac-rosin blends stored at ambient temperature were studied after two years of storage. Flow of the shellac sample (100%) decreased significantly by 65% whereas 50%, 31% and 18% decrease were recorded in shellac rosin blend samples 70:30, 50:50, and 40:60 respectively. Life of shellac sample decreased by 56% whereas nominal decrease was observed in shellac rosin blends samples.
- In a preliminary trial, application of lac-based formulations improved glossiness, while, reduced PLW and cumulative percentage rotting in pomegranate.

5. Processing and Storage

- Raw lac mixed with salt (5%) and control were studied after storage for a period of two years. Yield of the seedlac obtained from salted lac was less (72%) in comparison to that obtained from lac without salt (80%). But the physico-chemical properties (except life under heat) like hot alcohol insoluble %, flow, color index and rate of filtration were much better in salted lac.

6. Capacity Building Activities

- Extensive training programmes on scientific lac cultivation, processing and utilization were organized for farmers, trainers and students. Under one-week farmers' and housewives' training programme, a total of 941 farmers from 14 districts of six states namely Jharkhand, Odisha, Chhattisgarh, West Bengal, Madhya Pradesh and Bihar were trained. Maximum participation was from Jharkhand (353) followed by Chhattisgarh

(199), Odisha (186), West Bengal (138), Madhya Pradesh (44) and Maharashtra (18).

- Under Trainers' training programme on scientific lac production, processing and uses, 11 courses were conducted for 346 trainers.
- One-week educational programmes on production, processing and uses of natural resins and gums were conducted for undergraduate students of agriculture from two Universities, under which a total of 118 students were trained.
- Under field out-reach activities, a total of 37 camps were organized in collaboration with other organizations in Jharkhand, Chhattisgarh, and Maharashtra covering 10 districts namely Gondia, Yawatmal, Buldana and Amravati of Maharashtra; Khunti, Latehar, Lohardaga and Ranchi in Jharkhand and Dhamtari and Raigarh in Chhattisgarh. A total of 2834 farmers benefited from this programme. In addition, 14 on-farm camps were organized to impart training to 2017 beneficiaries from Simdega, West Singhbhum, Palamu, Gumla, Daltonganj and Khunti districts, under Jharkhand Lac Development Scheme (JLDS).
- Fifteen on-farm, motivational/supplementary training programmes on lac cultivation were conducted in collaboration with NGOs and GOs of different states; 3,512 persons, mainly farmers from about 100 villages of nine districts of Maharashtra, Andhra Pradesh, Chhattisgarh and Jharkhand benefited from this programme.
- On-farm Training Hall has been constructed at IRF. Lac processing machine developed by the institute has been installed in the hall for demonstration to the trainees / farmers.

7. Technology Assessment, Refinement and Dissemination

- Demonstration of intensive lac cultivation on 1202 bushy host-plant (*semialata*) using 40 kg of early *kusmi* lac was carried out in Kharsidag village. A very good crop yielding 333 kg broodlac and 45 kg scraped lac was obtained.
- Cultivation of three productive *kusmi* breeds was demonstrated at three villages in two districts. A good crop giving 191 kg broodlac of Kulajanga, 207 kg of Nawadih and 174.5 kg of late variety respectively was harvested against 20.0 kg broodlac each at Mangobandh besides 33 kg (12, 9, 12 kg) of sticklac. Performance pattern of the breeds at other two locations was similar but yields were slightly lower.
- The performance of large scale field trials of newly identified chemical insecticides namely indoxacarb, spinosad and fipronil and bio-pesticide Halt WP (*Bt* formulation) carried out at Institute Research Farm and at different locations in farmers field was quite encouraging and satisfactory. The pesticides were effective in reducing the incidence of lac insect predators without showing any detrimental effect on lac crop. The quality of broodlac and lac crop yield was substantially increased with the application of these pesticides on standing lac crop.
- Incidence of new *Chrysoperla* species, *Chrysoperla zastrowi arabica* Henry et al. (Neuroptera: Chrysopidae) was recorded for the first time on *Kerria lacca* on lac bearing *Schleichera oleosa* (kusum) trees. *Drosicha* sp (Hemiptera: Margarodidae); Curculionids, viz., *Myloccerus discolor*, *Peltotrachelus* sp, *Hypolixus* sp. and *Cleonus* sp. Chrysomelidae beetle *Oocassida pudibunda* were also recorded for the first time on trees. Hemipteran bug, *Physomerus grossipes* (Hemiptera: Coreidae) was recorded for the first time on kusum trees congregated on lower surface of leaves.
- Socio-economic study of lac growers in Kanker district of Chhattisgarh has been made. According to exporter, importers and manufacturer of lac, the demand of seedlac and other value added products is around 17000-18000 tons at present. Demand of lac may increase up to 25-30000 tons if there is stability in the prices and production of lac. Analysis of price spread in marketing of lac in Kanker district shows that lac grower's share in

consumers price was 85.30 per cent. Two success stories of lac growers in Chhattisgarh have been documented and published.

8. Commercialization of Technologies

- A Memorandum of Understanding (MOU) has been signed with a firm M/s MDM Corporation, Delhi for commercial production of multi coloured Lac based dental base plate on September 20, 2010 for a period of 4 (four) years. The firm is in obligation to pay royalty on

the sale of the product @ 2% at the end of each Financial Year.

- Two lac based products namely Spiritless Wood Varnish (MSV005) and Multipurpose Glazing Varnish have been launched as brand name 'Extra Gloss' and 'Gelwo' respectively by the firm M/s PNP Corporation, Mumbai, Maharashtra. Continuous suggestions and advice were given to the firm for preparation and launching of the products on commercial scale.

IINRG : AN INTRODUCTION



Historical Development

Lac, a natural resin, is a non-timber forest produce cultivated and collected by tribals inhabiting the sub-hilly tracts of Jharkhand, Chhattisgarh, West Bengal, Madhya Pradesh, Maharashtra, Odisha and Uttar Pradesh. Before the advent of synthetic plastics and resins, lac was invaluable in moulding and insulating industries, and India, then under British rule, had an unparalleled global monopoly over the lac trade. Realising 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 was laid on September 20, 1924 at Ranchi.

Initially, the Institute consisted of an Entomological Section as the principal unit supported by a Biochemical Section which started functioning from 1925. Then, in 1927, a Physico-chemical Section was added to take up applied research. Later, these two chemical sections were combined to form a Chemical Division. The scope of this Institute was thus, widened to cover both the entomological and chemical aspects. Subsequently, on the recommendations of the Royal Commission on Agriculture, the Indian Lac Cess Committee (ILCC) was constituted, which took over the reigns of the Indian Lac Research Institute in 1931. The ILCC also organized and maintained the (1) London Shellac Research Bureau, UK and (2) Shellac Research Bureau, Polytechnique Institute of Brooklyn, USA. As a result of reorganization of agricultural research and education within the country after independence, the ICAR took over the administrative control of the ILRI from April 1966. This Institute is thus, one of the oldest within the ICAR system, having completed

more than 84 years of fruitful service to the Nation. It has immensely contributed towards all round development of lac besides maintaining India's leadership in production, installed processing capacity and export. The Governing Body of ICAR Society in its 206th meeting held on March 19, 2007 have approved revised mandate and new name of the Institute as Indian Institute of Natural Resins and Gums with effect from September 20, 2007.

A Unique Institute

The IINRG is unique and only one of its kind in the world, being devoted exclusively to all aspects of lac cultivation, processing and utilization. It employs a multidisciplinary approach of researches, encompassing all areas related to lac production, refinement and utilization. The areas covered include lac insects and their biota; their host plants (both trees and bushy species); lac insect and host management; refinement/isolation of commercially important products from raw lac; lac based product diversification and other areas such as economics, marketing etc. It has the world's richest and the oldest books and literature on lac, a well-organized lac museum depicting all aspects of lac and a collection of a wide range of lac host plants and lac insects collected from different parts of the country.

Location and Agro-Climate

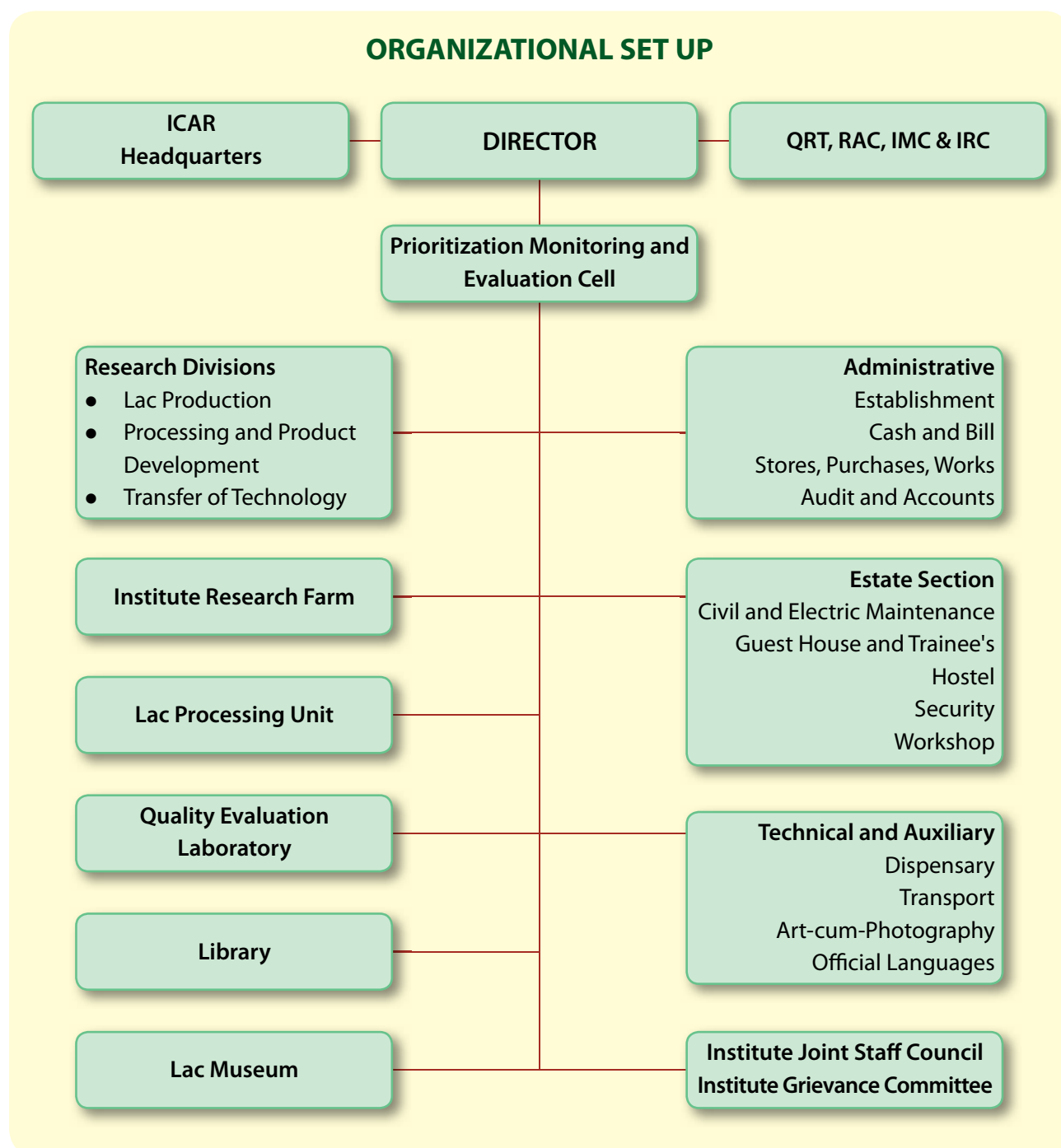
The Institute is located 9 km south-east of Ranchi city, on the Ranchi-Jamshedpur highway NH 33 at an altitude of 650 m above mean sea level, 23°23' N latitude and 85°23' E longitude. The soil status of the Institute indicates advance weathering on granitic gneiss. The soil of the experimental farm is of lateritic type. The area experiences mild, salubrious climate, with a rather heavy rainfall pattern of about 1400 mm average, of which about 1250 mm is during the monsoon. During the year, the highest mean maximum temperature (39.9°C) was observed in the month of April and the lowest mean minimum temperature (8.7°C) during

January. May 1st and December 1st were recorded as the hottest and the coldest day of the year with a temperature of 42.5° C and 2.2° C, respectively. The total rainfall during the period was 1477.8 mm of which the monsoon rainfall was 1386.6 mm which is nearly 98.3% of the total yearly rainfall.

Organizational Structure

The 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 1995-96, 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 Institute is headed by a Director.



Staff

Institute has a sanctioned strength of 1 RMP, 46 scientific, 62 technical, 36 administrative and 81 supporting grade with total of 226 sanctioned posts, out of which 29 scientific including RMP, 56 technical, 23 administrative and 62 supporting posts with total of 170 staff are in position.

Infrastructure

Manned by a strong band of dedicated scientists from various disciplines including entomology, plant sciences, organic chemistry, physics, engineering, bio-technology etc., the Institute has about 200 staff in scientific, technical, administrative and supporting categories. The Institute has several prestigious labs, viz., High Voltage Laboratory, Biotechnology, Bio-control Laboratory, Instrument Laboratory, Quality Evaluation Laboratory etc. Besides these, the DTP and publications facilities are also available. A number of modern and sophisticated laboratory equipment, including DSC, FT-IR, Insect Activity Meter, Environmental Growth Chamber etc. are available for research on all aspects of lac production, processing and product development. Various sophisticated equipments such as PCR machine, Real Time PCR, Rocker Shaker, -20°C deep freezer, Dry bath, Tissue homogeniser and Soil moisture meter (TDR) are recently purchased for advance research in various disciplines. There are several well-organized and equipped service sections to support research management of the Institute. The administrative wing comprises of Director's Office, Administrative Section, Finance and Accounts Section, Purchase and Central Stores. The following sections provide the technical support: 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 spread over 36 ha. has all conventional and cultivated lac host plants. The Institute is responsible for the collection and maintenance of germplasm of lac insect lines as well as lac host trees. Presently, the IINRG is maintaining more than sixty five lines of the lac insect, which

include collection from different parts of the country, inbred and crossbred lines. Similarly, the Institute Research Farm has approx. 1550 host trees of *S. oleosa* (kusum), 2480 trees of *B. monosperma* (palas), 1351 *Z. mauritiana* (ber) and 8700 minor host plants. The field gene bank of the Institute has 21 genera and 50 species covering tree, medium and bushy type of lac host plants. The field gene bank include 12 collections of *Ficus*, 4 collections each of *Acacia* and *Albizia*, 5 of *Flemingia*, 3 of *Zizyphus*, 2 each of *Prosopis*, *Dalbergia* and *Desmodium* alongwith each of *Cajanus*, *Croton*, *Garuga*, *Pithecolobium* and *Peltoforum*. Altogether 86 collections of 50 lac host species collected from different agro climatic regions have been planted in the field gene bank. The IRF also maintain a nursery of host plants for meeting demand from institution as well as farmers, a green agroshade of 25m x 10m has been constructed in year 2010 under JLDS for serving the purpose. More than 1300 cultures of 65 lac insect lines are being conserved live on potted plants of *bhalia* (*F. macrophylla*) under protected conditions in the Field Gene Bank of National Lac Insect Germplasm Centre (NATLIGEC). Drip irrigation system has been installed in the Field Gene Bank of NATLIGEC for mechanical irrigation of the plants to save manual labour.

The IINRG Library has holdings of more than 30,000 volumes of scientific journals, 2000 rare books, including back volumes of research periodicals in the field of lac and surface coatings. Since the holdings of back volumes of certain journals date back to circa 1760, the library has been catering to the document supply services of INSDOC, New Delhi. Besides catering to the scientists and staff of the Institute, the library also attracts researchers of neighboring educational and research institutions, including BIT, RU, BAU and HARP, Ranchi, IIT, Kharagpur, RAU, Samastipur, PU, Patna, NIT, Jamshedpur etc.

The Quality Evaluation Laboratory of the Institute has recently been accredited IS IISO 9001:2000 and it caters to the quality control needs of the lac processing/lac product industries as well as exporters of lac/lac products. The QEL analyses, on an average about 150 samples per annum. The lab has facilities for carrying out testing of lac/lac products as per BIS requirements.

The PME cell provides the scientists, access to internet and e-mail facilities for communication and information retrieval. The Institute website www.icar.org.in/ilri/default.html is a valuable source of information on IINRG. The Institute has attained international recognition for its contribution in cultivation and utilization aspects of lac.

Budget

During 2010-11, the non-plan expenditure was Rs. 914.79 lakhs, against a revised estimate of Rs. 956.50 lakhs; the plan expenditure was Rs. 189.96 lakhs against a revised estimate of Rs. 190.00 lakhs. The detailed figures are shown in the table :

Budget allocation & utilization during 2010-11: At a glance

(Rs. in lakhs)

| Sl. No. | Head | | PLAN | | NON-PLAN | |
|---------|---------------------------|--------------------------|---------------|---------------------|---------------|---------------------|
| | | | R.E. 2010-11 | Expenditure 2010-11 | R.E. 2010-11 | Expenditure 2010-11 |
| A | Plan & Non-plan | | | | | |
| 1 | Establishment Charges | | 0.00 | 0.00 | 735.25 | 714.75 |
| 2 | Wages | | 0.00 | 0.00 | 0.00 | 0.00 |
| 3 | O.T.A. | | 0.00 | 0.00 | 0.25 | 0.25 |
| 4 | Travelling Allowances | | 6.00 | 5.99 | 3.00 | 3.00 |
| 5 | H.R.D. | | 3.00 | 3.00 | 0.00 | 0.00 |
| 6 | Other Charges | | 60.5 | 60.48 | 56.5 | 56.47 |
| | Equipments | | 50.00 | 50.00 | 4.00 | 3.97 |
| | Furniture Fixture | | 0.00 | 0.00 | 0.00 | 0.00 |
| 7 | Information Technology | | 0.00 | 0.00 | 0.00 | 0.00 |
| 8 | Works | | 57.5 | 57.49 | 0.00 | 0.00 |
| | Special Repairs | (a) Equipment & Vehicle | 0.00 | 0.00 | 7.00 | 0.00 |
| | | (b) Office Building | 0.00 | 0.00 | 10.00 | 6.99 |
| | | (c) Residential building | 0.00 | 0.00 | 10.00 | 10.00 |
| | | (d) Minor works | 0.00 | 0.00 | 0.00 | 10.00 |
| 9 | Other Items | | 13.00 | 13.00 | 0.00 | 0.00 |
| | Publicity (Library) | | | | | |
| B | Loan & Advances | | 0.00 | 0.00 | 5.50 | 4.70 |
| C | Pensions | | 0.00 | 0.00 | 125.00 | 104.66 |
| | Total (A+B+C) | | 190.00 | 189.96 | 956.50 | 914.79 |
| | Plan Schemes | | | | | |
| | Network Project | | 24.00 | 23.98 | 0.00 | 0.00 |
| | IPR | | 7.50 | 5.50 | 0.00 | 0.00 |
| | Revenue Generation target | | 0.00 | 0.00 | 34.00 | 36.36 |

Revenue Generation

During the period under report, a sum of Rs. 36.36 lakhs was earned as revenue, through different

programmes of various divisions and sections of the Institute.

RESEARCH ACCOMPLISHMENTS



1 LAC PRODUCTION

1.1 Insect Improvement

1.1.1 Collection, conservation, characterization and documentation of lac insect bio-diversity

Evaluation of lac insect stocks

Evaluation of five lac insect stocks; two from Maharashtra (Ahmednagar & Aurangabad) and three from West Bengal (Bankura, Midnapore & Purulia) was continued for the second consecutive year. Post-harvest attributes viz. cell weight, resin weight and fecundity of summer season (*baisakhi* 2009-10) crop (Figs. 1 to 2), all attributes of rainy season (*katki* 2010) crop including pre-harvest attributes viz., density of settlement, initial mortality and male proportion (Figs. 3 to 5) were studied.

Cell weight varied from 9.57 mg in Bankura to 16.94 mg in Ahmednagar stock during *baisakhi* (summer season) crop 2009-10 (Fig. 1). Similarly quantity of resin secreted by individual female lac insect ranged between 6.94 to 12.49 mg for Bankura and Ahmednagar stocks respectively. Average resin secreted was about 72% of the cell weight by *rangeeni* stocks. While fecundity was lowest (353) in Aurangabad stock and highest (679) in Purulia stock (Fig. 2).

During rainy season crop, cell weight (Fig. 3) varied from 7.68 mg in Purulia to 14.87mg in Ahmednagar stock. Similarly, quantity of resin secreted by individual ranged from 5.01mg for Purulia to 11.41mg for Ahmednagar. While fecundity (Fig. 4) was lowest (274) in Purulia stock and highest (633) in Ahmednagar stock. Lac insect stocks collected from Maharashtra (Ahmednagar and Aurangabad) were found to be most productive on pooling the data for summer and rainy season together. Male proportion (Fig. 5) ranged between 22 to 46 per cent, which was significantly lower than *baisakhi* crop 2009-10, reported last year.

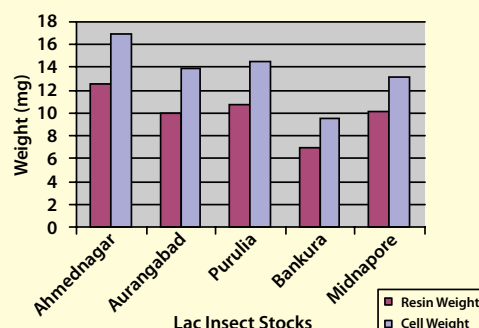


Fig. 1 Cell and resin weight of different lac insect stocks during summer season (*baisakhi*) crop 2009-10

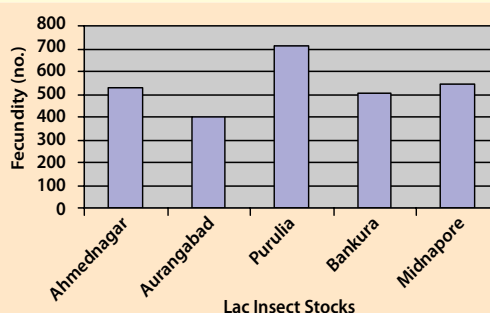


Fig. 2 Fecundity of different lac insect stocks during summer season (*baisakhi*) crop 2009-10

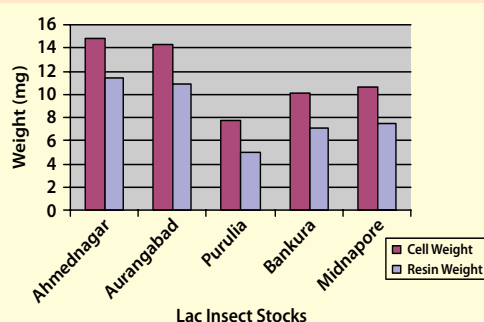


Fig. 3 Cell and resin weight of different lac insect stocks during rainy season (*katki*) crop 2009-10

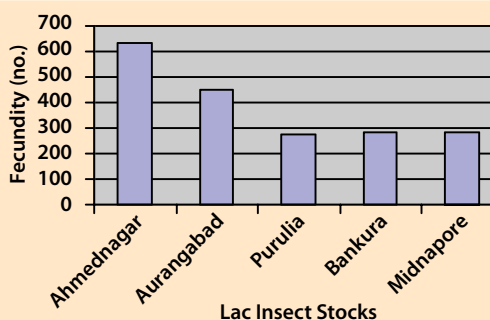


Fig. 4 Fecundity of different lac insect stocks during rainy season (*katki*) crop 2009-10

However, initial mortality during rainy season was much more than the summer season crop. Density of settlement and fecundity was found to be highly variable depending upon the quantity of broodlac used and time taken to complete one generation respectively irrespective of the lac insect stock.

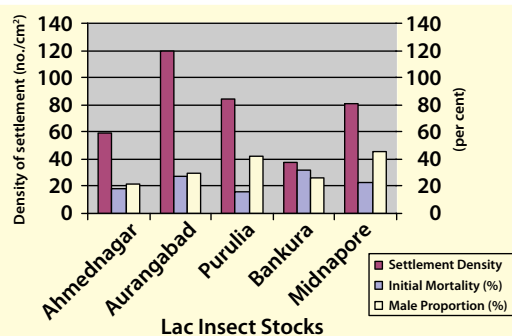


Fig. 5 Pre-harvest biological attributes of different lac insect stocks during rainy season (*katki*) crop 2009-10

Multiplication and evaluation of five new stocks collected from Agra (UP), Bankhedi (MP), Imphal (Manipur), Nangal and Ropar (Punjab) have been initiated from summer season crop. Initial density of settlement varied from 62 in Nangal to 81 in Ropar stocks. The lowest initial mortality (7.1%) was recorded in Bankhedi and highest (26.2%) in Nangal stock.

Multiplication and evaluation of yellow *kusmi* lac insect breed under field conditions

More than 20 kg of broodlac of yellow *kusmi* lac insect was harvested in January from 50 *semialata* plants giving 8:1 (output:input) broodlac ratio, during winter season (*aghani*) crop. An average of 644g broodlac was harvested from an individual plant, of which 58% was of good quality, 24% of medium quality and 18% was rejected (Fig. 6). 17.5 kg of this broodlac was inoculated on 17 *kusum* trees in IRF for further multiplication and 97 kg broodlac was harvested from summer season (*jethwi*) crop in June, giving 5.54 (output/input) broodlac ratio.

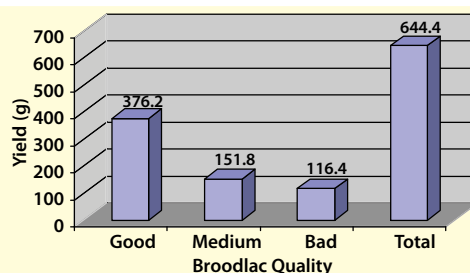


Fig. 6 Performance of kusmi yellow on *F. semialata* during winter season (*aghani*) crop 2009-10

Out of the total broodlac harvested, 89.5 kg was inoculated on *Ziziphus mauritiana* (*ber*), 7.0 kg on *Albizia procera* (*safed siris*) and 0.5 kg on *Ficus cunia* (*porho*) for further multiplication and evaluation on different host-plants. Lac insects did not survive on *A. procera* and complete mortality was observed soon after inoculation but performed well on *F. cunia* and *Z. mauritiana* (Figs 7 and 8). 2.0 kg and 322 kg (including 51.7 kg rejected) was harvested from one *porho* and 80 *ber* plants respectively giving a healthy output of 4.0 and 3.6 times respectively. 247 kg of broodlac has been inoculated on *Schleichera oleosa* (*kusum*) at IRF and 20 kg has been inoculated in Mangobandh village for evaluation in farmer's field also.



Fig. 7 Performance of kusmi yellow lac insect on *F. cunia*



Fig. 8 Performance of kusmi yellow lac insect on *Z. mauritiana*

Cultures of yellow *rangeeni* lac insect inoculated on *F. macrophylla* during October 2009 succumbed to heavy parasitization and failed to survive beyond February 2010.

New lac insect-host plant combination

Culturing of *Kerria chinensis* on *Calliandra calothyrsus* during both summer as well as winter season gave satisfactory results. Lac insects survived on the twig of even more than five cm diameter (Fig. 9). Since culture was raised only on one available plant, efforts in future will be made to multiply the plant for cultivation on a large scale.



Fig. 9 Performance of *Kerria chinensis* on *Calliandra calothyrsus*

Lac insects collected from Imphal (Manipur) from *Hibiscus chinensis* has been cultured on *F. macrophylla* for multiplication and evaluation. Two cultures raised from the lac insect collected in July are surviving well and likely to mature in February 2011.

Culturing yellow *rangeeni* lac insect on pumpkin

Yellow *rangeeni* lac insect (Aurangabad, Maharashtra) conserved in the Lac Insect Field Gene Bank of the NATLIGEC was inoculated on ripened pumpkin (*Cucurbita moschata*) in June 2010 during rainy season (*katki*) crop. Lac insect developed satisfactorily (Fig. 10) and completed its cycle in October, 2010. Biological attributes of the lac insect cultured on pumpkin were compared with that cultured on *bhalia* (*F. macrophylla*) and are presented in the Table 1. Larvae settled in patches on pumpkin whereas settlement was uniform on *bhalia*.



Fig. 10 Performance of yellow *rangeeni* lac insect on pumpkin during rainy season (*Katki*) crop.

Table 1. Comparative performance of lac insect on pumpkin and *bhalia*

| Sl. No. | Biological attribute | Sample size | Pumpkin | <i>Bhalia</i> |
|---------|---|-------------------|---------|---------------|
| 1. | Density of settlement (per sq. cm.) | 5 cm ² | 58 | 84 |
| 2. | Initial mortality (% of initial settlement density) | 5 cm ² | 23 | 18 |
| 3. | Male proportion (%) | 5 cm ² | 31 | 37 |
| 4. | Cell weight (mg) | 10 | 11.6 | 12.5 |
| 5. | Resin weight (mg) | 10 | 8.6 | 9.8 |
| 6. | Fecundity (no.) | 10 | 312 | 299 |

National Lac Insect Germplasm Centre (NATLIGEC)

Conservation of lac insect stocks

1750 cultures of 70 lac insect lines are being conserved live on potted plants of *F. macrophylla* in the Field Gene Bank of NATLIGEC. Five new stocks collected from the following locations have been added in Gene Bank : Agra (UP), Bankhedi (MP), Imphal (Manipur) and Nangal & Ropar (Punjab). The stocks are being multiplied for evaluation. Ant damaging lac cultures in Field Gene Bank of NATLIGEC reported earlier, has been identified as *Pheidologeton affinis* (Fig. 11).



Fig. 11 Ant (*P. affinis*) damaging lac culture in NATLIGEC

Multiplication and evaluation of potential *rangeeni* lac insect lines

Five (5) *rangeeni* lac insect lines from Kanker (Chhattisgarh), Putidih (W.B.), Ajmer & Pushkar (Rajasthan), another collection from Rajasthan (maintained in Institute Field Gene Bank) and one local line from IRF (Jharkhand) that survived in *bhailia* for broodlac productivity during summer season (2009-10) and were simultaneously raised in field conditions on *palas* and *ber* trees. Among five collections of *rangeeni* lac insects evaluated on *bhailia*, Local performed best (1: 8.5) followed by Rajasthan (1: 7.6), Putidih (1: 6.5) and Kanker (1: 6.3) during summer season. These lines were also raised on *bhailia* as *katki* 2010 crop and it was observed that the Ajmer collection performed best (1: 6.1) followed by Local (1: 5.9), Rajasthan (1: 5.8), Putidih (1: 5.8) and Kanker (1: 4.9).

Biological attributes viz., fecundity, fresh and dry cell weight of matured female raised on *bhailia* were also recorded for summer season (2009-10) crop. The data showed that the fecundity of both collections from Rajasthan was highest and significantly superior over others. The fecundity of Kanker collection was least. Fresh and dry cell weight of matured females of both collections from Rajasthan was highest and least for Kanker.

1.1.2 Field evaluation of promising insect races, lines and breeds for higher productivity and superior performance

Field evaluation of *rangeeni* crop for high productivity and summer sustainability on *ber* and *palas*

Due to large scale pre-summer mortality in *rangeeni* lac insects under field conditions, the data could not be analyzed conclusively for both the hosts (*ber* and *palas*) either for higher productivity or summer sustainability. However, these lines were evaluated in field conditions on *palas* and *ber* as *katki* 2010 crop and it was found that the local performed best (1:3.2) followed by Putidih (1:3.1), Kanker (1:2.4), Rajasthan (1:1.9) and Ajmer (1:1.6). Whereas, on *ber* trees, Ajmer collection performed best (1:4.1) followed by Putidih (1:4.0), local (1: 4.0), Rajasthan (1:3.9) and Kanker (1:3.2).

Quantification of parasites in *rangeeni* lac crop (*baisakhi* 2009-10)

Rangeeni lac insects reared on *palas* and *ber* were collected from IRF, Namkum and Latehar block (Jharkhand); Bagmundi and Jhaldah block of district Purulia (WB) in the month of January and March for the assessment of parasitization. Analysis of lac insect cells (No. 320) collected from *bhailia* in the month of January from IRF showed that 181 (56.6%) insects were dead. Remaining 139 living insects were further examined under microscope wherein 80 (57.6%) insects were also found parasitized. Thus only 59 (18.4%) of the total insects observed were normal. Examination of other dead samples from 4 different locations including IRF showed an average parasitization of 54.3% in infected lac culture. The lac insect parasitoid, *Aprostocetus* (*Tetrastichus*) *purpureus* emerged at the rate of 248 - 364 in the month of January whereas, it ranged from 416 - 573 in the month of March while caging 10 cm long lac encrustations. Emergence of other parasites ranged from 9 - 19 for the same sample. Subsequent sampling and caging of samples from the same locations did not show any significant emergence of the parasites. Thus, early parasitization (first and early second instars) of lac insects seems lethal for pre-summer mortality in *rangeeni* lac insect.

1.1.3 *In vitro* culturing of lac insect cells

Preliminary experiments showed that the ovaries were the preferred explant and surface sterilization treatment with ethanol, sodium hypochlorite and mercuric chloride eliminated the surface contamination from mature female lac insects while culturing them. The optimal number of ovaries was found to be 5-10 per 25 cm² culture vessel. The ovaries were dissected out from surface sterilized mature female lac insects, macerated and seeded in the culture vessel after washing. To remove the pigment and other debris, two to three washes were given with 1X PBS. To increase the adherence of cells, the cells were treated with 0.25% trypsin and 0.1% EDTA at 37°C for 3-5 minutes before seeding. This treatment reduced the number of floating cells. The cell culture medium was also supplemented with 200 units of penicillin, 200µg of streptomycin and 5µg of amphotericin per ml of medium to avoid further contamination. To optimize the culturing conditions, various insect cell culture media like MM medium–Mitsubishi and Maramorosch medium, TNM-FH medium, Grace's insect medium and Schneider's medium were used and eventually cells were incubated at 27°C. Although the cells did not proliferate, no contamination was observed.

1.1.4 Nature of diversity in lac insects of *Kerria spp.* in India and insect x host interaction

Survey of Mizoram and Tripura for lac insects

An extensive survey of Tripura and Mizoram was undertaken during 7-17th November 2010 for availability of lac insects. All the four districts of Tripura viz., West Tripura, South Tripura, Dhalai & North Tripura, and three districts of Mizoram viz., Aizawl, Champhai & Kolasib were surveyed. *Acacia auriculiformis*, *Albizia saman* and *A. lebbek*, prominent hosts in abundance and *Ziziphus mauritiana*, *Peltophorum ferrugineum* and *Ficus spp.* were also available in Tripura. *A. lebbek*, *A. saman*, *A. auriculiformis* were also observed in Mizoram. But lac insect could not be located in both the states. The region is characterized with high rain fall and high humidity throughout the year. Most of the host plants especially *Ficus spp.* and rain trees were covered with epiphytes, whereas *ber* trees were

infected with galls/fungus, making hosts unsuitable for lac insect. This could perhaps be the reason for absence of lac insect in the region. However, exhaustive survey would be required to rule out the presence of lac insect in these states.

Collection of lac insects from Manipur

Lac insect was reported last year on *A. auriculiformis* (Ukhrul district), *Hibiscus chinensis* (Imphal (W and Churachandpur districts) and *F. religiosa* & *Z. mauritiana* (Imphal (E) and Bishnupur districts) during survey of Manipur conducted in November, 2009. However, no emergence of larvae took place as the samples collected were not mature. Therefore, lac samples on *Hibiscus chinensis* in right stage were collected (Fig. 12) during July 2010 from West Imphal. Two cultures established for multiplication are developing satisfactorily.



Fig. 12 Lac insect on *H. chinensis* in West Imphal district of Manipur

Molecular characterization

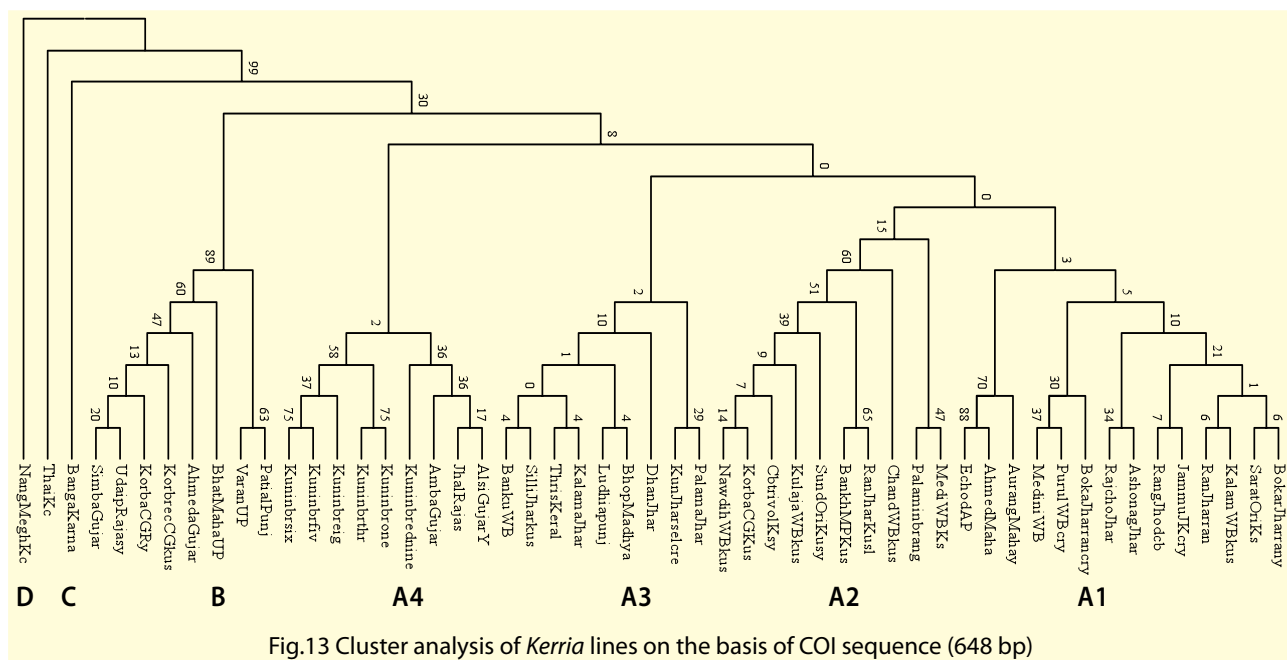
Sequence variation of 648 bp region of COI gene was studied in 53 lac insect lines. Both Folmer as well as new primersets designed were used for amplification of COI gene, separately or in combination. PCR products were gel purified and sequencing was performed in both directions. Forward and reverse reads were aligned and trimmed for a consensus sequence of 650bp, which is specified for universal bar-coding of life.

Analysis of disparity index (Kumar and Gadagkar, 2001) by pair-wise comparison of fifty-three lines showed significant differences ($p < 0.05$) in seven pairs of lines. Significant disparity has been

recorded only with two inbred lines (Kuninbrfv and Kuninbrsix) in relation to seven races of *K. lacca* and one of *K. sharda*. Meier's genetic distance in the pair-wise comparisons within *K. lacca* ranged from 0 to 1.84%. Lines showed that the genetic distance of 84.07 % of the matches ranged between 0.0 and 1.0%; and rest in between range of 1.0-2.0%; showing considerable genetic variation among populations of *K. lacca* in India. Comparison of the inter-specific divergence by similarity values varied between 0 to 9.23% among *K. lacca*, *K. chinensis* and *K. sharda*. The nodal group 0-0.5%, contained the matches between *K. sharda* and *K. lacca* lines; the

sec nodal group, 8.5-9.0% included *K. chinensis* with *K. lacca* and *K. sharda*.

Evolutionary tree (Fig. 13) based on the COI gene segment clearly separated *K. chinensis* from India and Thailand from *K. lacca* and *K. sharda* lines (cluster D). The *K. lacca* line Banga Karna from peninsular India is an out-group of other *K. lacca* lines (cluster C). The tree also segregated the eight geographic races from central, western and northern India (cluster B). Cluster A was the largest with 24 lines, comprising of mostly cultivated *rangeeni* and *kusmi* lines of *K. lacca* as well as two lines of *K. sharda*.



Spectral analysis of body colour pigments

Qualitative variation among lac insect lines was observed. Crimson lac insects lines have at least two peaks in the range of 525-527nm and 291-294nm. Lac insects LIK 0048 and LIK 0019 (both crimson) possess one extra peak in the range of 204-207nm in the spectrum. Yellow lac insects possess two peaks clearly distinct from crimson lac insects in the range of 422-429nm and 310-319nm.

Comparative picture of yellow and crimson line revealed that LIK 0039 (crimson) does not possess the peak no.6 as indicated by arrow whereas LIK 0003 (yellow) do possess the peak (Fig. 14).

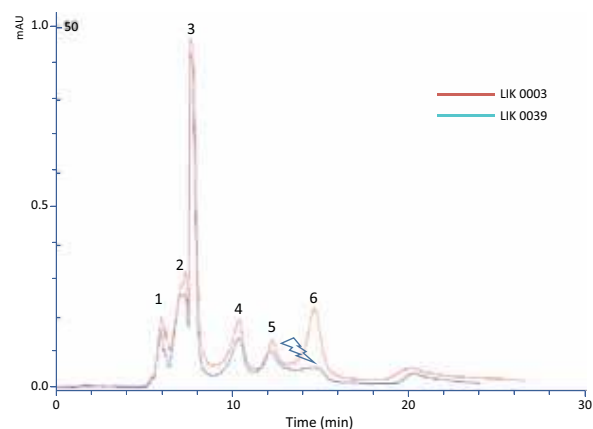


Fig. 14 HPLC Chromatogram showing one extra peak in yellow lac insect line

Analysis of biological parameters in lac insects

Analysis of data on density of settlement during summer season crop 2009-10 clearly differentiated different lac insect lines into four groups. Lac insect stocks belonging to *Kusmi* lines, Thailand & Meghalaya and lines from Karnataka and Kerala had

distinctly higher density of settlement than *rangeeni* lines (Fig. 15). Range of settlement was much wider in *rangeeni* lines in comparison to other three groups. Average density of settlement is significantly higher (Fig. 16) during summer season crop (89.5/cm²) than rainy season crop (70.0/cm²).

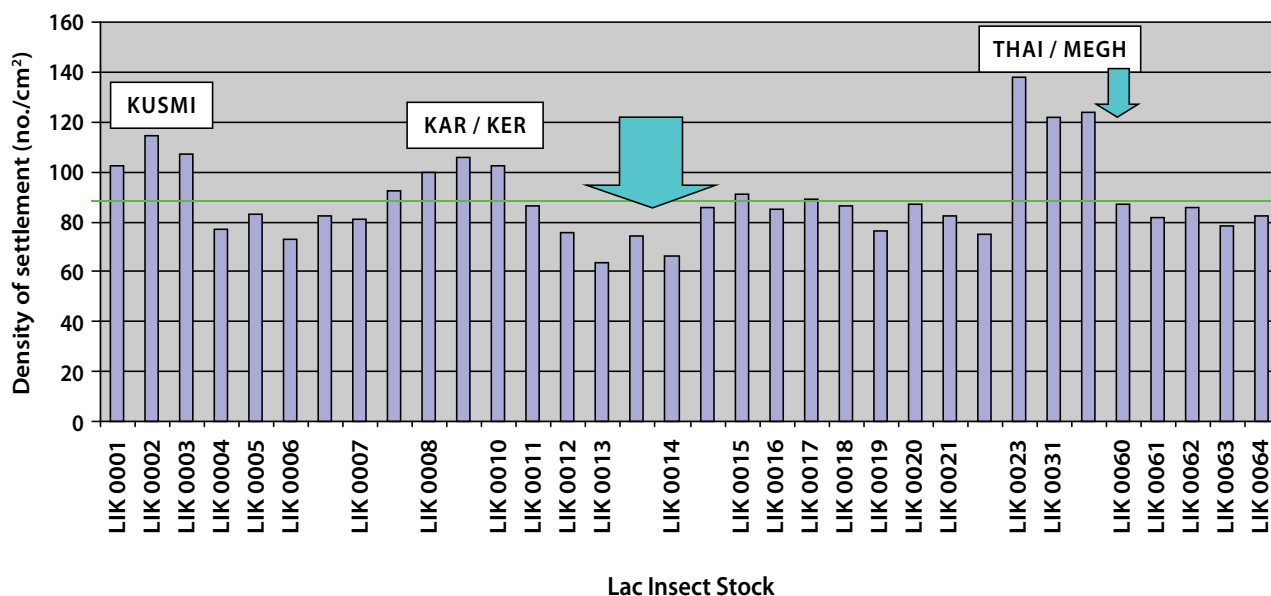


Fig. 15 Density of settlement in lac insect lines during summer season crop 2009-10

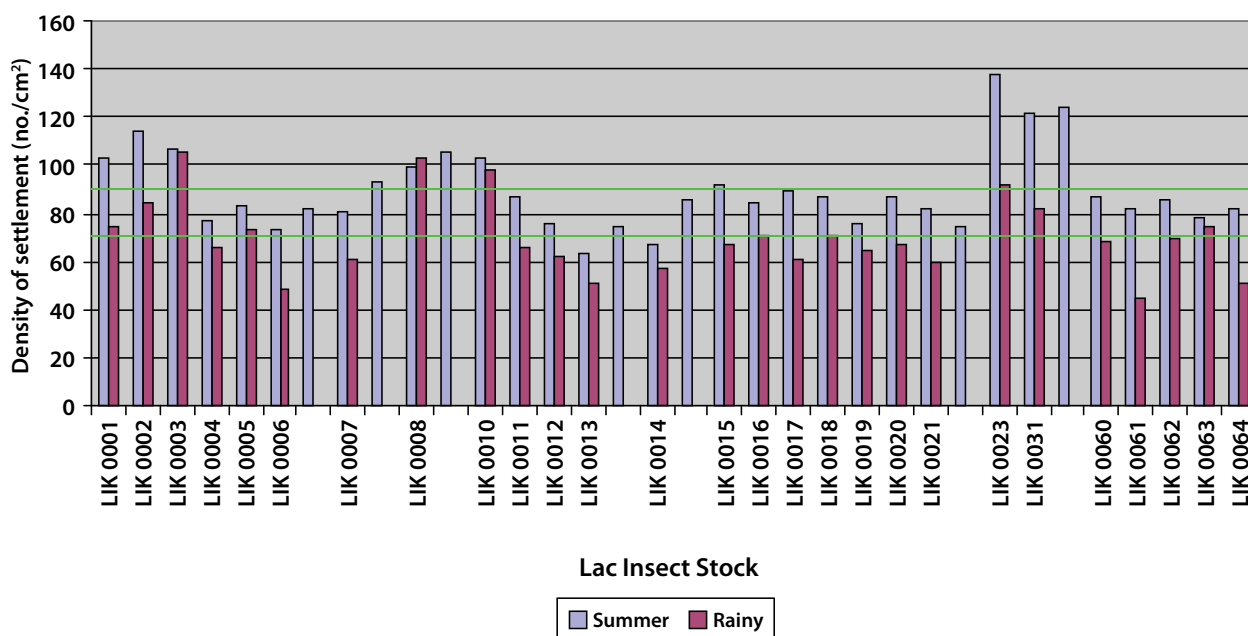


Fig. 16 Comparative density of settlement of lac insect stocks during summer and rainy seasons

Another interesting phenomenon observed was that environmental conditions affected duration of life cycle of certain lines. Lac insect stocks from Meghalaya, Punjab and Jammu completed three

cycles in a year instead of usual two. However combined productivity of two crops in a year was higher than three crop per year (Fig. 17).

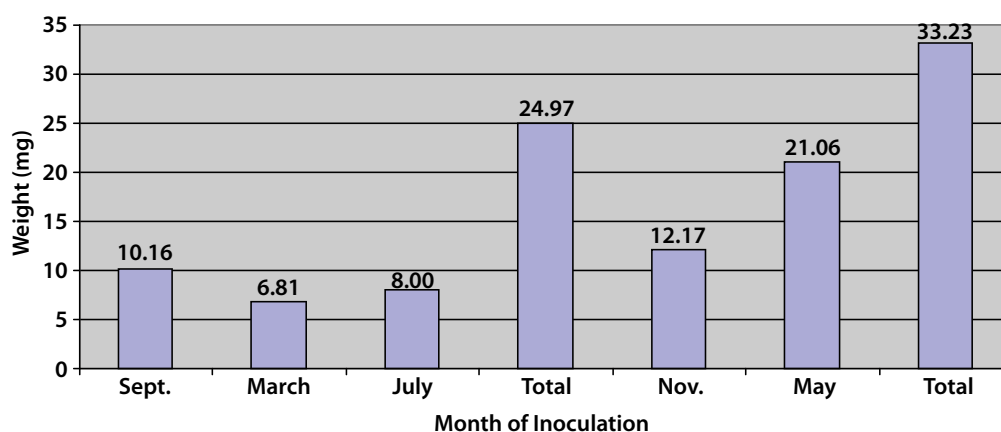


Fig. 17 Resin productivity of Meghalaya lac insect during different crop seasons

Average initial mortality of different insect lines was significantly higher (Fig. 18) during rainy season crop (23.9 %) than summer season crop (13.6 %). No significant differences were observed in mortality between different insect lines. Prevailing abiotic factors especially during rainy season have greater effect on initial mortality than summer season crop.

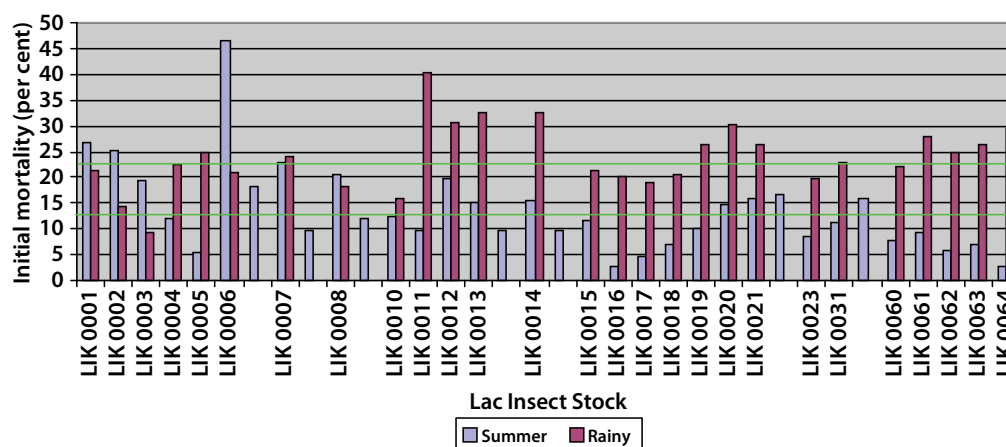


Fig. 18 Comparative initial mortality of various lac insect stocks during summer and rainy seasons

Average sex ratio tended to be significantly higher in favour of males (Fig. 19) during summer season crop (49.5 %) than rainy season crop (34.6 %).

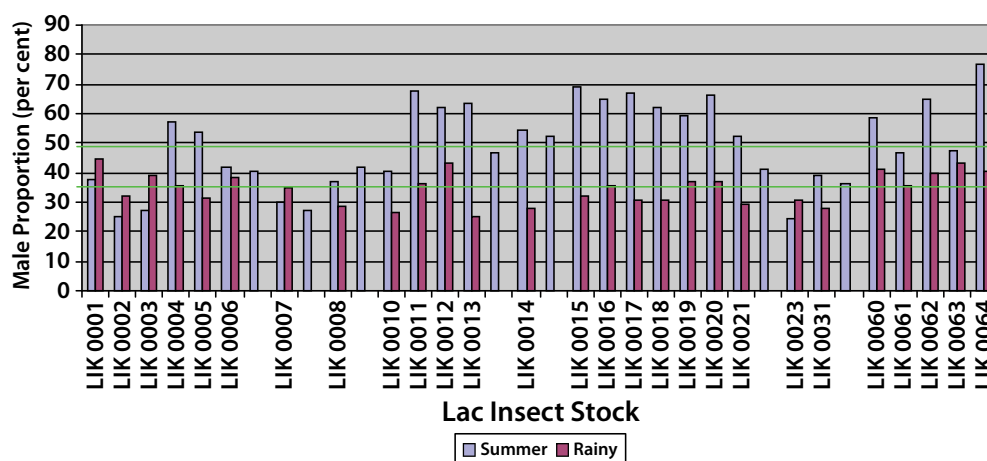


Fig. 19 Comparative male proportion in lac insect stocks during summer and rainy seasons

1.2 Host Improvement

1.2.1 Collection, conservation, characterization and documentation of lac host biodiversity

Identification and documentation of high yielding lac host plants

A survey was made in four districts of major lac growing states viz., Putidih, Purulia, (W.B); Bastipali, Raigarh (Chhattisgarh); Dumka and Jamtara (Jharkhand) and Dang (Gujarat). These areas were surveyed during 2010 for identification of lac host trees as reported by lac growers for documentation and clonal multiplication.

Variants of *palas* tree

In Jamtara (Narayanpur block, Baramjhladih village) and Dumka dist. (Bhournia village), *palas* plants have been identified with leaf shape variation i.e. acuminate leaf (middle leaflet is pointed at the apex) than normal obtuse leaf (Fig. 20).

In Narayanpur block, Baramjhladih village, (Jamtara), and Karmatand village of Dumka District, *palas* plants having large trifoliate leaf have been identified (Fig. 20).

Occurrence of lac on white *palas* (canopy colour) was observed in the farmer's field at Sinjotola village, Jamtara district, Jharkhand (Fig. 20).



Acuminate leaf



Obtuse leaf



Trifoliate leaf



White *palas*

Fig. 20 Variants of *palas* tree on the basis of leaf shape and colour

Variant of *Flemingia chappar* (Barasalpan) and its morphological characterization

A new variant has been identified in *F. chappar* based on leaf colour, having dark green leaves as well as bracts than the normal pale green colour plant at IRF (Fig. 21).

Leaf chlorophyll content Index (CCI) of new variant shows significant variation in chlorophyll content (mean-29.12) than the pale green colour plant

(mean-11.66). The bract chlorophyll content Index (CCI) of new variant also shows significant variation in chlorophyll content (mean-3.68) than the pale green colour plant (mean-1.93). Drying of bracts and flowering is earlier in dark green canopy plant than the pale green canopy plant. During flowering, flower of dark green plant remains enclosed in the bract whereas flower remains open in pale green plant (Fig. 21).



Leaf colour



Bract colour



Flower enclosed in bract of dark green leaf canopy (variant)



Flower open in pale green leaf canopy (IRF)

Fig. 21 Comparative morphological characters of *F. chappar* variant

Variant of *Flemingia bracteata*

A new variant has been observed in *Flemingia bracteata* having green bracts compared to purple bracts (Fig. 22).



Green bracts (variant)



Purple bracts

Fig. 22 Variant of *F. bracteata*

Enrichment and conservation of lac host in field gene bank

A collection of the *kusum* plants from Dang district of Gujarat was added to the lac host field gene bank at the institute, in all 86 collections are conserved in the field gene bank. In addition, 11 Dhawda gum (*Anogeissus latifolia*; family: Combretaceae) plants were collected from Sungadhaw forest of Chhattisgarh.

1.2.2 Host plant evaluation and improvement for lac productivity and summer sustainability

Evaluation of *F. semialata* lines for summer sustainability of *kusmi* lac crop

Evaluation of lac producing potential and growth performance of selected line of *F. semialata* as compared to control was done during summer season (Table 2). Out of 65 inoculated plants, 41% could sustain *kusmi* lac throughout the summer season. 22 cm encrustation of living lac sustained in the selected line, while the control line could not produce lac at all. By adopting proper lac crop management, summer lac production can be improved further. As far as growth is concerned, the selected line has been found to be significantly vigorous as compared to control.

Table 2. Growth attributes and lac producing potential of selected line against control in *F. semialata*

| | No. of leaves per plant | No of big shoots (100-150 cm) | No.of small shoot per plant | Diameter of shoot with dead lac (cm) | Length of lac mortality (cm) | Length of surviving lac per plant (cm) |
|---------------|-------------------------|-------------------------------|-----------------------------|--------------------------------------|------------------------------|--|
| Selected line | 81.1 | 4.46 | 3.4 | 0.91 | 138 | 22.2 |
| Control | 68.1 | 1.78 | 4.2 | 0.87 | 127.6 | 0 |
| t- test | NS | * | * | NS | NS | * |

*Significant at 5% level of significance

Characterization of *kusum* and *galwang* genotypes for lac production

Lac producing potential of two selected lines of

galwang has been evaluated by inoculating *kusmi* lac in July for winter season crop. No significant difference in lac settlement and survival was found

between the lines. Experimental results suggested that plant height, light interception within the canopy and total canopy size of trees influenced lac production significantly.

Screening of *ber* genotypes for lac attributing traits

Based on data recorded over three consecutive

years for *kusmi* lac yield performance, five out of 96 *ber* (*Z. mauritiana*) genotypes were selected. The five selected lines are being multiplied through budding for further propagation. Lac yield and yield attributing characters of these genotypes are given in Table 3.

Table 3. Lac yield attributing characters of selected *ber* genotypes

| Tree No. | Mean yield ratio (3 yr) | Rejected yield ratio | Encrustation thickness (cm) | Tree type |
|-------------------|-------------------------|----------------------|-----------------------------|-----------------|
| A | 12.31 | 0.71 | 0.68 | Semi erect |
| B | 10.57 | 2.21 | 0.62 | Erect |
| C | 9.8 | 2.39 | 0.6 | Spreading dense |
| D | 15.74 | 3.39 | 0.77 | Spreading dense |
| E | 10.83 | 3.08 | 0.66 | Spreading thin |
| Average (96 tree) | 5.73 | 1.81 | 0.63 | |

1.3 Crop Production

1.3.1 Development of *kusmi* lac cultivation technology on *Albizia procera*

The projects was aimed to (a) to standardise the pruning time (b) to assess the suitable age of shoots for inoculation (c) to assess the most suitable crop for lac production (d) to assess the productivity and quality of broodlac and lac and (e) to identify operational constraints if any.

Pruning time and age of shoots

Availability of number and length of primary shoots was considered for standardizing pruning time and suitable age of shoots for inoculation.

Availability of primary shoots

The growth of primary shoots was better if trees were pruned in January rather than July. This was same for all cases *i.e.*, 6, 12, 18 months of pruning. The average length of primary shoot was 2.11, 2.57, and 3.83 meter for January pruning and 0.58, 1.26 and 2.80 meter in case of July pruning. Similarly the range of primary shoot length was 1.8-3.5, 1.8-2.7 and 3.4-4.3 meter in case of 6, 12, 18 months for January pruning and 0.58, 1.26, 2.80 meter in case

of 6, 12, 18 months for July pruning. These figures indicate relatively higher length of primary shoots availability at the time of inoculation if pruning is done in January (Table 4).

Availability of secondary shoots

The secondary shoots were not available six months after the pruning but appear after 12 months. The average length was 0.14 and 0.10 in case of January and July pruning after 12 months respectively. The corresponding figures were 0.39 and 0.24 meter after 18 months respectively. The average number of secondary shoots per shoot was 7-12 and 4-7 as result of January and July pruning after 12 months. The corresponding figures after 18 months of pruning were 10-12 and 10-15 respectively. Hence there was no difference in number of secondary shoots with respect to January and July pruning (Table 4).

Settlement behaviour of lac insect on petiole and shoots

In case of 6 months prior pruning, the lac insects settled mainly on petiole and then on primary shoot. In case of 12 months prior pruning, settlement is almost equal on petiole and primary shoots. However,

in case of 18 months prior pruning, settlement was mainly on secondary shoot and petioles as primary shoots become very thick (Table 4).

Based on availability of appropriate length and number of secondary shoots per primary shoot besides its suitability for settlement of lac insect, 18 months wait period between pruning and inoculation will be more appropriate.

Assessment of suitable crop season for lac production

The data have indicated that when inoculation was done on trees pruned 6 months prior to inoculation, the lac culture survived on 20 trees out of 26 which is 77%. The average output to input ratio of broodlac recorded was 2.26 in case of 6 months prior pruned trees and 1.62, 8.51 in cases of 12 and 18 months prior pruning respectively (Table 5). There was wide variation in productivity between tree to tree and some trees did not accept lac insect. Based on data it may also be inferred that 18 months gestation period between pruning and inoculation was most suitable. This is due to fact that large numbers of secondary shoots are available in this treatment, suitable for lac insect settlement and survival.

Studies were carried out for biological attributes namely settlement density, mortality of lac insect at initial and sexual maturity stage, male percentage etc. (Table 6). These attributes do not differ between 6, 12, and 18 months prior pruned trees. These characters have been quantified from primary shoots in case of 6 and 12 months prior pruned trees and secondary shoots in case of 18 months.

Assessment of productivity and quality of broodlac and lac

Productivity: The productivity was relatively more in case of trees pruned 18 months prior to inoculation (Table 5). The petiole encrustation contributes substantially in winter season crop as the leaf fall takes place sometimes in late March or early April. The summer crop however lacks petiole encrustation as the settled insects on petioles are lost in March due to leaf fall. The percentage contribution due to petiole encrustation differs between 6, 12 and 18 months prior pruned trees and was recorded to

be 67.4, 48.5 and 19.7% respectively (Table 7). As mentioned earlier, the productivity was recorded to be highest in group of trees inoculated 18 months prior pruned trees followed by 6 and 12 months.

Quality of broodlac from winter crop: A comparison of broodlac from secondary shoots and petioles indicated that the per meter broodlac weight was 182g for secondary shoots but only 69g for petiole, indicating more weight for secondary shoots. However, in terms of encrustation, the petiole broodlac constituted 81% encrustation but secondary shoots only 37 per cent, while the rest part constituted plant stick (Table 8). Hence despite heavy weight of the secondary shoots, the quality of petiole broodlac is better as it constitute more resin. From one kg of winter broodlac crop of *siris*, which include secondary shoots and petioles, 775g *phunki* was obtained which yielded 600g of scraped lac, indicating quality of broodlac in terms of lac encrustation.

Quality of broodlac from summer crop: The weight of broodlac recorded from primary shoot was 81g and 87g per meter for 6 and 12 months prior pruned trees; respectively whereas broodlac derived from secondary shoot weighed 111g per meter for 18 months prior pruned trees compared to *kusmi* broodlac from *kusum* tree which weighed 200g per meter. The lac encrustation was 58.6% in secondary shoots in 18 month prior pruned trees but only 43 and 41% derived from primary shoots in 6 & 12 months prior pruned trees. The secondary shoots provide more encrustation even in *kusmi* also. The thickness of secondary shoot encrustation was 5mm. The summer season derived broodlac lacks petiole as stated earlier (Table 9).

Quality of lac resin: Seedlac obtained from *siris*, *ber* and *kusum* trees were tested for the industrial parameters (Table 10). The flow of seedlac derived from *siris* tree was found to be much higher than *ber* during winter season. However, during summer season crop, the flow was about the same as in *kusmi* lac grown on *kusum* tree. Hot alcohol insoluble percentage was lower than *kusmi* on *ber* (1.25 and 2.5 respectively) during winter season. During summer season also, this was lower than *kusmi*

on *kusum* tree (1.62 and 2.14 respectively). No any operational constraints were recorded.

Other observations recorded

1. Around one meter long branch cutting of about 4 cm diameter raised during December becomes a plant of around 2 meter height after 8 months.
2. 1, 2 and 4 year old vegetatively propagated plants attain a height of 5, 12 and 25 ft. The four year plant is capable of producing 4-5 kg of broodlac per year.
3. It is possible to reduce the gestation period to a large extent by vegetative propagation.
4. As the bark of the shoots are thick and hard, the lac crawlers prefers to settle on petioles (Fig. 23 a & b).
5. It was observed that the leaflets fall wherever there was heavy encrustation on trees but the petioles remained intact on trees till harvesting of mature lac crop.
6. The observation on growth of tree indicated that two year old trees attained a trunk diameter of 7.5cm. The 5-6 years old trees possess a diameter of 15cm and a height of 25 ft.

Table 4. Availability of primary and secondary shoots after different intervals of pruning

| Gestation period between pruning and inoculation (month) | Pruning Time | Observation recorded | Mean length of primary shoot (m) (Range) | Mean length of secondary shoot (m) (Range) | Remark |
|--|--------------|----------------------|--|--|---|
| 6 | January | July | 2.11 (1.8-3.5) | Nil | Insect settle mainly on petiole & primary shoot |
| 12 | July | July | 1.26 (0.80-2.0) | 0.10 (0.05-0.12) (4-7)* | Insect settle mainly on petiole & primary shoot equally |
| 18 | January | July | 3.83 (3.4-4.3) | 0.39 (0.3 – 0.45) (10-12) | Insect settle mainly on secondary shoot & petiole. |
| 6 | July | Jan | 0.58 (0.40-0.75) | Nil | As in January pruning |
| 12 | January | Jan | 2.57 (1.8-2.7) | 0.14 (0.10-0.20) (7-12) | As in July pruning |
| 18 | July | Jan | 2.80 (1.90-3.5) | 0.24 (0.15-0.25) (10-15) | As in January pruning |

*Figures in parentheses are numbers of secondary shoots (range) per primary shoot

Table 5. Assessment of suitable crop season

| Crop | Gestation period between pruning and inoculation (month) | No. of trees inoculated | No. of trees with survived lac culture | Quantity of broodlac inoculated (kg) | Yield (kg) | Ratio |
|--------|--|-------------------------|--|--------------------------------------|------------|-------|
| Winter | 6 | 26 | 20 | 24 | 54.2 | 2.26 |
| | 12 | 20 | 20 | 17 | 27.58 | 1.62 |
| | 18 | 12 | 10 | 13 | 110.6 | 8.51 |
| Summer | 6 | 10 | 2 | | 5.0 | |
| | 12 | 10 | 2 | | 5.9 | |
| | 18 | 3 | 2 | | 6.5 | |

Table 6. Performance of winter crop in respect of biological attributes

| Host | Gestation period (months) | Settlement density (per sq cm) | Initial mortality (%) | Sexual stage mortality (%) | Male (%) |
|--------------|---------------------------|--------------------------------|-----------------------|----------------------------|----------|
| <i>Siris</i> | 6 | 23.33 | 25.73 | 19.77 | 21 |
| | 12 | 23.33 | 34.47 | 22.47 | 20 |
| | 18 | 20.33 | 38.63 | 22.53 | 18 |
| <i>Ber</i> | 5 | 47.33 | 13.03 | 22.00 | 13 |

Table 7. Contribution of petiole in winter

| Gestation period (months) | No. of trees | Yield (kg) | Weight of petiole encrusted broodlac (kg) | % contribution |
|---------------------------|--------------|------------|---|----------------|
| 6 | 8 | 30.7 | 20.5 | 67.4 |
| 12 | 7 | 57.1 | 27.7 | 48.5 |
| 18 | 3 | 36.6 | 7.2 | 19.7 |

Table 8. Assessment of broodlac quality from winter crop

| Shoot type | Total length of broodlac sample (cm) | Weight of broodlac (g) | Weight of scraped lac (g) | Weight of plant stick (g) | Average diameter of stick (cm) | % scraped lac from broodlac |
|------------|--------------------------------------|------------------------|---------------------------|---------------------------|--------------------------------|-----------------------------|
| Secondary | 46.3 | 84.3 | 34.1 | 50.1 | 1.39 | 37.2 |
| | 1 meter | 182 | | | | |
| Petiole | 75 | 52 | 42 | 10 | 0.50 - 0.65 | 80.8 |
| | 1 meter | 69.33 | | | | |

Table 9. Assessment of broodlac quality from summer crop

| Host | Gestation period (month) | Shoot type | Total length of broodlac sample (cm) | Weight of broodlac (g) | Weight per meter (g) | Weight of <i>phunki</i> scraped (g) | % scraped lac from broodlac |
|--------------|--------------------------|------------|--------------------------------------|------------------------|----------------------|-------------------------------------|-----------------------------|
| <i>Siris</i> | 6 | Primary | 19.3 | 16.7 | 81.0 | 35 | 43.2 |
| | 12 | Primary | 21.9 | 20.0 | 87.4 | 36 | 41.2 |
| | 18 | Secondary | 44.0 | 52.5 | 111.0 | 65 | 58.6 |
| <i>Kusum</i> | 18 | - | 23.2 | 46.4 | 200 | 110 | 55.0 |

Note: Thickness of encrustation from *Siris* tree = 5mm

Table 10. Quality of resin based on industrial parameters

| Parameter | Winter crop | | Summer crop | |
|---------------------------|--------------|------------|--------------|--------------|
| | <i>Siris</i> | <i>Ber</i> | <i>Siris</i> | <i>Kusum</i> |
| Flow (mm) | 74 | 48 | 38 | 40 |
| Colour index | 7 | 8 | 8 | 8 |
| Moisture (%) | 1.25 | 1.21 | 1.15 | 1.1 |
| Wax (%) | 3.3 | 3.6 | 2.95 | 3.3 |
| Hot alcohol insoluble (%) | 1.25 | 2.5 | 1.62 | 2.14 |
| Acid value | 72.0 | 71.0 | 72.98 | 70.9 |

Fig. 23a Kusmi winter crop on *Albizia procera*Fig. 23b Lac on single petiole of *Albizia procera*

1.3.2 Management of sooty mould in *kusmi* lac winter crop on *ber*

To optimize the dose of hexaconazole (Cantaf) for reducing sooty mould, an experiment was undertaken in *kusmi* lac winter crop on *ber*. Five doses of Cantaf were sprayed thrice at 60 days, 90

days and 120 days after brood lac inoculation (dabli). Data of sooty mould on randomised samples were taken thrice at 20 days after all the three sprayings and lac yield was recorded at harvest. All the doses were found to reduce the sooty mould growth and increase the lac yield (Table 11).

Table 11. Optimization of doses of hexaconazole (Cantaf)

| Sl. No. | Doses of fungicide (ml/l) | Severity of sooty mould (%) | | | Yield ratio (brood lac used / produced) |
|---------|---------------------------|-----------------------------|-----------|-----------|---|
| | | 80 DABLI | 110 DABLI | 140 DABLI | |
| 1 | 0 | 25.0 | 43.8 | 45.0 | 4.0 |
| 2 | 0.5 | 16.3 | 23.8 | 23.8 | 6.4 |
| 3 | 1.0 | 17.5 | 22.5 | 21.3 | 6.7 |
| 4 | 1.5 | 16.3 | 23.8 | 20.0 | 5.3 |
| 5 | 2.5 | 17.5 | 22.5 | 24.0 | 5.6 |
| CD 5% | | NS | 9.6 | 6.8 | 2.1 |
| CV % | | | 23.3 | 16.2 | 25.0 |

DABLI: Days after broodlac inoculation

Optimization of doses of Chlorothalonil (Kavach)

The effect of different doses of Kavach on sooty mould growth was studied in *kusmi* lac winter crop on *ber*. Five doses of Kavach were sprayed thrice at 60 days, 90 days and 120 days after brood lac inoculation.

Data of sooty mould on randomised samples were taken thrice at 20 days after all the three sprayings and lac yield was recorded at harvest. All the doses were found to reduce the sooty mould growth and increase the lac yield (Table 12).

Table 12. Optimization of doses of Chlorothalonil (Kavach)

| Sl. No. | Doses of fungicide (g/l) | Severity of sooty mould (%) | | | Yield (ratio of brood lac used / produced) |
|---------|--------------------------|-----------------------------|----------|----------|--|
| | | 80 DABI | 110 DABI | 140 DABI | |
| 1 | 0 | 38.3 | 50.8 | 43.8 | 2.3 |
| 2 | 0.5 | 30.0 | 33.3 | 29.8 | 4.5 |
| 3 | 1.0 | 26.3 | 33.3 | 33.5 | 7.5 |
| 4 | 1.5 | 25.0 | 31.5 | 31.3 | 8.8 |
| 5 | 2.5 | 28.8 | 36.3 | 32.5 | 4.7 |
| CD 5% | | 5.7 | 6.0 | 7.7 | 2.9 |
| CV % | | 12.4 | 10.5 | 14.6 | 33.9 |

Standardization of spraying schedule of hexaconazole (Cantaf)

The suitable spraying schedule of Cantaf was standardized. Nine treatments comprising of different spraying schedules and control were

undertaken with four replications. Three sprays of cantaf or bavistin both at 60, 90 and 120 days after lac inoculation reduced the sooty mould more than rest of the treatments and increased the yield accordingly (Table 13).

Table 13. Standardization of spraying schedule of hexaconazole (Cantaf)

| Sl. No. | Treatment | Severity of sooty mould (%) | | | Yield ratio (brood lac used / produced) |
|---------|---|-----------------------------|----------|----------|---|
| | | 80 DABI | 110 DABI | 140 DABI | |
| 1 | One spray at 60 DABI | 35.3 | 38.8 | 36.5 | 2.4 |
| 2 | One spray at 90 DABI | 28.8 | 31.3 | 26.0 | 3.1 |
| 3 | One spray at 120 DABI | 26.3 | 36.5 | 26.8 | 2.4 |
| 4 | Two sprays at 60 and 90 DABI | 23.8 | 32.5 | 27.5 | 4.2 |
| 5 | Two sprays at 60 and 120 DABI | 25.0 | 35.3 | 31.8 | 3.6 |
| 6 | Two sprays at 90 and 120 DABI | 22.5 | 29.3 | 29.5 | 4.8 |
| 7 | Three sprays at 60, 90 and 120 DABI | 18.0 | 23.0 | 24.0 | 5.5 |
| 8 | No fungicide spray | 39.5 | 41.3 | 42.0 | 2.3 |
| 9 | Three sprays of bavistin at 60, 90 and 120 DABI | 17.0 | 20.3 | 18.8 | 5.5 |
| CD 5% | | 14.0 | 9.8 | 11.0 | 1.8 |
| CV % | | 36.7 | 20.9 | 25.8 | 32.0 |

1.3.3 Soil fertility management of *ber* (*Z. mauritiana*) for shoot growth & lac yield (*aghani*)

Lac yield ratio

Yield ratio as affected by different primary nutrients and liming revealed that potassium could markedly influence lac yield (Fig. 24). Application of 150g potassium per tree in *ber* could increase yield ratio to the tune of 32% over control. Liming and phosphorus application have been found to influence yield ratio negatively, but not significantly whereas effect of nitrogen was found to be almost indifferent.

Post harvest broodlac quality

Encrustation thickness (cm), scraped lac weight per

meter (g), number of predators per meter and living cell per cent were estimated for each treatment. Only encrustation thickness was found to be influenced positively due to liming and potassium application.

Soil analysis

Soil analysis data revealed that potassium application could decrease nitrogen availability significantly. Available soil potassium was significantly increased by liming. Thus potassium application has benefited lac crop in two ways *i.e.*, by decreasing soil nitrogen availability and also by increasing available soil potassium instantly.

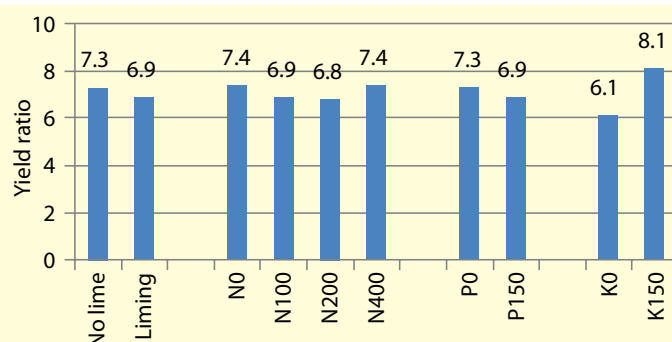


Fig. 24 Effect of liming and N, P & K on lac yield ratio of *aghani* crop in *ber* (2009-10)

1.3.4 Production of quality *kusmi* broodlac at Institute Research Farm

Large scale production of broodlac

Summer season (*jethwi*) crop

1322 kg broodlac was produced under Revolving Fund Scheme on *kusum* during summer season (*jethwi*) crop 2010. This included:

- ✓ 247.5 kg of *ber* stock,
- ✓ 351.0 kg of Gumla stock,
- ✓ 533.0 kg of Kulajanga,
- ✓ 126.5 kg of Nawadih and
- ✓ 64.0 kg of *kusmi* late stock
- 1073.0 kg of broodlac (worth ₹ 1, 28, 708) was sold / provided to Institute projects and 249 kg broodlac (worth ₹ 29,880) has been sold to the needy farmers.

Winter season (*aghani*) crop

Revolving Fund Scheme concluded in July 2010. 439.5 kg of productive breeds broodlac as detailed below and records have been handed over to IRF for maintenance, conservation and production of broodlac as institute activity.

- ✓ 82.5 kg of *ber* stock,
- ✓ 106.0 kg of Gumla stock,
- ✓ 104.0 kg of Kulajanga,
- ✓ 88.0 kg of Nawadih and
- ✓ 59.0 kg of *kusmi* late stock

Comparative performance of different productive *kusmi* breeds on *kusum*

Two early maturing (Kulajanga and Gumla stocks), one medium (*Ber* stock) and two late maturing *kusmi* breeds were maintained and evaluated on *kusum* during summer season crop. Performance of early maturing breeds was found superior in comparison to late maturing breeds (Table 14).

Table 14. Comparative performance of different productive *kusmi* breeds on *kusum* during summer season (*jethwi*) crop 2010.

| Lac insect stock | No. of trees inoculated | Broodlac inoculated (Kg) | Broodlac harvested (Kg) | Output / Input ratio | Yield per tree (Kg) |
|------------------|-------------------------|--------------------------|-------------------------|----------------------|---------------------|
| Kulajanga | 49 | 129.3 | 533.0 | 4.122 | 10.878 |
| Gumla | 61 | 145.6 | 351.0 | 2.411 | 5.754 |
| Ber | 50 | 122.7 | 247.5 | 2.017 | 4.950 |
| Nawadih | 44 | 91.6 | 126.5 | 1.381 | 2.875 |
| Bandgaon | 50 | 90.7 | 64.0 | 0.706 | 1.280 |
| Total | 254 | 579.9 | 1322.0 | 2.280 | 5.184 |

Kusmi* lac on *palas

About 10 kg each of three *kusmi* breeds (one early and two late maturing) were inoculated on *palas* during rainy season (*aghani*) crop in July 2010 to find out the possibility of rearing *kusmi* lac on *palas*. Both the late maturing breeds could not survive beyond *phunki* removal stage. But early maturing breed is surviving well. However, survival of lac insect showed very high variability on different plants.

1.3.5 Evaluation of potential herbicides for weed management in *Flemingia semialata* and *ber* plantation

During rainy season, seven weed control treatments (Herbicides-5, weed free-1 and unweeded as control) were imposed in the field for weed control in established plantations of *F. semialata* and *ber* at pre and post inoculation stages. *Kusmi* lac crop (*aghani*

2009-10) raised on these host plants, was harvested towards the second fortnight of February 2010 and lac yield was assessed. Perusal of data (Table 15) revealed that there was no herbicidal toxicity on lac crop on account of pre and post inoculation application of herbicides for weed control. Among tested herbicides, the highest stick lac yield was obtained with glyphosate treated plot (223.64g/ bush or 17.89q/ha) which was 59.61% higher and 7.18% lower than that of control (un weeded) and weed free treatments in established plantation of *F. semialata* respectively. Similarly in *ber*, the highest per meter stick lac production was from weed free treatment (40.19 g/m shoot length) followed with glyphosate (38.05 g/m shoot length) where as in case of control, it was 26.5g/m shoot length (Table 15). However, treatment effects were found to be non significant.

Table 15. Sticklac yield of *F. semialata* and *ber* as influenced by weed control

| Treatments | Stick lac yield | | |
|-----------------------------------|---------------------|--------------|----------------------------------|
| | <i>F. semialata</i> | | <i>Ber</i> |
| | Yield/bush (g) | Yield (q/ha) | Yield per meter shoot length (g) |
| Paraquat @ 0.4 kg ai/ha | 222.29 | 17.78 | 33.91 |
| Glyphosate @ 1.0 kg ai/ha | 223.64 | 17.89 | 38.05 |
| Glufosinate @ 1.0 Kg ai/ha | 219.79 | 17.58 | 35.05 |
| Atrazine @ 0.2 Kg ai/ha | 204.06 | 16.06 | 27.23 |
| Quizalofop-p-ethyl @ 0.2 Kg ai/ha | 152.38 | 12.19 | 35.15 |
| Weed free (manually) | 239.70 | 19.18 | 40.19 |
| Unweeded (control) | 140.12 | 11.18 | 26.50 |
| LSD (p=0.05) | 42.63 | 3.41 | NS |

Economics

Economics of lac production on *F. semialata* as effected by various weed control treatments is presented in Table 16. The highest net return (₹ 64,736/ha) and net return per rupee investment (₹ 2.10) were accrued under glyphosate @ 1.0 kg

ai/ha as compared to other treatments (Table 16). Though the gross income of weed free treatment was highest (₹ 1,91,200/ha) but net profit and net return per rupee investment were low over most of the herbicides mainly due to higher cost of production, as large number of labourers were engaged to maintain weed free conditions.

Table 16. Economics of lac production under different weed control treatments (Mean values of two years)

| Treatments | Gross income (₹/ha) | Cost of production (₹/ha) | Net profit (₹/ha) | Net return per rupee investment (₹) |
|-----------------------------------|---------------------|---------------------------|-------------------|-------------------------------------|
| Paraquat @ 0.4 kg ai/ha | 121,800 | 57,909 | 63,891 | 2.10 |
| Glyphosate @ 1.0 kg ai/ha | 123,550 | 58,814 | 64,736 | 2.10 |
| Glufosinate @ 1.0 Kg ai/ha | 122,600 | 63,734 | 58,866 | 1.92 |
| Atrazine @ 0.2 Kg ai/ha | 108,800 | 59,020 | 49,780 | 1.84 |
| Quizalofop-p-ethyl @ 0.2 Kg ai/ha | 90,050 | 69,820 | 20,230 | 1.29 |
| Weed free (manually) | 191,200 | 83,400 | 46,900 | 1.57 |
| Unweeded (control) | 86,150 | 55,800 | 30,350 | 1.54 |

1.3.6 Biochemical analysis of host plants (*ber* and *palas*) in view of *Rangeeni* lac insect survival

Biochemical analysis of bark and leaf extracts of *ber* and *palas* was carried out for *baisakhi* crop, 2010 to know the relationship between the biochemical status of the host plant and lac insect survival. The data reveals a negative correlation between proline content, an indicator of stress inside the host plant and lac insect survival in case of *ber* (Fig. 25). While no such relation was found in *palas*. Irrigation reduced the proline content in the *ber* plants resulting in better survival (giving 80% higher yield over control) of lac insect. Flower removal showed a positive correlation with stick lac yield both under irrigated and non-irrigated conditions in *ber* (to produce 130% and 120% yield respectively over control (Fig. 26). *Ber* bark has shown significant increase in amount of photosynthates due to irrigation and flower removal, compared to unirrigated conditions in *ber* innoculated with *baisakhi* crop (Fig. 27).

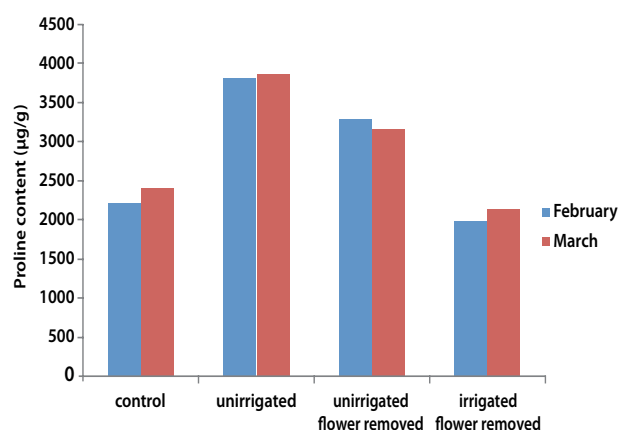


Fig. 25 Proline content (µg/g) in *ber* plants during Feb-March

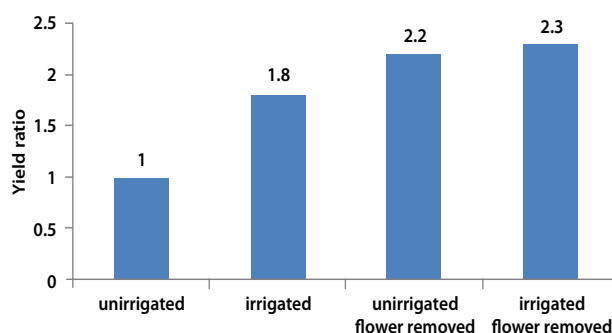


Fig. 26 Impact of irrigation and flower removal on yield ratio (input/output) in *ber* plants

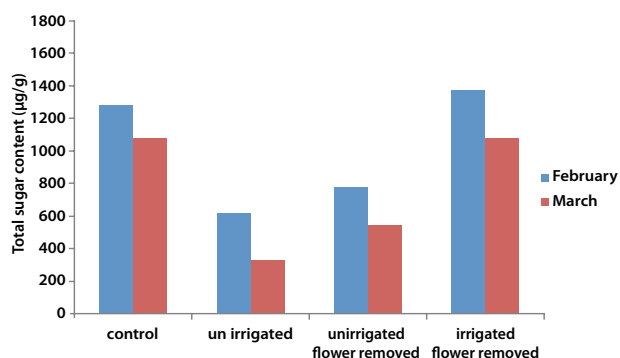


Fig. 27 Effect of irrigation and flower removal on total sugar content ($\mu\text{g/g}$) in *ber* plants during Feb-March

Hormonal application for flower removal in *ber*

A method for removal of floral buds from *ber* has been standardized. Application of NAA @50ppm during flower bud formation stage resulted in complete flower removal in *ber* plants within two weeks of application. The application of NAA@100ppm resulted in complete flower removal by one week itself. Fruiting load on the plant can be reduced by this method, which will ultimately help in better lac yield during summer season *rangeeni* crop as it has been recorded in 2009-10 *baisakhi* crop (Fig. 28).



NAA @ 50 ppm (0 days)



NAA @ 50 ppm (after 14 days)

Fig. 28 Effect of NAA spraying on flower removal in *ber*

Role of RH and wind on lac insect mortality

The effect of wind and relative humidity on lac insect survival was assessed on *palas* for *baisakhi* 2010, wherein for treatments were imposed as listed below:

| | ST ₁ | ST ₂ | ST ₃ | ST ₄ |
|------------------------------|-----------------|-----------------|-----------------|-----------------|
| Lac inoculation | + | + | + | + |
| Protection by agro shade net | - | + | + | + |
| Protection by nylon net | - | + | - | - |
| Water spraying | - | - | + | - |

The results indicates that both wind protection and high relative humidity maintained through regular water spraying helped in better survival of lac insect during *baisakhi* 2010 as the yield ratio has shown a significant increase over the corresponding control (Fig. 29).

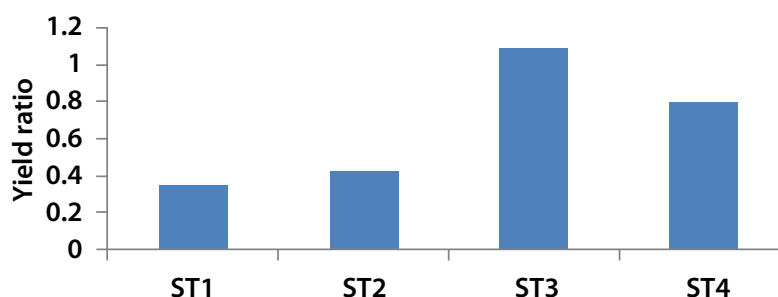


Fig. 29 Yield ratio of *baisakhi* crop in *palas* as influenced by water spraying and different wind protection measures

1.3.7 Evaluation of mulches for enhancing lac production under rainfed condition

To enhance lac productivity on *palas* (summer season) and *ber* & *F. semialata* (winter season) under rainfed condition, five mulch material viz., black polyethylene, white polyethylene, organic (local grasses/leaves),

dust mulch/soil mulch (tilling of upper crust of the soil up to 10 cm depth) and lac mud were imposed during October-November, 2010 after cessation of rains (Fig. 30). These mulch materials will be evaluated against control (no mulch condition). Basic soil physico-chemical properties were determined before application of mulches



Ber



Palas

Fig. 30 Host trees under black mulch

1.3.8 High density *ber* plantation for lac production under semi protected conditions

Ber plantation was raised using high density system in four strips (each having 134 plants) at Institute Research Farm. In two strips, 12kg of summer *kusmi* (*jethwi*) broodlac was inoculated in the March 2010. Vermicompost was applied @ of 200 kg/strip and sufficient irrigations were ensured during summer. After one month of inoculation, crop was sprayed with thiodan and second spray was given in May along with fungicide (bavistin). Mulching was done with dried paddy straw. However complete mortality occurred due to heavy parasitization. In the month of July, 2010, these two strips of *Ber* plants were again inoculated with 25 kg of winter *kusmi* (*aghani*) broodlac. The broodlac was tied in nylon mesh sieve for reducing the infestation by predators and parasitoids. After proper settlement, *phunki* lac was removed. The crop was sprayed thrice with Thiodan+Nuvan, first at 25 days after inoculation and subsequently at 30 days intervals. Some mortality was observed in August. The crop is growing satisfactorily then onwards. For winter

kusmi (*aghani*) crop, 29 kg brood lac was inoculated in remaining two strips in 2010 which was harvested in February, 2011 yielding 110 kg brood lac and 28 kg of rejected lac.

1.3.9 Production of summer *kusmi* broodlac on *kusum* for promotion of lac cultivation in Gujarat with farmers' participation

Summer *kusmi* broodlac production

For production of summer *kusmi* lac crop, about 615 kg broodlac from Institute was sent to Malegaon area of Dang district in February 2010. It was inoculated on 500 unpruned *kusum* trees and 2000 kg (approx) broodlac was produced (Fig. 31). Out of total broodlac produced, 256 kg was inoculated on 450 *ber* trees at Rajpipla, Motia, Balethi and Dhanol and 850 kg was inoculated on 382 *kusum* trees at Malegaon and Vesalkhari areas in July 2010 under Silviculture and Forest Utilization Division, Rajpipla. Winter *kusmi* lac crop inoculated on 156 *ber* plants at Motia and 80 *kusum* plants at Rajpipla was monitored during January 2011. Total crop mortality was found in these crops and the reason may be attributed to the heavy parasite infestation due to untimely spraying of pesticide. Same condition was observed

in Malegaon area, where crop was inoculated on 150 *kusum* trees. In Vesalkhari, the crop condition was a little better than other places.



Fig. 31 Summer *kusmi* lac crop development on *kusum* at Malegaon (May 2010)

1.3.10 Lac Integrated Farming System (LIFS)

Under lac integrated farming system (LIFS), multi-tier horti-lac system has been developed at Institute Research Farm covering an area of 53x48m. The components of multi-tier horti-lac system comprises *aonla*, *ber*, lime, guava, *semialata* and bittergourd. The different components were arranged in the geometry of 10x 10 m for *aonla* (Kanchan+NA7), 25 plants, 5x5 m for guava (*Allahabad Safeda*), 27 plants, 5x5m for lime, 27 plants, 10x10m for *ber*, 16 plants, 0.5x1m for *F. semialata*, 729 plants. Bitter gourd was planted with *semialata* for sustaining soil moisture under stress

conditions for summer sustainability of lac crop. The model is in infancy stage and only a few components have started yielding whereas others are growing well in the integrated system. The lac yield for *aghani* crop was 97.650 kg+ 6 kg rejected and for *jethwi* crop, 44.25 kg+44.28 kg rejected in the year 2010. The yield of guava and bitter gourd was recorded to be 36.34 kg and 85 kg respectively till May 2011.

1.3.11 Rainy season *rangeeni* lac yield on *palas* as affected by potassium application

Potassium plays a significant role in augmenting *kusmi* (winter season) lac production on *ber*. To verify its role on augmenting *rangeeni* lac production (rainy season) was tested on unpruned *palas* trees. Results indicated that application of 250 g and 500 g potassium per tree significantly increased lac yield ratio over control (Table 17). Broodlac production both from shoots and petioles were recorded separately. Application of potassium 60 days after inoculation and at harvest resulted in significantly higher thickness of lac encrustation. However, fertilizer application increased the level of predator infestation significantly. The study also indicated that shoots with comparatively higher mean diameter could bear and sustain lac till maturity on potassium applied treatments.

Table 17. Lac yield attributes as affected by potassium application

| Treatments | Brood yield ratio (total) | Brood yield ratio (from shoot) | Brood yield ratio (from petiole) | Mean encrustation thickness cm (60 DAI) | Encrustation thickness (cm) (at harvest) | No. of predator/ 10 cm broodlac | Mean lac stick diameter (cm) |
|------------------------------|---------------------------|--------------------------------|----------------------------------|---|--|---------------------------------|------------------------------|
| Control | 0.63 | 0.40 | 0.23 | 0.40 | 0.98 | 0.91 | 0.43 |
| K ₂ O 250 g/ tree | 1.58 | 1.18 | 0.41 | 0.49 | 1.37 | 4.33 | 0.51 |
| K ₂ O 500 g/ tree | 1.83 | 1.30 | 0.53 | 0.55 | 1.49 | 10.43 | 0.59 |
| CD _(0.05) | 0.88* | 0.70* | 0.23* | 0.13* | 0.29* | 5.03* | 0.15* |

*Significant at 5% level of significance

1.3.12 Impact of pitcher fertigation (urea) on shooting response and *kusmi* lac yield on *ber*

The *ber* trees (16 no) were fertigated through pitchers from February end till mid June (onset of monsoon). Same number of trees was kept under control (no pitchers). Spraying schedule was kept

uniform for treatment and control trees. The quantity of urea was kept @ 200 g/tree for the duration and it was split accordingly at weekly interval. Lac crop was harvested during July 2010. The complete mortality was observed under the experiment. The reason for the complete failure of lac crop may be attributed to relatively harsh climatic factor in comparison to that

of last ten years. The mean maximum temperature during the crop growth stage (March-April) was higher by approximately 10°C. The rainfall received during December 2009-May 2010 was also low (57 mm) compared to ten year mean for the same period (130 mm). Less rainfall was also associated with lower humidity during this period which was lower by 3-20%. Due to mortality of the crop, brood value calculation for summer season crop could not be done.

Broodlac inoculation for winter season *kusmi* lac crop on the other set of *ber* trees (32 Nos.) was done during July 2010. A total of 35.0 kg (mean rate 1.10 kg/tree) broodlac was inoculated on *ber* trees. Spraying schedule was kept similar for fertigated and control trees. Fertigation through pitchers (200 g urea/tree) was applied to 16 trees from October end till mid

February (harvesting time of the crop). The broodlac was harvested to the tune of 121.0 kg and 102.90 kg, making a broodlac yield ratio of 6.9:1 and 5.9:1 under pitcher and control trees, respectively. Thus an increase of 17.7% was registered in broodlac yield under pitcher trees compared to control.

Ber shoot length and girth was recorded at the time of broodlac inoculation and harvesting. Both these parameters were compared after harvesting the crop. The mean shoot length and girth for *ber* under pitcher treatment was recorded to be 117.39cm and 3.52cm and 193.39cm and 5.09cm at the time of broodlac inoculation and harvesting, respectively; while the values recorded were 132.18cm and 3.97cm and 187.60cm and 5.68cm under control for mean shoot length and girth at mentioned time respectively.



2. Processing and Product Development

2.1 Synthesis & Product Development

2.1.1 Thiosemicarbazide and thiadiazole from aleuritic acid and their bioactivity

Hydrazide, thiosemicarbazide and its derivatives, synthesized from aleuritic acid were evaluated for nematocidal, hypoglycemic and antifungal activities.

Nematicidal activity

Nematicidal activity of compounds against the root-knot nematode (*Meloidogyne incognita*) was carried out at five concentrations (62.5-1000 ppm) and observation was recorded on mortality of second stage juveniles of root-knot nematodes after 48 hours. The percent mortality was computed as the average of three replications. The nematicidal activity increased with the concentration of the compound. 4-Methylphenyl thiosemicarbazide showed 100% mortality at 500 ppm level. While hydrazide, thiosemicarbazide, 4-chlorophenyl thiosemicarbazide, 2-bromophenyl thiosemicarbazide and 2-chlorophenyl thiosemicarbazide of aleuritic acid showed 100% mortality at 1000 ppm.

Hypoglycemic activity

Eight-week old male rats were used for hypoglycemic activity. Diabetes was induced by a single intra-peritoneal injection of freshly prepared streptozotocin. Injection was given at 95 to 133 mg/kg weight on overnight fasted rats. Control rats were given only normal saline solution.

Diabetes was identified by measuring non-fasting plasma glucose level one day after injection. Rats having 200 mg/dl and above glucose level were considered as diabetic. Diabetic animals were tested for blood glucose after 0, 12, 24, 36, 48 hours with known oral hypoglycemic agent—Glibenclamide (2 mg/kg body weight by oral route). Eight compounds were tested at doses of 10 and 20 mg/kg in the same manner and at the same interval as of Glibenclamide. Normal rats with normal saline solution injection showed glucose level in the range of 93 to 98 mg/dl. Diabetic rats showed

blood glucose level ranging from 250 to 280 mg/dl. Administration of Glibenclamide produced a significant decrease in plasma glucose after twelve hours and maximum decrease was noted after 48 hours. Eight compounds namely, thiosemicarbazide, 4-chlorophenyl thiosemicarbazide, 4-methylphenyl thiosemicarbazide, 2-ethylphenyl thiosemicarbazide, 4-bromophenyl thiosemicarbazide, 2-bromophenyl thiosemicarbazide, 2-chlorophenyl thiosemicarbazide and 2-methylphenyl thiosemicarbazide (concentration - 10 mg and 20 mg of each) were found effective. 2-ethylphenyl thiosemicarbazide and 2-methylphenyl thiosemicarbazide lowered the blood glucose level up to 230 mg/dl and 220 mg/dl at 10 mg dose whereas at 20 mg dose, it lowered to 210 mg/dl and 214 mg/dl, respectively. Thus, 2-methylphenyl thiosemicarbazide was found more effective as compared to other compounds. Further, 20 mg dose was found to be more effective than 10 mg dose in controlling the sugar level. Though the increased dose was found to be further effective, however, it was not tried due to its toxic effect.

Antifungal activity

Ten compounds, namely, hydrazide, thiosemicarbazide, 4-methylphenyl thiosemicarbazide, 2-ethylphenyl thiosemicarbazide, 4-chlorophenyl thiosemicarbazide, 2-methylphenyl thiosemicarbazide, 2-chlorophenyl thiosemicarbazide, 2-bromophenyl thiosemicarbazide, thiadiazole and 2-chlorophenyl thiosemicarbazide were screened for their fungicidal activity by poison food technique on potato dextrose agar medium against *Fusarium sp.* The diameter of the fungal colony was measured at three different concentrations, viz., 250, 500, 1000 ppm. The fungicidal activity of tested compounds was compared with commercial fungicide, carbendazim.

All the screened compounds showed fungicidal activity at 1000 ppm, whereas, least effect was observed at 250 ppm. Maximum activity was obtained from 2-ethylphenyl thiosemicarbazide and 2-bromophenyl thiosemicarbazide. These compounds showed 100% inhibition at 1000 ppm. Least

fungicidal activity was obtained from thiadiazole and 2-chlorophenyl thiosemicarbazide.

2.1.2 Characterization and bioactivity of oleo gum-resins from *Boswellia serrata*, *Commiphora mukul* & *C. wightii*

The viscosity of resinoids of *Boswellia serrata*, *Commiphora mukul* & *C. wightii* was determined at M/s Shree Ram Gum Industries Limited, Jodhpur, Rajasthan and found to be in the range of 0.6 to 1.08 cps indicating that the components present in the resinoids are of low molecular weight.

Anti-inflammatory activity of resinoids of *Boswellia serrata*

Eight resinoid samples of *Boswellia serrata*, collected from different places were tested for their anti-inflammatory activity by the carageenan induced rat paw oedema method (Winter *et al.* 1962). Inbred rats (Swiss White) were divided into groups of six rats each and inflammation was induced by subcutaneous administration of 0.1ml of 1% aqueous solution of carageenan into right hind paws. The test sample (250 mg/kg body weight) suspension was administered orally for 7 consecutive days prior to the administration of carageenan. Paw volume was measured for 5h after the carageenan administration at an interval of 60min with the help of vernier callipers. Indomethacin (10mg/kg) & Shallaki (250mg/kg) were used as standard drugs. Exudates of *Boswellia serrata* collected from Andhra Pradesh & Madhya Pradesh as also exudates of *Commiphora mukul* collected from Madhya Pradesh and extracted in ethyl acetate showed significant anti inflammatory activities as compared to control group even better than that of the standard drug Shallaki in rats.

Hypolipidemic activity of resinoids of *Commiphora spp.*

Hypolipidemic activity was studied by first inducing hyperlipidemia in inbred rats (Swiss White) with the help of cholesterol-rich high fat diet (HFD) model. Then they were administered with extracts of *Commiphora wightii* or *C. mukul*, collected from different regions, at daily dose of 250mg/kg body weight orally for a period of 28 days. In the cholesterol-rich HFD induced model of hyperlipidemia, feeding with cholesterol-rich HFD in rats caused remarkable increase in the plasma

levels of total cholesterol (TC), HDL, triglycerides (TG) and also body weight.

Exudates of *C. wightii* collected from Gujarat and extracted in ethyl acetate or ethyl alcohol and the exudates of *C. mukul* collected from Gujarat & Madhya Pradesh and extracted in ethyl acetate showed highly significant activity ($p < 0.001$) i.e. increased HDL and decreased body weight, total cholesterol as well as triglycerides as compared to cholesterol control group in rats.

2.1.3 Synthesis of hydrogel from gum acacia and gum karaya

Gum acacia has been modified with substituted methacrylate by varying the substituent ratio and its hydrogel has been prepared. Equilibrium swelling of the hydrogel was determined by the tea bag method and after 24h at room temperature, it was found to be ~4100% and ~3670%. Equilibrium re-swelling (%) of the hydrogel was determined after the interval of 24h, 48h and 72h at room temperature and it was recorded as ~3296%, 3503%, 3975% respectively.

Hydrogels have also been prepared from grafted copolymers of modified gum karaya with substituted methacrylate, acrylamide and acrylic acid using cross-linking agents and initiators. Sufficient drying methods like under vacuum, vacuum with suction, vacuum oven, microwave oven, freeze drying were tried. Finally, the hydrogel was dried under vacuum with suction at room temperature. Equilibrium swelling of three hydrogels obtained using acrylic acid, acrylamide and substituted methacrylate as grafted copolymers was found to be 1600%, 1230% and 1190% respectively. One of the hydrogels has been characterized by FTIR and Scanning Electron Microscopy (SEM) (Fig. 32).

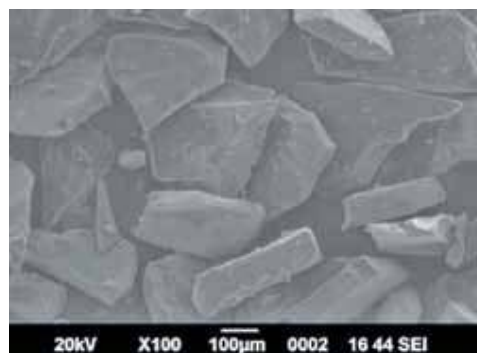


Fig. 32 SEM image of hydrogel of karaya gum

2.2 Surface Coating & Use Diversification

2.2.1 Surface coating compositions based on shellac-synthetic resin/polymer blends

Shellac-novolac blends were treated with hexamethylene tetra-amine (HMTA), as a cross-linking agent and the surface coating properties were studied. Gloss increased with the treatment of HMTA, whereas scratch hardness and water resistance decreased. Further, when the films were baked, water resistance improved tremendously.

Polyblends of shellac, rosin and novolac were made in solution. Films were studied for their different surface coating properties. Gloss increased with increasing novolac concentration. There was no much significant difference in scratch hardness, impact resistance, water & chemical resistance and flexibility of the blends. But when the blends were treated with a synthetic resin, gloss of the films increased; water and chemicals resistance also improved as no effect of water and H_2SO_4 was observed upto 10 days of dipping.

Shellac was blended with synthesized epoxidised novolac and treated with a synthetic resin. Gloss improved with the increasing concentration of epoxidised novolac. Blends did not show much difference in scratch hardness, impact resistance, flexibility, etc. No effect of water and H_2SO_4 was observed for 15 days, but alkali resistance was poor.

Physico-chemical properties like flow, life under heat, hot alcohol insoluble, wax, colour index, acid value and saponification value were studied for button lac samples of lac-rosin blends stored at ambient temperature. After two years of storage, very significant difference was observed in mainly flow and life of the samples. Flow of the shellac sample decreased by 65% whereas 50%, 31% and 18% decrease was recorded in shellac-rosin blend samples of 70:30, 50:50, and 40:60, respectively. Life of shellac sample decreased by 56%, whereas nominal decrease was found in shellac-rosin blends. Shellac and shellac-rosin blend samples did not found sufficient differences for other properties.

Encapsulation of spices with natural gum/lac

A new study on post harvest treatment of spices in collaboration with IISR, Calicut has been initiated.

It aims at control of moisture loss, color loss and decrease in oleoresin content of spices during processing/storage. Incidence of microbial/fungal growth needs to be checked especially in areas with high humidity level. Preliminary work on encapsulation of coriander, cumin, black pepper and fresh cardamom capsules was carried out with different wall materials by fluidized bed encapsulating technique based on gum and lac.

Shelf life enhancement of Nagpur mandarin (*C. reticulata* Blanco) fruits through lac-based coating formulations

A new project on Post Harvest Technology of loose skinned mandarin oranges was initiated with NRCC, Nagpur. It is proposed to coat mandarin oranges with lac-based formulations to increase their shelf life and marketability.

Preliminary trials were carried out in current season of Ambia Bahar crop. 120 fruits per treatment were coated manually and stored in CFB boxes. The treatments included Fresh Coat SH01, 02, 03, 01B, 02B, 03B, commercial formulation and control. Observations on stored fruits are in progress at NRCC, Nagpur.

Post harvest processing of pomegranate with lac-based formulations

Preliminary trials had been carried out at NRCP, Solapur, revealed that application of lac-based formulations improved glossiness, while, reduced PLW and cumulative percentage rotting in pomegranate. In the current season, it was envisaged to observe effect of on-farm spraying of lac-based emulsions for protection against sun scale, bacterial blight and cracking observed in pomegranate.

2.2.2 Preparation and market evaluation of shellac varnish

Comparative evaluation of marketed products vis-a-vis Lac Wood Shine

Properties of Lac Wood Shine was compared with those of two similar commercial products. Lac Wood Shine was at par in general with the commercial products; but was superior with respect to drying time which is very important in saving time for application of multiple coats. Samples of Lac Wood Shine (14 litre) and Lac Glaze (11 litre) were also prepared for promotional purposes.

2.2.3 Improvement in nail polish

Fresh samples of nail polish were prepared in order to verify and improve the properties of lac based nail polish. Film properties of the nail polish was studied as per BIS standard. It was observed that the nail polish passed the BIS standards. Gloss and non-volatile matter improved remarkably. Gloss of the polish was found to be 98% (Ref: Black stone -100%).

2.2.4 Shellac modification by tamarind gum and guar gum

Guar gum and tamarind gum were blended with shellac. The solution (30%) of the above blends were prepared in ethanol and water respectively. These were coated on aluminum sheets. Film formations after drying were observed to be satisfactory. Scratch hardness and flexibility of the films were observed to be comparable with control samples. The coated

panels were tested for resistance to lubricating oil at 150°C for 24hrs. The panels were also tested for resistance to motor gasoline and toluene mixture, 3:1 (v/v) for 24hrs. Films showed no softening or cracks on testing.

2.3 Processing and Storage

2.3.1 A Value chain on lac and lac based products for domestic and export markets

Promotion of *kusmi* lac on *ber*

Kusmi winter lac crop was raised in July, 2010 on 128 *ber* trees of 32 farmers. Recommended pest management schedule was followed. Due to extreme conditions of temperature and post monsoon rainfall, heavy mortality was observed resulting in low harvest. The yield harvested per tree was 4.5 kg of broodlac; the out put- input ratio was 1.5 (Table 18a). It was noticed that lac crop mortality was much in shady, poor ventilated and marshy area (Table 18b)

Table 18a. Production of lac on *ber* trees

| Crop Cycle | Broodlac distributed (Kg) | Harvested broodlac from previous crop | No. of trees inoculated | Production of broodlac (Kg) | Remark |
|----------------------------|---------------------------|---------------------------------------|-------------------------|------------------------------|--|
| Jan-Feb to June-July, 2010 | 415 | 510 | 124+253 | 558 Kg Broodlac + 159 Kg ari | Heavy mortality was observed due to extreme condition of temperature |
| June-July to Jan-Feb, 2010 | 230 | 558 | 536 | ----- | Crop will be harvested in the month of Jan-Feb, 2011 |

Table 18b. Crop mortality as influenced by location of area

| Location of tree | No of trees | Total yield obtained (Kg) | Yield obtained per tree (Kg) |
|--------------------|-------------|---------------------------|------------------------------|
| Upland+shade | 34 | 110 | 3.23 |
| Upland+ventilated | 34 | 290.5 | 8.54 |
| Lowland+shade | 34 | 65 | 1.91 |
| Lowland+ventilated | 22 | 92.5 | 4.20 |

1500 *F. semialata* and 150 *ber* seedlings were provided to farmers for gap filing. 404 plants of *F. semialata* were inoculated with 5 kg of broodlac which will be harvested in the month of Jan-Feb, 2011. 200 farmers from 11 villages have been surveyed to find the interested group of cultivators for their association in the project.

Evaluation of quality parameters of shellac and bleached lac

Five Shellac samples of different lac industries of Shakti & Kathgora (Chattisgarh), Khunti & Bundu (Jharkhand) and Balrampur (W.B) were evaluated for determining quality of shellac. It was found that quality of shallac varied as: Flow 14-49 mm, Life 15-36 min, Impurities 1-2%.

Five bleached lac samples of different lac industries Dhamtari & Shakti (Chattisgarh) and Khunti (Jharkhand) were evaluated for determining quality parameters. The quality parameters varied as wax 0.20-0.25%, Life 0-15 min, impurities 0.24-1.28%, Colour Index <1.

Improvement in processing and quality of lac based products (bleached lac and aleuritic acid) for domestic and export markets

Improvement in manufacturing process of bleached lac

Up-scaling trial of bleached lac preparation on pilot plant scale with alternate bleaching agent (sodium hypochloride) was carried out in 5 kg lot. One control sample was also prepared as per commercial process for comparison. Evaluation of quality parameters of different samples indicated improvement in quality (Table 19) using alternate method compared to conventional technique (Fig. 33a & b).



Fig. 33a Manufacturing of bleached lac



Fig. 33b Samples of bleached lac

Table 19. Comparative physico chemical properties of different samples of bleached lac

| Test Parameters | Commercial Sample | Controlled Sample | Test Sample 1 | Test Sample 2 | Test Sample 3 |
|---------------------|-------------------|-------------------|---------------|---------------|---------------|
| Flow in mm | 7 | 16 | 35 | 15 | 30 |
| Life in minutes | 3 | 7 | 13 | 17 | 17 |
| Colour | 1.2 | 0.4 | | | |
| A portion insoluble | 1.5 | 1.6 | 1.8 | | |
| Impurity % | 0.4 | 0.5 A.P.I | 0.22 | 0.32 | 0.32 |
| Moisture % | 1.085 | 1.72 | 1.43 | 1.29 | 1.41 |
| Wax % | 0.25 | 0.58 A.P.I | 0.38 | 0.45 | 0.50 |
| Acid value | 82.6 | 85.4 A.P.I | 82.6 | 78 | 76 |

Improvement in manufacturing process of aleuritic acid for higher yield and reduction in time

Two samples of aleuritic acid from industries were evaluated. Melting point was found as 94°C & 96°C and purity of the samples was 96%. Process of making aleuritic acid was improved (filtration and saponification) which increased yield (from 12-14 to 16%) and quality (melting point - 96°C) as compared to method followed in the industry.

Technical grade aleuritic acid has been prepared by

modifying the process of hydrolysis with changing the ratio of water : seedlac, concentration of NaOH solution and time of addition of salt solution. Yield of aleuritic acid obtained was 22% to the weight of seedlac (5 year old *rangeeni* seedlac). Method has been standardized for preparation of pure aleuritic acid with a yield of 55-60% from technical grade aleuritic acid by crystallization with water. The yield is approximately twice the yield obtained earlier by the same method

Value addition of by-products

Two commercial samples of lac dye from Ranchi and Khunti district were evaluated at CFTRI, Mysore to

determine presence of heavy metals like Lead (Pb), Arsenic (As) etc. for their suitability for conversion into pure lac dye. The findings are given below.

| Sl. No. | Particulars | Result | | Test Method |
|---------|----------------|-------------------------------|------|----------------------------|
| | | 1 | 2 | |
| 1 | Lead, mg/Kg | 0.76 | 1.32 | AOAC 18th Edn. 2005,999.11 |
| 2 | Iron, mg/Kg | 358 | 249 | AOAC 18th Edn. 2005,985.35 |
| 3 | Arsenic, mg/Kg | Below detection limit of 0.02 | | AOAC 18th Edn. 2005,912.01 |
| 4 | Nickel, mg/Kg | 0.51 | 1.66 | AOAC 18th Edn. 2005,975.34 |

Development of suitable packaging for shellac, bleached lac and lac dye

Experiments have been laid out for storage study of bleached lac and lac dye using different packaging materials (HDPE, LDPE, PP, aluminium coated polythene, paper bags) at ambient as well as controlled condition of temperature/humidity for enhancing shelf-life of the products. Freshly prepared

dewaxed bleached lac and lac dye were studied for their initial quality parameters. Bleached lac and lac dye samples were packed in different packaging materials viz., LDPE (200 & 400 gauge), HDPE (200 gauge), polypropylene (200 gauge), aluminium foil laminate and paper bag and stored in ambient and refrigerated conditions for evaluation (Fig. 34a & b).



a



b

Fig. 34 Evaluation of different packing materials for lac resin (a) and dye (b)

2.3.2 Effect of salt on scraped lac during storage

The *kusmi* lacs (mixed with salt and control) were studied after storage for a period of two years. A very characteristic phenomena was observed that scraped lac mixed with salt was darker in colour apparently compared to lac without salt, but when washed, seedlac obtained from salted scraped lac appeared lighter in color than that of without salt. During processing, more colour (dye) came out in

salted lac in comparison to lac without salt. Yield of the seedlac obtained from salted lac was less (72%) in comparison to that obtained from lac without salt (80%). Physico-chemical properties of both the seedlacs obtained were also determined. All the properties (except life under heat) like hot alcohol insoluble%, flow, color index and rate of filtration were much better in salted lac than those of the lac without salt. Scraped lac life was found to be little less in seedlac obtained from salt mixed lac.



3. TRANSFER OF TECHNOLOGY

3.1 Human Resource Development

3.1.1 Training, demonstration, extension education and information service on lac culture, processing and product development

The Institute conducted different types of training programmes as per need of the stakeholders on scientific lac cultivation, processing and utilization. The Institute continuously assessed the need of stake holders and modified the programmes accordingly. Besides, many in-campus programmes, out-reach training activities, technical guidance, lac crop monitoring were also undertaken.

Training programme for farmers and housewives

This one-week programme mainly covers lac cultivation, processing at farm level and uses of lac. A total of 941 farmers from 14 districts of six states, namely, Jharkhand, Odisha, Chhattisgarh, West Bengal, Madhya Pradesh and Bihar participated in this programme. A summary of different courses conducted are given in Table 20. It is evident from the table that maximum participation was from Jharkhand (353) followed by Chhattisgarh (199), Odisha (186), West Bengal (138) Madhya Pradesh (44) and Maharashtra (18).

Trainers' training programme on scientific lac production, processing and uses

Managers of Primary Forest Produce; Unemployed educated rural youth designated as lac facilitators; Master Trainers and Junior Lac Executives sponsored by Chhattisgarh State Minor Forest Produce (Trade and Development Federation Ltd), Raipur; progressive farmers and forest official from Rajpipla Gujarat underwent Trainers' Training Programme on scientific method of lac cultivation, production, processing and utilization. A total of 346 trainers completed this training programme under 11 courses (Table 21).

One-week educational programme on production, processing and uses of natural resins and gums

Agriculture graduate students from Sam

Higinbottom Institute of Agriculture Science & Technology, Allahabad (formerly Allahabad Agricultural Institute (Deemed University), Uttar Pradesh and Institute of Agricultural Sciences, Banaras Hindu University, Varanasi, Uttar Pradesh underwent one week training in lac cultivation, processing and its uses (Table 22). A total of 118 students were educated through four courses under this programme.

Field out-reach programme

On-Farm training on 'Scientific cultivation of lac'

A total of 37 camps were conducted, in collaboration with other organizations in Jharkhand, Chhattisgarh, and Maharashtra covering 10 districts; Gondia, Yawatmal, Buldana, Amravati of Maharashtra; Khunti, Latehar, Lohardaga, Ranchi in Jharkhand and Dhamtari, Raigarh in Chhattisgarh. A total of 2834 farmers benefited from this programme. The details of training programme have been presented in Table 23.

In addition, 14 camps organized to impart training at village level for beneficiaries of externally funded project Jharkhand Lac Development Scheme. A total of 2017 families were trained in Simdega, West Singhbhum, Palamu, Gumla, Daltonganj and Khunti districts (Table 24)

On-farm motivational/supplementary training programme on lac cultivation

A total of 15 camps were organized in collaboration with NGOs and GOs. A total of 3,512 persons, mainly farmers representing around 100 villages of nine districts of four states namely Maharashtra, Andhra Pradesh, Chhattisgarh and Jharkhand benefited from this programme. The details of training programme conducted have been given in Table 25.

Other activities

Monitoring of *kusmi* lac crop, technical guidance, remedial measures for pest attack, demonstration of inoculation, spraying etc were carried out at different locations.

Transfer of process/product know-how

Farm process/product technologies were transferred to four entrepreneurs as detailed in Table 26.

Table 20. Farmer training programme on scientific lac cultivation, processing and utilization

| Sponsoring Organization | State | Period | No. of participants |
|---|---------------------------|---------------------|---------------------|
| IINRG, Ranchi (NAIP-Value Chain Component -2) | Jharkhand | 29.12.09 - 02.01.10 | 42 |
| District Industries Centre, Bankura | West Bengal | 04.01.10 - 09.01.10 | 31 |
| District Industries Centre, Malda | West Bengal | 04.01.10 - 09.01.10 | 7 |
| Steel Authority of India Ltd. & Ramkrishna Mission, Ranchi | Jharkhand | 11.01.10 - 16.01.10 | 38 |
| Forest Department, Chaibasa | Jharkhand | 18.01.10 - 23.01.10 | 31 |
| Raigarh Sahyog Samiti, Raigarh | Chhattisgarh | 25.01.10 - 30.01.10 | 15 |
| District Industries Centre, Purulia | West Bengal | 25.01.10 - 30.01.10 | 49 |
| IINRG, Ranchi & Indira Gandhi Krishi Viswavidyalaya, Raipur (Jagdalpur) (NAIP - component 3), Private, Ranchi | Chhattisgarh Jharkhand | 01.02.10 - 06.02.10 | 29 1 |
| Udami Vikas Sansthan, Mandla | Madhya Pradesh | 15.02.10 - 20.02.10 | 31 |
| Child Fund India, Chakradharpur, West Singhbhum | Jharkhand | 08.03.10 - 12.03.10 | 11 |
| District Industries Centre, Murshidabad | West Bengal | 08.03.10 - 12.03.10 | 9 |
| District Industries Centre, West Midnapur | West Bengal | 08.03.10 - 12.03.10 | 13 |
| District Industries Centre, Bankura | West Bengal | 08.03.10 - 12.03.10 | 6 |
| IINRG, Ranchi (NAIP- Lac Value Chain Component - 2) | Jharkhand | 08.03.10 - 12.03.10 | 15 |
| Forest Department, Chhindwara | Chhattisgarh | 15.03.10 - 20.03.10 | 20 |
| Forest Department, Raigarh | Chhattisgarh | 12.04.10 - 17.04.10 | 41 |
| SHDER, Raipur | Chhattisgarh | 12.04.10 - 17.04.10 | 10 |
| Chhattisgarh State Minor Forest Produce Federation Ltd (CGMFP), Kanker | Chhattisgarh | 26.04.10 - 01.05.10 | 18 |
| Private, Ranchi | Jharkhand | | 1 |
| TRIFED, Ranchi | Jharkhand | 26.04.10 - 01.05.10 | 17 |
| Private, Ranchi | | | 2 |
| Forest Department, Dhanbad | Jharkhand | 17.05.10 - 22.05.10 | 23 |
| Forest Department, Palamau | Jharkhand | 17.05.10 - 22.05.10 | 12 |
| IINR), Ranchi & Birsa Ag University, Ranchi (NAIP –component 3) | Jharkhand | 17.05.10 - 22.05.10 | 1 |
| Forest Department, Yawatmal | Maharashtra | 24.05.10 - 29.05.10 | 18 |
| Private, Howrah | West Bengal | | 1 |
| Forest Department, Amravati | Madhya Pradesh | 12.07.10 - 17.07.10 | 13 |
| NABARD, Dhanbad | Jharkhand | 12.07.10 - 17.07.10 | 23 |

| Sponsoring Organization | State | Period | No. of participants |
|---|--------------|---------------------|---------------------|
| IINRG, Ranchi, - Jharkhand Lac Development Scheme (JLDS- Citizen Foundation Simdega (Extension cadre) | Jharkhand | 12.07.10 - 17.07.10 | 10 |
| Forest Department, Ranchi | Jharkhand | 02.08.10 - 07.08.10 | 19 |
| IINRG, Ranchi - JLDS- (Citizen Foundation Simdega, Khunti, Ranchi, West Singhbhum, Garhwa, Extension cadre) | Jharkhand | 09.08.10 - 21.08.10 | 22 |
| IINRG, Ranchi - JLDS- Ranchi, West Singhbhum, Simdega, Palamu | Jharkhand | 16.08.10 - 21.08.10 | 20 |
| IINRG, Ranchi - JLDS- West Singhbhum, Latehar, Simdega | Jharkhand | 23.08.10 - 28.08.10 | 32 |
| TRIFED, Sundargarh | Odisha | 30.08.10 - 04.09.10 | 47 |
| TRIFED, Sundargarh | Odisha | 06.09.10 - 11.09.10 | 46 |
| Jharkhand State Livelihood Programme, Dhurwa, Ranchi | Jharkhand | 27.09.10 - 01.10.10 | 23 |
| GraminVikas Trust, Purulia | West Bengal | 04.10.10 - 08.10.10 | 22 |
| Forest Department, Ambikapur | Chhattisgarh | 04.10.10 - 08.10.10 | 13 |
| Forest Department, Ambikapur | Chhattisgarh | 25.10.10 - 30.10.10 | 20 |
| IINRG, Ranchi - JLDS- Simdega | Jharkhand | 25.10.10 - 30.10.10 | 05 |
| TRIFED, Sundargarh | Odisha | 22.11.10 - 27.11.10 | 47 |
| TRIFED, Nabrangpur and Kalahandi | Odisha | 06.12.10 - 11.12.10 | 46 |
| CGMFP and TRIFED, Mahasamund, Chhattisgarh | Chhattisgarh | 20.12.10 - 24.12.10 | 33 |
| Private, Ranchi | Jharkhand | 20.12.10 - 24.12.10 | 5 |
| Total | | | 938 |

Table 21. Master trainer programme on scientific lac cultivation, processing and utilization

| Sponsoring Organization | State | Period | No. of participants |
|--|----------------|---------------------|---------------------|
| Chhattisgarh State Minor Forest Produce Federation Ltd. (CGMFP), Raipur-(Pr. Society Managers) | Chhattisgarh | 15.03.10 - 20.3.10 | 9 |
| CGMFP Fed. Ltd., Raipur (Master trainers) | Chhattisgarh | 22.03.10 - 27.03.10 | 12 |
| CGMFP Fed. Ltd., Raipur (Jr. Executive) | Chhattisgarh | 22.03.10 - 27.03.10 | 26 |
| CGMFP Fed. Ltd., Raipur (Pr. Society Managers) | Chhattisgarh | 29.03.10 - 03.04.10 | 30 |
| CGMFP Fed. Ltd., Raipur (Managers) | Chhattisgarh | 05.04.10 - 09.04.10 | 12 |
| CGMFP Fed. Ltd., Raipur (Jr. Executive) | Chhattisgarh | 05.04.10 - 09.04.10 | 2 |
| Private- Balaghat | Madhya Pradesh | 05.04.10 - 09.04.10 | 1 |

| Sponsoring Organization | State | Period | No. of participants |
|---|--------------|---------------------|---------------------|
| Lakh Sahyog Samiti, Gaurbera, Khunti- MESO | Jharkhand | 31.05.10 - 05.06.10 | 29 |
| CGMFP Fed. Ltd., Raipur (Special SGSY)-Master trainers | Chhattisgarh | 14.06.10 - 19.06.10 | 32 |
| CGMFP Fed. Ltd., Raipur (Special SGSY)-Master trainers | Chhattisgarh | 21.06.10 - 26.06.10 | 40 |
| Forest Deptt, Raigarh | Chhattisgarh | 21.06.10 - 26.06.10 | 5 |
| CGMFP Fed. Ltd., Raipur (Master trainers-19 + Prabandhak -30) | Chhattisgarh | 13.09.10 - 18.09.10 | 49 |
| CGMFP Fed. Ltd., Raipur (Field facilitator + Executive) | Chhattisgarh | 08.11.10 - 13.11.10 | 37 |
| CGMFP Fed. Ltd., Raipur (Field facilitator) | Chhattisgarh | 15.11.10 - 20.11.10 | 45 |
| Gujarat Forest Deptt., Rajpipla | Gujarat | 15.11.10 - 20.11.10 | 1 |
| IINRG, Ranchi : NAIP-Lac Value Chain (Processing of lac) | Jharkhand | 18.11.10 - 20.11.10 | 16 |
| Total No. of courses : 11 | | | 346 |

Table 22. Educational programme (four weeks) on production, processing and uses of natural resins and gums

| Sponsoring Organization | State | Period | No. of participants |
|--|---------------|---------------------|---------------------|
| College of Agriculture, Banaras Hindu University, Varanasi | Uttar Pradesh | 03.05.10 - 08.05.10 | 62 |
| Indian Institute of Natural Resin and Gums (IPR) | Jharkhand | 03.05.10 - 08.05.10 | 2 |
| College of Agriculture, Banaras Hindu University, Varanasi | Uttar Pradesh | 10.05.10 - 15.05.10 | 31 |
| Sam Higginbottom Institute of Ag. Sc. & Tech, Allahabad | Uttar Pradesh | 31.05.10 - 05.06.10 | 5 |
| Sam Higginbottom Institute of Ag. Sc. & Tech, Allahabad | Uttar Pradesh | 05.07.10 - 09.07.10 | 18 |
| Total | | | 118 |

Table 23. On-farm training programme on scientific lac cultivation

| District, State | Sponsoring/ Nominating Agency | Venue (Village, Block) | Date | No. of Participants |
|------------------------|----------------------------------|---|----------------------|---------------------|
| Gondia, Maharashtra | Forest department | KVK Hivara, Gondia | 09.01.10 | 47 |
| Gondia, Maharashtra | Forest department | KVK Hivara, Gondia | 11.01.10 | 58 |
| Gondia, Maharashtra | Forest department | Maharudraksh Yagya Asthal, Amgaon, Gondia | 12.01.10 | 39 |
| Gondia, Maharashtra | Forest department | Panchayat Bhawan, Darbada, Salekasa, Gondia | 13.01.10 | 63 |
| Gondia, Maharashtra | Forest department | Adivasi Ashram School, Purada, Northdevri, Gondia | 14.01.10 | 60 |
| Gondia, Maharashtra | Forest department | Zila Parishad Central School, Chipa, Goregaon, Gondia | 15.01.10 | 55 |
| Dhamtari, Chhattisgarh | Forest department | Training Hall, Forest Deptt, Dugli | 08.02.10 09.02.10 | 54 |

| District, State | Sponsoring/ Nominating Agency | Venue (Village, Block) | Date | No. of Participants |
|----------------------------------|---|---|----------|------------------------|
| Khunti, Jharkhand | NAIP, Component-2- Lac value chain, IINRG, Ranchi | Panchayat Bhawan, Digri, Khunti | 04.03.10 | 55 |
| Khunti, Jharkhand | NAIP, Component-2- Lac value chain, IINRG, Ranchi | Samudayik Bhawan, Bonasilda, Khunti | 05.03.10 | 56 |
| Yawatmal, Maharashtra | Forest department | Aardi | 25.06.10 | 300 |
| Yawatmal Maharashtra | Forest department | Antargaon, (Bhansara Range), Mangur | 26.06.10 | 40 |
| Yawatmal Maharashtra | Forest department | Krishi Utpaden Bazar Samiti, Baghda, Ghatanji Range | 27.06.10 | 250 |
| Yawatmal, Maharashtra | Forest department | Krishi Utpaden Bazar Samiti, Baghda, Ghatanji Range | 28.06.10 | 35 |
| Yawatmal Maharashtra | Forest department | Vill-Jormuha, Khateshwar Mandir, Sabhagrah | 29.06.10 | 250 |
| Yawatmal Maharashtra | Forest department | Ganesh Bari | 30.06.10 | 10 |
| Latehar Jharkhand | Forest department | Range office Chandwa | 22.10.10 | 73 |
| Latehar Jharkhand | Forest department | Range office, Balumath | 23.10.10 | 125 |
| Latehar Jharkhand | Forest department | Forest Guest house campus | 23.10.10 | 133 |
| Latehar Jharkhand | Forest department | Lohia Bhavan Manika | 23.10.10 | 165 |
| Raigarh Chhattisgarh | Forest Department | Janpad Prathmikshala, Tenda, Gharghora | 23.10.10 | 85 |
| Raigarh Chhattisgarh | Forest Department | Chitakathra, Kharasia | 24.10.10 | 75 |
| Raigarh Chhattisgarh | Forest Department | Chandli, Saranggarh | 25.10.10 | 50 |
| Lohardaga Jharkhand | Forest department | RFO campus, Lohardaga | 02.11.10 | 65 |
| Ranchi Jharkhand | Forest department | Kita broodlac farm | 09.11.10 | 72 |
| Ranchi Jharkhand | Forest department | Range office Mahilong | 09.11.10 | 23 |
| Ranchi Jharkhand | Forest department | Range office campus (East) | 20.11.10 | 52 |
| Ranchi Jharkhand | Forest department | Range office campus (West) | 20.11.10 | 55 |
| Ranchi Jharkhand | Forest department | Forest Range office, Bundu | 24.11.10 | 52 |
| Ranchi Jharkhand | Forest department | Forest Range office, Bundu | 24.11.10 | 54 |
| Ranchi Jharkhand | Forest department | Forest Rest House, Tamar | 25.11.10 | 32 |
| Ranchi Jharkhand | Forest department | Forest Rest House Tamar (West), Mandar Beat | 25.11.10 | 37 |
| Ranchi Jharkhand | Forest department | Forest Rest House Tamar (East), Burmu Beat | 25.11.10 | 33 |
| Khunti Jharkhand | Forest department | Range office campus (North) Khunti | 30.11.10 | 55 |
| Khunti Jharkhand | Forest department | Range office campus (South) Khunti | 30.11.10 | 47 |
| Jharkhand | Forest department | Range Forest Office campus (East) | 08.12.10 | 67 |
| Buldana Maharashtra | Forest department | Chinchpur, Undri Area | 08.12.10 | 50 |
| Amrawati, Maharashtra | Forest department | Karanja, Bhiram, Paratwara | 09.12.10 | 62 |
| Total no. of courses : 37 | | | | 2834 |

Table 24. On-farm training programme on lac cultivation under Jharkhand Lac Development Scheme

| District | Sponsoring/ Nominating Agency | Venue (Village, Block) | Dated | No. of families/ participants |
|----------------------------------|--|---|----------|----------------------------------|
| Simdega | Tribal Welfare Deptt., (JLDS-SEEDS) Jharkhand | Samudayik Bhawan, Girija Toli, Pongloya Lachragarh, Simdega | 19.01.10 | 70 |
| Simdega | Tribal Welfare Deptt., (JLDS-SEEDS) Jharkhand | Govt. School, Kebetang, Bano, Simdega | 20.01.10 | 110 |
| Khunti | Tribal Welfare Deptt., (JLDS-VICAS) Jharkhand | Govt. Utkramik Middle School, Silda, Khunti | 27.01.10 | 85 |
| Daltonganj | Tribal Welfare Deptt., (JLDS-Vivek for Vikas) Jharkhand | Salatna, Cheinpur, Daltonganj, Jharkhand | 21.07.10 | 150 |
| Gumla | Tribal Welfare Deptt., (JLDS-SEEDS) Jharkhand | Pated | 22.07.10 | 100 |
| Chandwa | Tribal Welfare Deptt., (JLDS-Citizen Foundation) Jharkhand | Jaihind Pustkalayas | 24.07.10 | 132 |
| Chandwa | Tribal Welfare Deptt., (JLDS-Citizen Foundation) Jharkhand | Meno Night Mission, Chandwa | 24.07.10 | 130 |
| W Singhbhum | Tribal Welfare Deptt., (JLDS-SEEDS) Jharkhand | Utkramit Madhya Vidyalaya, Karika, Bandgaon (West Singhbhum) | 25.07.10 | 107 |
| Simdega | Tribal Welfare Deptt., (JLDS-Citizen Foundation) Jharkhand | Kinkel, Bandhgaon | 27.07.10 | 250 |
| W Singhbhum | Tribal Welfare Deptt., (JLDS-VICAS) Jharkhand | Tutikel, Bandhgaon | 29.07.10 | 150 |
| W Singhbhum | Tribal Welfare Deptt., (JLDS-VICAS) Jharkhand | Sarvasiksha Abiyan Bhawan (South Block), Pondeggar, Bandgaon, | 29.07.10 | 113 |
| W Singhbhum | Tribal Welfare Deptt., (JLDS-VICAS) Jharkhand | Pundenger, M.E. School, Bandhgaon | 29.07.10 | 120 |
| W Singhbhum | Tribal Welfare Deptt., (JLDS-Gramin Vikas Trust) Jharkhand | Karkatta | 02.08.10 | 250 |
| W Singhbhum | Tribal Welfare Deptt., (JLDS-Gramin Vikas Trust) Jharkhand | Sharada, West Singhbhum | 03.08.10 | 250 |
| Total no. of courses : 14 | | | | 2017 |

Table 25. On-farm motivational/supplementary training programme on lac cultivation

| District, State | Nominating Agency | Venue (Village, Block) | Dated | No. of Participants |
|---------------------------|-----------------------|------------------------------|----------|------------------------|
| W Singhbhum, Jharkhand | VICAS (NGO), Chaibasa | Tokad, Bandgaon | 15.01.10 | 25 |
| Ranchi, Jharkhand | TRIFED, Ranchi | Play Ground, Murudih, Namkum | 05.02.10 | 103 |

| District, State | Nominating Agency | Venue (Village, Block) | Dated | No. of Participants |
|----------------------------------|--|--|----------|---------------------|
| Ranchi, Jharkhand | TRIFED, Ranchi | Govt. Utkramik Madhya Vidyalaya, Kakda, Namkum | 08.02.10 | 166 |
| Khunti, Jharkhand | Udogini (NGO) | Digri, Rania, Khunti | 07.05.10 | 100 |
| Khunti, Jharkhand | MESO, Khunti | Gaurbera, Murhu | 18.06.10 | 150 |
| Khunti, Jharkhand | MESO, Khunti | Gaurbera, Murhu | 20.06.10 | 270 |
| Khunti, Jharkhand | MESO, Khunti | Gaurbera, Murhu | 22.06.10 | 158 |
| Khunti, Jharkhand | Forest Department | Lalli, Kakda, Manika, Latehar | 12.07.10 | 50 |
| Ranchi Jharkhand | TRIFED Ranchi | Kakda, Namkum, Ranchi | 15.07.10 | 50 |
| Gumla, Jharkhand | Tribal Development Project, Daladih | R.C. Primary School Hall, Dalmadih | 27.08.10 | 47 |
| Dhanbad Jharkhand | Forest Department | CIFMRI, Training Hall | 27.10.10 | 250 |
| Ambikapur Chhattisgarh | Forest Department | CF Training Hall | 28.11.10 | 43 |
| Vishakhapatnam Andhra Pradesh | Sahyog Community Co-ordination Network (NGO) | Barda, Laxmipuram, Hamshaband | 04.12.10 | 33 |
| Vishakhapatnam Andhra Pradesh | Sahyog Community Co-ordination Network (NGO) | Lukuru, Laxmipuram | 05.12.10 | 35 |
| Amrawati, Maharashtra | Forest Department | Arni | 10.12.10 | 15 |
| Total no. of courses : 15 | | | | 3512 |

Table 26. Transfer of technology knowhows

| Subject | Entrepreneur/Firm | Duration |
|---|-------------------------------|---------------------|
| Water soluble lac and Gasket shellac cement compound | M/s Roneet Enterprises Mumbai | 06.09.10 - 08.09.10 |
| Preparation of dewaxed decolourised lac and water soluble lac | M/s Cosmochem, Mumbai | 05.10.10 - 08.10.10 |
| Gasket shellac cement compound | M/s Polymers, Hyderabad | 02.11.10 - 03.11.10 |
| Aleuritic acid | Sri Vivek Jaiswal | 23.11.10 - 28.10.10 |

3.1.2 Enhancing livelihood options for poor tribal families of the Jharkhand state through capacity building in cultivation of lac and its value addition (JLDS)

A. Training

- One-week training was provided to 89 beneficiaries under the JLDS project (Table 20).
- On-farm training camps were organised for 2017 beneficiaries of the project (Table 24).

B. Action Research

Intensive lac cultivation on bushy host-plants

40.0 kg of early *kusmi* breed inoculated on 1202 *semialata* plants in Kharsidag village in collaboration with SEEDS, an NGO, yielded a very good crop (333 kg broodlac and 45 kg scraped lac. *Semialata* plants in the absence of proper soil moisture management were found to be prone to termite damage and showed slow growth after harvesting of lac crop. *Semialata* plantation of about 1100 plants has been

raised in Kharsidag village in collaboration with a farmer. 35 kg and 20 kg of early *kusmi* broodlac has been inoculated in the fields of the farmer and the NGO respectively in July 2010.

Lac cultivation on reported high yielding/alternate host plants

Four-years-old plants raised from reported high yielder *ber* at Purulia and a local variety have been inoculated with *kusmi* broodlac in July 2010 and *rangeeni* broodlac in October 2010 for comparative performance.

Kusmi broodlac inoculated on six month old twigs of *A. procera* showed preferential tendency of settling on petioles. However, the petioles shed in December before crop could attain maturity. Lac inoculation would be tried next year under modified pruning schedule for further evaluation of this host.

Field demonstration of productive breeds of lac insects

Lac crops were raised using three productive *kusmi* breeds in three villages of two districts. A good crop giving 191 kg broodlac of Kulajanga, 207 kg of Nawadih and 174.5 kg of late variety respectively was harvested using 20.0 kg broodlac each at Mangobandh, besides 33 kg (12, 9, 12 kg respectively) of sticklac. Yield was affected due to incessant rain during settlement in the late stock. Performance pattern of the breeds at other two locations was similar but yields were slightly lower. 20 kg each of these three varieties have been inoculated again at two villages in collaboration with NGOs namely SEEDS and *Laksha* in July 2010 for demonstration at farmers' field.

Lac cultivation on *Cajanus cajan* (arhar)

Three varieties of *arhar* (*Cajanus cajan*) viz. early maturing, middle and late maturing inoculated with *rangeeni* lac for cultivation on plantation basis in October 2009 were harvested in June 2010. The crop on *arhar* was provided irrigation at fortnightly interval in Feb-March and at 10 days interval from April 2010 onwards. Crop on *arhar* under irrigation on medium and late maturing variety gave an output : input ratio of 3.57 : 1 and 5.09 : 1 respectively of broodlac showing the promise of utilizing *arhar* for lac cultivation under irrigated conditions (Fig.

35). Quality of the broodlac obtained was also satisfactory. Broodlac obtained was utilized for lac culture on *palas* during rainy season crop with satisfactory results.



Fig. 35 Lac crop on Arhar

Development of broodlac standards

10 kg broodlac each of *rangeeni* broodlac from *palas* and *kusmi* from *ber* and *kusum* was studied for broodlac standardization for rainy season and summer season crops respectively. The broodlac, scrapedlac and stick lac of *kusmi* from *ber* (Fig. 36) and *rangeeni* from *palas* (Fig. 37) were studied for weight loss. Weight of each was recorded daily till it became constant.

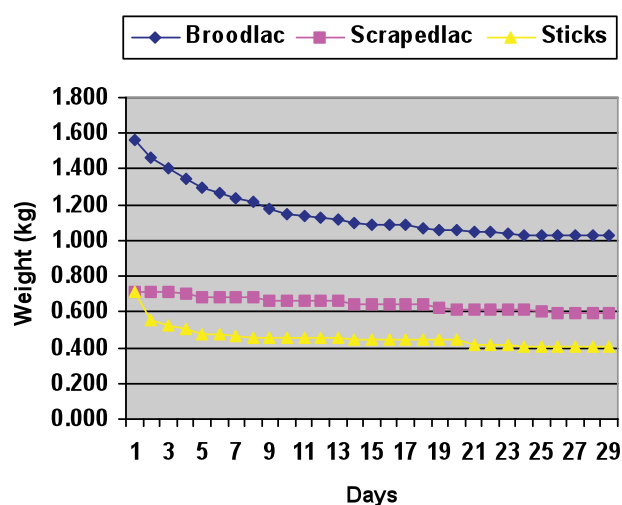


Fig. 36 Weight loss in *kusmi* broodlac from *ber* during March

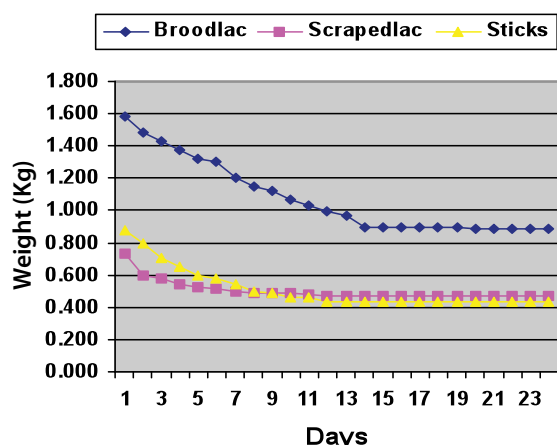


Fig. 37 Weight loss in *rangeeni* broodlac from *palas* during October

Effect of crop geometry on kusmi broodlac quality on *semialata*

Three-years-old *semialata* plantation (single-row and paired-row) were used for growing winter season (*aghani*) crop of *kusmi* lac. In single-row system distance between rows and within row was one meter, whereas, in paired-row system distance between paired rows was 50 cm and within row one meter in triangular system. Distance between two paired rows was two meters. Broodlac harvested was divided into three groups of good (more than 80% coverage of twig), medium (40-80% coverage) and bad (less than 40% coverage) quality.

It was observed that though total yield of the broodlac was not significantly different, proportion of bad quality broodlac was about 12.5% more in single-row planting (Fig. 38). Quality of broodlac was found to be inferior due to higher mortality before crop maturity and sooty mould growth.

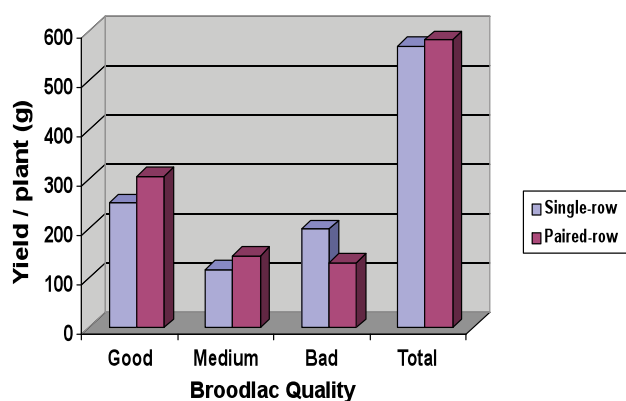


Fig. 38 Effect of crop geometry on quality of *kusmi* broodlac during winter season (*aghani*) crop

Pre-summer large scale *rangeeni* mortality

Observations on pre-summer large scale *rangeeni* lac insect mortality were recorded on lac cultures inoculated on *bhalia*, *palas* and *ber* and also on samples collected from the fields in Jharkhand and West Bengal. Microscopic examination revealed that 54 % lac insects were parasitized in population while 25% parasitization was recorded in the apparently normal cultures. Percentage survival of lac insects was only 20% in affected samples and 62% in the apparently normal cultures. Parasitization was observed to be the major factor, causing insect mortality (Figs. 39a & b). Parasitization before sexual maturity invariably killed the lac insect. While, lac insects were able to survive when parasitized after fertilization but its brood value and resin producing efficiency was adversely affected. Caging experiment also confirmed the heavy incidence of parasitization by *Aprostocetus purpureus*. Up to 573 parasitoids emerged from 10cm lac encrustation in the month of March.



a



b

Fig. 39 Lac insect population showing heavy parasitization by *Aprostocetus purpureus*

Study was continued in rainy season crop also. Interestingly, extent of parasitization in lac culture was comparable to that of *baisakhi* crop but survival of lac insects was significantly higher during rainy season crop than that of summer season.

Ant-lac-host plant association at IRF

Ants were reported to be associated with all major lac hosts earlier (October 2009). Some of these ants were found damaging cultures in the Field Gene Bank of NATLIGEC. Therefore, different types of ants, irrespective of their interaction with lac insect/host plant were collected from the Institute Research Farm for identification. These ants have now been identified as *Camponotus compressus*, *C. dichrous*, *C. parius*, *Crematogaster subnuda*, *Lepisiota*

capensis, *Leptogenys diminuta*, *Lophomyrmex quadrispinosus*, *Monomorium scabriceps*, *Myrmecaria brunnea*, *Oecophylla smaragdina*, *Pachycondyla tesseronoda*, *Paratrechina longicornis*, *Pheidole indica*, *Pheidologeton affinis*, *Tapinoma indicum*, *Tetraponera allaborans* and *T. rufonigra*.

C. Infrastructure development

On-farm Training Hall has been constructed at IRF under JLDS. Lac processing machine developed by the institute has been installed in the hall for demonstration to the trainees / farmers.

D. Field visits

A number of field visits were undertaken for lac crop monitoring on *ber*, *palas*, *bhalia* and *semialata*. Details of field visits are presented in Table 27.

Table 27. Details of field visits for lac crop monitoring

| Date | Village | Purpose / Comments |
|----------|------------------------------|---|
| 30.01.10 | Alankel and Angrabari | Crop monitoring of <i>kusmi</i> lac on <i>ber</i> and <i>palas</i> . <i>Rangeeni</i> on <i>ber</i> heavily infected by predators. |
| 10.02.10 | Irud, Chitramu and Kharsidag | Crop monitoring of <i>rangeeni</i> lac on <i>ber</i> for mortality. <i>Semialata</i> plantation dying due to non-irrigation. <i>Kusmi</i> crop harvesting on <i>semialata</i> . |
| 16.02.10 | Chitir | <i>Kusmi</i> lac crop monitoring on <i>ber</i> |
| 13.03.10 | Irud | <i>Rangeeni</i> lac crop monitoring on <i>ber</i> and <i>palas</i> for mortality |
| 05.10.10 | Bhurkunda | Crop monitoring of <i>kusmi</i> lac on <i>bhalia</i> |

3.1.3 Sustainable farming system models for prioritized micro watersheds in rainfed areas of Jharkhand

The project was sanctioned in July 2008 under component-3 of NAIP. The institute is a consortium partner and Birsa Agriculture University, Ranchi is the lead centre. The other partners are Horticulture and Agroforestry Research Programme, Ranchi and Central Upland Rice Research Station, Hazaribag.

Performance and output from *rangeeni* summer crop

The summer crop was raised on large number of *palas* trees in the adopted villages. The performance of *rangeeni* lac on *ber* was excellent in Karela village of Dumka district. The crop completed its cycle in the last week of June when emergence started. However, limited survival on *ber* have been observed

in Bhounra, Guhajori and Kodokicha - 7 villages. In comparison to *ber*, the summer crop on *palas* was excellent in all the villages of Dumka and Jamtara on more than 1000 trees.

Identification of a high yielder *palas* tree in Dumka district

Butea monosperma is conventional and most common lac host tree for *rangeeni* lac production. A highly productive and potential tree for lac production was identified in Bhounra village of Jama block in Dumka district owned by Shri Sudhir Murmu (Fig. 40). Around 8 kg of *rangeeni* broodlac was inoculated in October 2009 on this tree and 125 kg of broodlac was harvested after eight months, in the last week of June 2010. A few encrustation left for further propagation in view of available tender shoots for further settlement of newly emerged lac

insect in June 2010 and 27 kg broodlac was further harvested in October 2010. Thus from one year crop (October to October), 152 kg broodlac of worth Rs 9,120 was obtained. The tree is located between two paddy fields in upland. The diameter of main trunk is 22 inch, average canopy diameter 30 ft and height around 50 ft. The average productivity of same sized normal *palas* tree is 40-50 kg per tree.



Fig. 40 A high yielder *palas* tree in Bhounra village, Dumka

Performance of rainy season crop

The summer crop was mainly self-inoculated. Only excess amount of broodlac was harvested from trees and inoculated on adjacent trees as per recommendation. Last year in 2009, a total of 1193 kg of broodlac worth Rs 60,000 was produced in six villages of Jamtara district benefiting 24 families directly. This year 1735 kg broodlac worth approximately Rs 1,05,000 have been produced in Jamtara district. The average income per family was Rs 6,355. A total of 350 mandays were generated from production and marketing of this quantity of broodlac (Table 28). During the current year, a total of 1337 kg *rangeeni* broodlac worth Rs 80,000 has been produced for the first time by nine families of five villages in Jama and Dumka block. The average income per family was Rs 8913 per year in Dumka district (Table 29). The highest income earned by the families of each of the five villages, ranges from Rs 5,400 to 38,100. A brief success story has been documented for highest income earner Shri Sudhir Murmu of Bhounra village in Dumka district. An estimated 270 mandays generated in Dumka district by inoculation of lac production this year.

Market linkages

Many farmers of Jamtara village have established market linkages themselves but for Dumka, it has been established this year. The broodlac produced by these adopted families was of very good quality and hence there was no problem in marketing.

Training conducted

On-farm training on 'Scientific lac cultivation' was conducted at Baramajhladih village on 26.2.10 where 95 farmers participated. A total of 13 farmers received training at IINRG for a week on 'Scientific lac cultivation, processing and uses'

Crop monitoring

Lac crop monitoring and interaction with farmers was carried out regularly in different villages of both districts. Farmers were guided for protection of lac crop against insect-pests.

Sustenance of broodlac

All the farm families who have produced and marketed broodlac are now self-sufficient in broodlac. No more support from NAIP project has been given this year in respect of broodlac.

Purchasing of lac production implements

A few farmers purchased lac cultivation implements like Secateur on their own after earning substantial income.

Inoculation of *rangeeni* summer crop

A total of 70 beneficiaries have been involved in both districts. More than 2,500 *palas* trees have been inoculated in October-November 2011. On an estimate, 1600 kg of broodlac has been inoculated in both districts by the farm families (Table 30 & 31).

Video film

A video film has been prepared for success of lac cultivation in Jamtara district under NAIP project. The film was prepared by DIPA, New Delhi

Utilization of trees located on bunds of paddy field

Generally *palas* trees occur on fallow land in clusters. But at a few places *palas* is also found on borders of paddy field. Such border trees are now being utilized by the farmers of Badamanjhladih, Dahartola, Bhounra and Charedih villages for lac cultivation without any adverse effect on paddy production.

Lac on these trees survived better in view of more moisture availability during summer season.

Involvement of women in lac production and its marketing

Women of area under NAIP project were actively involved in lac production activities specially scraping and marketing at village level.

Broodlac hub

Considering shortage of *rangeeni* broodlac in Jharkhand in view of high demand of broodlac (lac seed) and success of NAIP project for introduction of lac cultivation in Jamtara district, it was decided to develop Baramajhladih village of Narayanpur and

Dahartola village of Jamtara block in Jamtara district as broodlac hub.

Impact

Introduction of lac cultivation activity in the adopted village and subsequent publication of success news in local print media created more awareness in these districts. Now these *palas* trees are not cut for fuel wood purpose rather small plants are protected and allowed to develop into trees for future lac production. The income generated from lac production were utilized for schooling of children, marriage, purchase of agriculture inputs and other necessities of daily use including medicines etc.

Table 28. Production, marketing and income generation from *rangeeni baisakhi* broodlac in Jamtara district (2010)

| Block | Village | No. of beneficiaries | Production and Marketing of broodlac (kg) | No. of trees involved (<i>Palas</i>) | Income (₹) | Average income per family (₹) | Highest income by single family (₹) | Farmer's Name |
|------------|---------------|----------------------|---|--|------------|-------------------------------|-------------------------------------|------------------|
| Jamtara | Dahartola | 1 | 258 | 100 | 15,480 | 15,480 | 15,480 | Vakil Murmu |
| | Charedih | 3 | 163 | 100 (+8 ber) | 9,780 | 3,260 | 3,900 | Suresh Kisku |
| | Rupaidih | 1 | 58 | 50 | 3,480 | 3,480 | 3,480 | Hemant Soren |
| | Sinjotola | 4 | 180 | 102 | 10,800 | 2,700 | 5,580 | Parmeshwar Kisku |
| | Saurmundu | 3 | 202 | 122 | 12,120 | 4,040 | 8,760 | Ranjan Hansda |
| Narayanpur | Baramajhladih | 8 | 874 | 600 | 52,440 | 6,555 | 14,220 | Baldeo Marandi |
| Total | Six villages | 20 | 1735 | 1082 | 1,04,100 | 6,355 | 15,480 | Vakil Murmu |

Estimated employment generated from lac production and marketing = 350 mandays

Table 29. Production, marketing and income generation from *rangeeni baisakhi* broodlac in Dumka district (2010)

| Block | Village | No. of families | Production and Marketing of broodlac (Kg) | No. of trees involved (<i>Palas</i>) | Income (₹) | Average Income per family (₹) | Highest income by single family (₹) | Farmer's Name |
|-------|-----------|-----------------|---|--|------------|-------------------------------|-------------------------------------|---------------|
| Jama | Karela | 4 | 183 | 78 | 10,980 | 2,745 | 5,400 | DhumaMurmu |
| | Bhounra | 2 | 680 | 150 | 40,800 | 20,400 | 38,100 | SudhirMurmu |
| | Ragat | 1 | 130 | 60 | 7,800 | 7,800 | 7,800 | Ravilal |
| Dumka | Kodikicha | 1 | 135 | 80 | 8,100 | 8,100 | 8,100 | Babujan |
| | Karmatand | 1 | 209 | 80 | 12,540 | 12,540 | 12,540 | Akhilesh |
| Total | Five | 9 | 1337 | 466 | 80,220 | 8,913 | 38,100 | SudhirMurmu |

Estimated employment generated from lac production and marketing = 270 mandays

Table 30. Inoculation of *rangeeni* summer lac crop on *palas* & *ber* in Jamtara district (2010)

| Block | Village | No. of beneficiaries | Quantity of <i>rangeeni</i> broodlac used (Kg) | No. of <i>palas</i> trees inoculated | No. of <i>ber</i> trees inoculated | Total trees inoculated |
|------------|----------------|----------------------|--|--------------------------------------|------------------------------------|------------------------|
| Jamtara | Charedih | 3 | 130 | 195 | 10 | 205 |
| | Sinjotola | 7 | 198 | 260 | | 260 |
| | Saurimundu | 7 | 92 | 205 | | 205 |
| | Dahartola | 2 | 30 | 90 | | 90 |
| | Rupaidih | 1 | 20 | 30 | - | 30 |
| | Sub total | 20 | 470 | 780 | 10 | 790 |
| | | | | | | |
| Narayanpur | Badamanjhladih | 26 | 593 | 1088 | | 1088 |
| | Sub total | 26 | 593 | 1088 | | 1088 |
| | Total | 46 | 1063 | 1868 | 10 | 1878 |

Table 31. Inoculation of *rangeeni* summer lac crop on *palas* & *ber* in Dumka district (2010)

| Block | Village | No. of beneficiaries | Quantity of <i>rangeeni</i> broodlac used (Kg) | No. of <i>palas</i> trees | No. of <i>ber</i> trees | Total trees inoculated |
|--|--------------|----------------------|--|---------------------------|-------------------------|------------------------|
| Dumka | Kodokhicha-7 | 6 | 128 | 185 | - | 185 |
| | Karmatand | 7 | 148 | 186 | - | 186 |
| | Sub total | 13 | 276 | 371 | - | 371 |
| Jama | Karela | 4 | 82 | 103 | - | 130 |
| | Ragat | 2 | 53 | 75 | - | 75 |
| | Bhonra | 2 | 85 | 140 | - | 140 |
| | Palasi | 3 | 31 | 47 | - | 47 |
| | Sub Total | 11 | 251 | 365 | - | 365 |
| | Total | 24 | 527 | 736 | | 736 |
| | | | | | | |
| Grand total Jamtara & Dumka | | 70 | 1590 | 2604 | 10 | 2614 |

3.1.4 Improving rural livelihood security through sustainable integrated farming system model and allied enterprises in Bastar region of Chhattisgarh

The project started in October 2008 under component-3 of NAIP. The institute is a consortium partner and S. G. College of Agriculture Research, Jagdalpur of Indira Gandhi Krishi Viswavidyalaya,

Raipur is the lead centre. The other partners are Agroret Society, Kanker (NGO), Participatory Action for Rural Development Society (PARDS), Jagdalpur, CSWCRTI, ICAR and Sanjeevni (Forest Dept) Raipur. The work was to be carried out in four clusters namely Bastanar, Pandawada, Pusagaon of Jagdalpur district and Kanhanpuri in Kanker district. Following activities have been undertaken for the promotion of lac cultivation in these areas.

Training programme

Training programme on broodlac quality evaluation and marketing for senior research fellows, faculties and field workers was organized at SGCAR, Jagadapur for 15 persons. One week training programme on scientific lac cultivation, processing and uses was conducted for research associates, senior research fellows besides scientists associated with the project at IINRG, Ranchi w.e.f. 1.2.11 to 6.2.11.

Crop monitoring and technical guidance

Field visit to Tehkapal area was undertaken. The settlement of *rangeeni* crop on *ber* has been found poor and suggested for spray of recommended pesticides as incidence of lepidopteran and neuropteran have been observed. *Kusmi* lac crop was raised on *kusum* trees (Nos. 40) in Laluguda village (Fig. 41).



Fig. 41 Summer season *Kusmi* lac crop on *kusum* at village Laluguda

The summer crop was found good and no insect predators were observed under field condition. Fipronil was applied as suggested. In view of poor performance of *rangeeni* crop on *ber* trees in Tehkapal village, it was suggested to discontinue the

same. It was suggested to utilize *ber* trees for *kusmi* lac. Light inoculation was carried out on 27 *kusum* trees. It was suggested to use ethofenprox or fipronil instead of thiodan and also partial harvesting when crop mature.

3.1.5 National Action Plan (NAP) for sustainable income generation of tribals through cultivation and processing of lac

The project is sponsored by Tribal Co-operative Marketing Development Federation (TRIFED) of India Ltd, Ministry of Tribal Affairs, Government of India, New Delhi with a budgetary provision of ₹ 4.05 crores. The project is located in six selected districts of six states viz. Jharkhand, West Bengal, Odisha, Madhya Pradesh, Chhattisgarh and Andhra Pradesh comprising 666 SHGs and 6600 tribal members.

TOT Programmes on scientific lac cultivation (In-campus, one week)

In-campus Training of Trainers (TOT) programme of one week duration on scientific lac cultivation was organized for the trainers of Jharkhand, Chhattisgarh and Odisha. In this programme, six camps were organized for 236 beneficiaries (Table 20).

OFT/Motivational programmes on scientific lac cultivation

Three camps of On-farm training programmes were organized for 319 beneficiaries of Jharkhand state (Table 25).

Crop monitoring

Eleven visits were made by the experts of the institute to assess the progress of the lac crop in different adopted lac growing areas of the states of Jharkhand and West Bengal (Table 32). Necessary suggestions were given to farmers for the effective management of lac crop.

Table 32. Lac crop monitoring in adopted lac growing areas of Jharkhand and West Bengal

| District, State | Venue | Date | Observation/Remarks |
|---------------------------|--|---------------|---|
| Purulia, West Bengal | Villages – Darpa, Ranidih, Kemtia, Ohatu, Puhara, Kashitan, Bhusudih (Jhalda 1 Block) Burudih (Bagmundi Block) | 11 May, 2010 | Initial settlement and crop growth of <i>rangeeni</i> lac crop raised on <i>palas</i> was quite good. But due to unexpected sudden increase in temperature (45-50°C) during last April and May, heavy mortality of lac crop was observed due to heat. |
| Ranchi, Jharkhand | Villages – Beradih and Kakda (Block – Namkum) | 12 May, 2010 | <i>Kusmi</i> lac crop was raised on <i>kusum</i> and condition of the crop was quite good. <i>Rangeeni</i> lac crop was raised on <i>ber</i> . |
| East Singhbhum, Jharkhand | Villages – Mesoguda, Patisahi and Papdagadu. | 13 May, 2010 | <i>Rangeeni</i> lac crop was raised on <i>palas</i> . Initial settlements and growth of the crop was good but due to sudden increase in temperature during last April and May, mortality of the lac crop was noticed due to heat. |
| Ranchi, Jharkhand | Village – Ullahatu (Block – Namkum) | 14 May, 2010 | <i>Kusmi</i> lac crop was raised on <i>kusum</i> and crop was progressing well. Demonstration of pesticide spray was carried out by the expert of IINRG, Ranchi. |
| Ranchi, Jharkhand | Baradih and Kakra Block - Ranchi | 5 July, 2010 | <i>Kusmi</i> lac crop was raised on <i>kusum</i> and the crop condition was good. Technical guidance to farmers were provided regarding crop maturity, harvesting and inoculation of broodlac etc . |
| Ranchi, Jharkhand | Mangobandh of Namkum Block | 6 July, 2010 | <i>Kusmi</i> lac crop was raised on <i>kusum</i> and the crop condition was good. Technical guidance to farmers were provided regarding crop maturity, harvesting and inoculation of broodlac etc . |
| East Singhbhum, Jharkhand | Mesogunda and Patisahi of Potka Block | 9 July, 2010 | <i>Rangeeni</i> lac crop was raised on <i>palas</i> . The crop condition was not good as the spraying of the crop was not carried out by the farmers. |
| East Singhbhum, Jharkhand | Papdagundu of Potka Block | 10 July, 2010 | Monitoring of <i>rangeeni</i> lac crop raised on <i>palas</i> . The crop was progressing well and farmers were advised to spray the insecticides. |
| Ranchi, Jharkhand | Kakda, Namkum Block | 15 July, 2010 | For motivational training on lac cultivation. |
| Purulia, West Bengal | Bhusudih, Neemdih | 30 July, 2010 | To see the status of <i>rangeeni</i> lac crop raised on <i>palas</i> . |
| Ranchi, Jharkhand | Mesogonda and Pattisahi village of Potka, East Singhbhum | August, 2010 | Monitoring of <i>baisakhi</i> lac crop raised on <i>palas</i> . Survival of crop was poor due to pest infestation. The farmers were advised to adopt package and practices of the institute. |

The institute facilitated to TRIFED in procurement of broodlac, pesticides and tool kits etc. Necessary suggestions and demonstrations were also given to lac growers for pruning, bundling, broodlac inoculation and spray of pesticides as and when required.

3.2 Technology Assessment, Refinement and Dissemination

3.2.1 Evaluation of some newer insecticides and bio-pesticides for eco-friendly management of insect pests associated with lac insect and host plants

The project was initiated with an objective to bring about novel and eco-friendly pest management

technologies for managing the insect pests associated with lac insect and host plants in lac production system.

Evaluation of chemical insecticides on rangeeni rainy season (katki) lac crop

Newer chemical insecticides viz., indoxacarb (0.007%), spinosad (0.0025 & 0.005%) and fipronil (0.005%) along with recommended ethofenprox (0.02%) and endosulfan (0.05%) were evaluated on rainy season (katki) rangeeni lac crop raised on *Butea monosperma* (palas) at Institute Research Farm and on farmers field at Putidih, Jhalda, West Bengal. All the insecticides were found to be promising and did not show any detrimental effect on lac crop, confirming the previous findings. Reduction in incidence of *Eublemma amabilis* and *Pseudohypatopa pulverea* in different treatments was observed to the tune of 42-81% and 67-100%, respectively over control. Reduction in incidence of *E. amabilis* and *P. pulverea* was observed to the tune of 69 and 100%, respectively in *Bt* treatment.

Evaluation of chemical insecticides on kusmi winter season (aghani) lac crop

Newer insecticides namely indoxacarb, spinosad and fipronil along with recommended insecticides ethofenprox and endosulfan were evaluated on winter season kusmi lac crop raised on *Zizyphus mauritiana* (ber) at IRF, Ranchi and farmer's field at Putidih, Jhalda, West Bengal. Insecticides did not show any detrimental effect on lac crop and crop is progressing very well.

Evaluation of chemical insecticides on kusmi summer season (jethwi) lac crop

Summer season kusmi lac crop was raised on kusum trees for evaluation of some newer chemical insecticides viz., indoxacarb (0.007%), spinosad (0.005%) and fipronil (0.005%) along with recommended ethofenprox (0.02%) and endosulfan (0.05%) and one biopesticides (Halt) for their efficacy against lac insect predators.

Reduction in incidence of *E. amabilis* was observed to the tune of 62-87% in different treatments over control. Whereas reduction in incidence of *P. pulverea* in different treatments over control was observed to the tune of 61-89%.

Evaluation of biopesticides on kusmi winter season (aghani) lac crop

Two newer commercially available biopesticides *Bacillus thuringiensis* var. *kurstaki* formulations (Halt 5 WP, serotype H 3a, 3b, 3c and Knock WP) of indigenous origin at two concentrations (2g and 3g/l) along with *Bt* formulations Delfin (3gm/15lt) of exotic origin are being evaluated on kusmi lac crop raised on ber for the management of lepidopteran lac insect predators viz., *E. amabilis* and *P. pulverea*. The crop is progressing well without showing any detrimental effect of biopesticides on lac crop indicating its safety to lac crop. Quantification of lac insect predators and parasitoids incidence will be carried out at the time of crop harvesting.

First report of new chrysopid species on lac insect

Incidence of new *Chrysoperla zastrowi arabica* Henry et al. (Neuroptera : Chrysopidae) was recorded for the first time on *Kerria lacca* on kusum trees.

Insect pests of lac host plants

- *Drosicha* sp. (Hemiptera: Margarodidae) infestation was recorded for the first time on tender twigs of ber plants during first fortnight of May, 2010 in IRF. The bug incidence was effectively controlled with the application of lambdacyhalothrin (0.005%), imidacloprid (0.005%) and thiamethoxam (0.005%).
- Curculionids, viz., *Mylloceris discolor* Boheman (Coleoptera: Curculionidae); *Peltotrachelus* sp. (Coleoptera: Curculionidae); *Hypolixus* sp. (Coleoptera: Curculionidae); *Cleonus* sp. (Coleoptera: Curculionidae) were recorded for the first time in lac production system on ber trees.
- *Oocassida pudibunda* (Boheman) (Coleoptera: Chrysomelidae) was recorded for the first time on ber trees feeding green parts and chlorophyll content of ber leaves leaving white veins/patches on tender leaves.
- Hemipteran bug, *Physomerus grossipes* Fabricius was recorded for the first time on kusum trees. Bugs congregated on lower surface of the kusum leaves.

3.2.2 Front line demonstration on scientific lac cultivation

Front line demonstrations on scientific lac cultivation were carried out in three states viz.; Jharkhand, Odisha and West Bengal in association with KVK/NGOs/Progressive farmers for conducting demonstrations on farmer's field. Demonstrations and studies were carried out on *palas* and *ber* in Latehar district of Jharkhand state. Demonstrations were also carried out on *F. semialata* in Sundargarh (Odisha) and Gangacha, West Medinipur district, West Bengal (Table 33). The progress of lac cultivation at different places is as follows :

Jharkhand

Rangeeni lac crop was raised on *palas* and *ber* in four villages of Latehar and two villages of Palamu districts. The initial settlement and development of lac insect was satisfactory. However, lac crop failed to produce significant yield mainly due to heat mortality. *Ber* (50) and *Palas* (200) trees were pruned between February and April 2010 in Lalli and Dulsulma villages respectively. For raising *kusmi* lac crop (*aghani* 2010-11), 50 *ber* trees were inoculated with 50 Kg of broodlac during July,

2010 in Lalli and Nadelwa villages of Manika block (Latehar) for the first time to demonstrate and popularise lac cultivation. Apart from this, motivational training, demonstration for broodlac bundling and inoculation of broodlac etc. were also given. Two insecticidal spraying were carried out as per schedule on the *kusmi* crop. The condition of lac crop is quite satisfactory and a good harvest is expected. *Palas* trees (165 in Dulsulma village and 60 trees in Lalli village) were inoculated for raising *rangeeni* lac crop (*baisakhi* 2010-11).

Odisha (Sundargarh)

Under FLD programme at Sundargarh (Odisha), 20 kg of *Kusmi* broodlac was supplied during July 2009 against which 90 kg of *kusmi* broodlac (*aghani* 2009-10) was produced on *F. semialata* and utilized for inoculation of 20 *kusum* trees, 350 kg of summer season broodlac (*jethwi* 2010) was produced.

Gangacha (Medinipur/West Bengal)

For raising summer season lac crop (*jethwi* 2010) on *F. semialata* under FLD programme, 50 kg *kusmi* broodlac was supplied during February 2010, against which 80 kg broodlac were produced.

Table 33. Summer season lac crop (*jethwi* 2010) on *F. semialata* under FLD programme

| Sl. No. | Input | Output | Ratio (Input:Output) |
|--------------------------------|---|--|----------------------|
| Sundargarh (Odisha) | | | |
| 1. | 20 kg <i>Kusmi</i> broodlac (July 2009) on <i>F. semialata</i> bushes | 90 kg <i>kusmi</i> broodlac (January 2010) | 4.5 |
| 2. | 90 kg <i>kusmi</i> broodlac (Jan. 2010) on 20 <i>S. oleosa</i> trees) | 350 kg <i>kusmi</i> broodlac (July 2010) | 3.8 |
| Medinipur (West Bengal) | | | |
| 1. | 50 kg <i>kusmi</i> broodlac (Feb 2010) on <i>F. semialata</i> | 80 kg <i>kusmi</i> broodlac (July 2010) | 1.6 |
| Latehar (Jharkhand) | | | |
| 1. | 50 kg <i>kusmi</i> broodlac (July 2010) on <i>Z. mauritiana</i> | Good yield expected (3 to 4 times) | |

3.2.3 Documentation of lac production, processing in Chhattisgarh and market survey on lac based products.

Documentation of all lac related activities and progress

Survey has been conducted in fifteen districts (Kanker, Narayanpur, Rajnandgaon, Bastar, Bijapur, Dantewada, Durg, Kawardha, Bilaspur, Sarguja, Koriya, Jashpur, Raigarh, Janjgir-Champa and Korba) and

twenty seven forest divisions (Kanker, Narayanpur, East Bhanupratappur, West Bhanupratappur, Khairagarh, Rajnandgaon, North Kondagaon, South Kondagaon, Bastar, Bijapur, Dantewada, Sukuma, Durg, Kawardha, Bilaspur, Marwahi, E. Sarguja, N. Sarguja, S. Sarguja, Manendragarh, Koriya, Jashpur, Dharamjaigarh, Raigarh, Champa, Korba and Katghora) of Chhattisgarh for collection of information and data related to lac under various projects taken up by the Chhattisgarh Government. The necessary data and information have been collected for documentation purpose. The collected data and information related to lac under various projects taken up by the Chhattisgarh Government has been compiled.

Socio-economic status of lac growers in Kanker District

The analysis of survey data pertaining to profile characteristics of 100 lac growers of Kanker district shows that on an average, 18.0 per cent lac growers had marginal land holding of average size 0.64 ha., 25.0 per cent had small land holding with average size 1.04 ha., 39.0 per cent had medium land holding with average size 2.82 ha., 16.0 per cent had semi-medium land holding with average size 6.45 ha. and 2.0 per cent had large land holding with average size 13.0 ha. The families having up to 5 members and more than 5 members were 54 per cent and 46 per cent respectively, with an average family size of 5.92. On an average, the age of 39 per cent family heads was more than 50 years and 61 per cent family heads were less than 50 years.

More than 90 per cent lac growers are residing in Kachcha house. The average literacy rate of lac grower's family head was 73 percent. About 39 per cent family head had education up to primary level, 25 per cent had education up to high school, 6.0 per cent had education up to Intermediate level and only 3.0 per cent had education up to Degree level. About 40.0 per cent lac growers had herd size below 5 with average size of 3.11 and 60 per cent had more than 5 with average size of 6.0.

The source of farm and off-farm income of lac growers in Kanker district of Chhattisgarh is depicted in figure 42. The ratio of farm and off-farm income was 58:42. Income from lac cultivation was found to

contribute towards 23.54 and 40.73 per cent of total income and farm income respectively. Lac was a subsidiary crop for the lac growers who depend on it for meeting cash expenses towards family needs and cash purchase for their house hold requirements. Amongst the different sources of income, foodgrains ranked 1st (25.87 per cent) followed by lac (23.54 per cent), forest produce (16.22 per cent), labour (14.63 per cent), business/shop (4.88 per cent), livestock (4.24 per cent), vegetables (4.14 per cent), salary job (3.71 per cent) and others (2.7 per cent).

The data on lac host holding have been presented in Table 34. About 58.0 per cent lac growers had *Palas* (*Butea monosperma*), 17.0 per cent had *Ber* (*Zizyphus mauritiana*), 86.0 per cent had *Kusum* (*Schleichera oleosa*) and 12.0 per cent had other host trees available for lac cultivation. This shows that majority of lac growers had *kusum* tree for lac cultivation. Regarding availability of *Palas* host for lac cultivation, maximum lac growers (23.0 per cent) had holding of 10-25 hosts (average number 13.04) followed by 20.0 per cent with holding of less than 10 hosts (average number 3.95), 11.0 per cent had holding of 26-50 host (average number 36.64) and only 4.0 percent had holding of more than 50 host (average number 231.25). In case of *Ber*, 16.0 per cent lac growers had holding of less than 10 hosts (average number 2.38) and 1.0 per cent had holding of more than 50 hosts (average number 100.0). In case of *Kusum*, maximum lac growers (37.0 per cent) had holding of less than 10 hosts (average number 4.65) followed by 35.0 per cent with holding of 10-25 hosts (average number 16.37), 11.0 per cent had holding of 26-50 hosts (average number 38.73) and only 4.0 per cent had holding of more than 50 hosts (average number 59.0). Few lac growers had other lac host holding, 8.0 per cent lac growers had holding less than 10 hosts (average number 3.63) followed by 3.0 per cent had holding of 10-25 (average number 20.0) and 1.0 per cent had holding of more than 50 hosts (average number 250.0).

The lac production status of lac growers is depicted in figure 43 (a b & c) showing that the utilization of host trees for lac cultivation in the study area was 58.65 per cent for *Palas*, 32.61 per cent for *Ber*, 39.76 per cent for *Kusum* and 21.24 per cent for other host trees. This indicates a greater scope for

increasing lac production by utilizing more hosts for lac cultivation. The major causes for low utilization of hosts were found to be shortage of fund for purchase of broodlac, distance of host plant from home, uncertainty in production, height of hosts, scattered host plant, high cost of broodlac and difficulty in management of large scale hosts.

The ratio of *Rangeeni* and *Kusmi* lac produced at growers level were 20:80. This was due to huge availability of *Kusum* host in the study area in farmers land and in forest area. In the district, maximum contribution (79.03 per cent) in lac production was from *Kusum* followed by *Palas* (19.55 per cent), other hosts (1.28 per cent) and *Ber* (0.14 per cent). In terms of production, 51.0 per cent lac growers produced lac in the production group below 100 kg. with average production of 60.44 kg, 23.0 per cent lac growers in the production group 100-200 kg with average production of 161.22 kg, 11.0 per cent lac growers in the production group 201-300 kg with

average production of 234.44 kg and 15.0 per cent lac growers in the production group more than 300 kg. with average production of 418.08 kg. annually. Some of the growers were more interested in foodgrains production and some of the lac growers harvested *ari* lac (immature lac) because they do not have the financial resources to wait for the crop maturity stage and problem of theft increases at maturity stage.

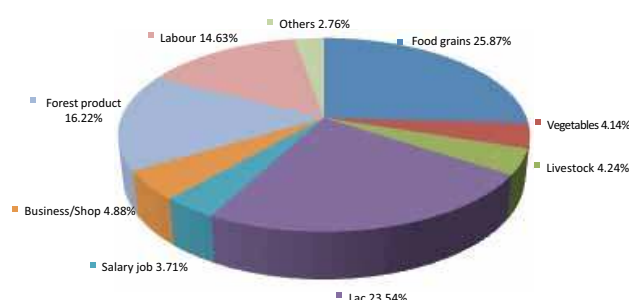


Fig. 42 Farm and off farm income of lac growers in Kanker distt.

Table 34. Lac host holding of lac growers

| Sl. No. | Name of hosts | Host holding group/average percentage of farmers | | | | |
|---------|---|--|-----------------|-----------------|-----------------|-----------------|
| | | No host | <10 | 10-25 | 26-50 | >50 |
| 1 | <i>Palas</i> (<i>Butea monosperma</i>) | 42.0 | 20.0 (3.95)* | 23.0 (13.04) | 11.0 (36.64) | 4.0 (231.25) |
| 2 | <i>Ber</i> (<i>Zizyphus mauritiana</i>) | 83.0 | 16.0 (2.38) | 0.0 | 0.0 | 1.0 (100.00) |
| 3 | <i>Kusum</i> (<i>Schleichera oleosa</i>) | 14.0 | 37.0 (4.65) | 35.0 (16.37) | 11.0 (38.73) | 4.0 (59.0) |
| 4 | Other | 88.0 | 8.0 (3.63) | 3.0 (20.0) | 0.0 | 1.0 (250.0) |

*Figures in parentheses are the average number of hosts in respective group

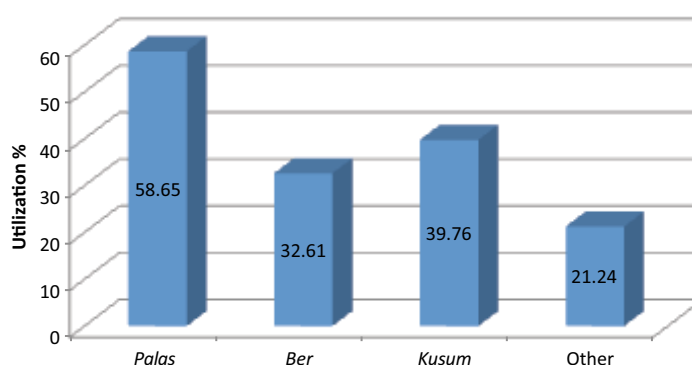


Fig. 43a Utilization of lac host trees (%)

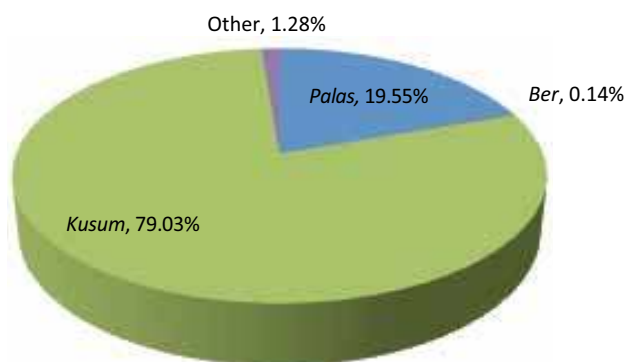


Fig. 43b Host-wise lac production at growers level

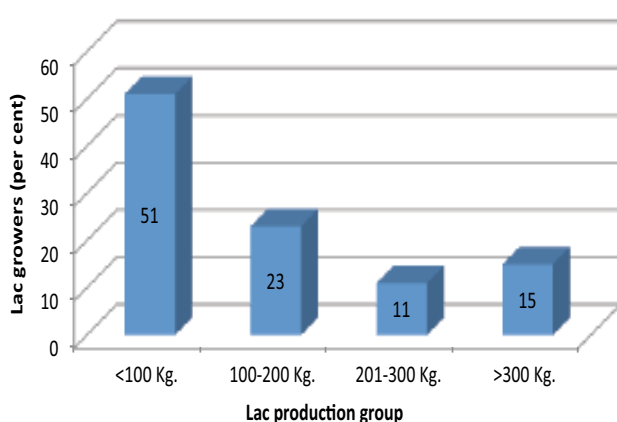


Fig. 43c Distribution pattern of lac growers on the basis of lac production

Survey of lac growers in Korba District

Survey of lac growers has been conducted in five villages of Korba (Kerakachar, Kolga, Simkenda, Samarkana and Solwan) and five villages of Katghora forest division (Chewndhara, Dumarmuda, Kuteshar-Nagoi, Dongartarai and Banbandha) of Chhattisgarh. The information shows that agriculture, lac and minor forest produce were the main source of income generation for the farmers. Preliminary analysis of data shows that average lac host holding was 26 (*Palas, Ber, Kusum*) while utilization percentage of lac host for lac cultivation was approximately 40 per cent. Per family average annual income from lac cultivation was around Rs 8000. Government assistance for lac cultivation in the project area was in the form of training on scientific method of lac cultivation, broodlac distribution, pesticide and implements distribution, crop monitoring etc. Detailed analysis of survey data is in progress.

A survey of lac cultivators was performed for

constraint analysis. The major constraints reported are:

- Lack of demonstration of scientific and technical method of lac cultivation in farmer's field.
- Non-availability of inputs like insecticides, nylon net etc. in local market.
- Heat mortality during summer.
- Damage to lac crop due to fog in winter season.
- Prevalence of theft.
- Problem of storage.
- Non-availability of good rate for lac.

Market survey in Jagdalpur

Jagdalpur is the big centre of wooden decorated furniture and wooden handicraft articles. Manufacturing of furniture and handicraft article is made mainly with teak and khamhar wood. Bastar is famous for teak wood and quality of Bastar teak is superior in India. The specialty of Jagdalpur furniture is carving on wooden articles with tribal art. The varnishes used on the furniture and wooden handicraft articles is based on lac (own prepared varnish) along with varnishes of other brands like Asian Paints (Touch Wood, Melamine), Pidilite (Wudfin) etc. Furniture and handicraft articles from wood and bell metal in Jagdalpur is a big consumption area for utilization of lac based varnishes. In Jagdalpur, there are around 15 big manufacturers and the average consumption of varnish is around 100 litre per manufacture per month. The total number of manufactures is around 300 (big and small manufacturers) and monthly consumption of wood varnish is around 25000-30000 litre in Jagdalpur. There is no exporter of wooden decorated furniture and wooden handicraft articles in Jagdalpur. Manufacturer feels that supply of items is less because of manufactured items sells in Indian Market only.

Price spread in Marketing of Lac

The average marketing costs and margins involved in marketing of lac were analyzed and it was observed that no expenditure incurred by lac growers in lac marketing because they sell their

produce either to primary purchaser in village or nearby markets. The quantity of each sell was small, ranging from 1 to 15 kg. Earnings from lac are utilized to fulfill the daily requirement of lac grower's household. The marketing costs incurred by primary purchaser per quintal were Rs. 13, Rs. 35 and Rs. 15 on transportation, handling loss (moisture loss) and other respectively. Primary purchaser received a margin of Rs. 260 per quintal. During peak arrival period the primary purchaser sell the produce to the wholesaler with in one or two days while in lean period they sell it on weekly basis.

Major portion of the marketing cost during marketing of lac is being paid by the wholesaler. The total marketing cost paid by wholesaler was Rs. 743 per quintal. The wholesaler marketing margin was Rs. 140 per quintal. Major portion of marketing cost at wholesaler level was the moisture loss in storage and on an average it came to Rs. 350 per quintal. The moisture loss was on the higher side in case of *ari* (immature) lac while it was on the lower side in case of *phunki* (used-up broodlac seed in case of lac cultivation) lac. On an average transportation cost paid by wholesaler was Rs. 130 per quintal. This cost varies according to the location of the different lac processing centers in the country where it is to be disposed for processing and amount of quantity handled.

Thus, it is evident that the primary purchaser and wholesaler are the vital player in marketing of lac in the study area. Major portion of the arrivals in the market are marketed through Kanker and Dhamtari (Chhattisgarh). Arhat is a place managed and owned by Arhatias or Commission Agents. Commission Agents is a person operating in the wholesale market who acts as the representative of either a seller or a buyer. A commission agent takes over the physical handling of the produce, arranges for its sale, collects the price from the buyer, deducts his expenses and commission and remits the balance to the seller. In an *Arhat* lac is sold by open auction method and the *Arhat* charges were 3 per cent of the amount transacted i.e. selling price of wholesaler.

Regarding the price spread in marketing of lac, it was found that price received by the lac growers was Rs.

70 per kg. This constitutes about 85.30 per cent of consumer's price. The primary purchaser gained a net margin of Rs. 260 per quintal by selling the produce to the wholesaler after incurring a marketing cost of Rs. 63 per quintal. The wholesaler in turn sell the produce to lac manufacturers incurring marketing cost of Rs. 743 per quintal which constitutes 9.05 per cent of consumer's price. The wholesaler earns a net margin of Rs. 140 per quintal.

A variety of constraints are associated with marketing of lac like lack of grading and standardization facility, lack of support services in the market, lack of information on current prices of lac, adulteration, price fluctuation and lack of infra-structural facilities i.e. transportation, storage. It is also reported that same time speculation made by trader (At one market traders purchased lac at high price, this high price of lac disseminate amongst lac growers and in next market day growers came with large quantity in market for sell, traders in this market down the price resulting into low price availability to lac growers). As the lac growers sell lac in very small quantities, it leads to imperfect competition price in the market. Due to cash need the farmers are forced to sell the produce even at a very low price. Some times the lac growers are indebted to local traders and hence they resort to village sale. All the lac growers are selling lac without any value addition and this fetches low price. Non-availability of proper record related to marketing is a major constraint for initiation of systematic marketing programme. The resource poor farmers, having small marketable surplus, are unable to take the advantage of higher prices prevailing in the distance consuming market.

Demand of lac

In recent years, revival of natural trend has stimulated the interest of sub-forest dwellers and tribal people in lac extraction from forests to sustain their livelihood. According to exporter, importers and manufacturer of lac presently the demand of seedlac and other value added products is around 17000-18000 tons. Demand of lac may increase up to 25-30000 tons if there is stability in the prices and production of lac. Increase in demand is expected

due to realization for eco-friendly and safe natural materials for human contact and consumption.

Global consumption of lac

Average consumption of lac in major lac (seedlac and other value added products) consuming countries has been shown in Figure 44. The average annual global consumption of seedlac and other value added products is around 18065 tons. USA is the largest consumer of lac in the world and consumes around 33 per cent of global consumption.

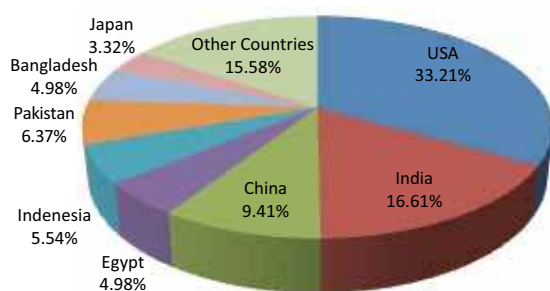


Fig. 44 Global scenario of average annual lac consumption

3.3 Liasion, Information and Advisory Services

3.3.1 Network project on harvesting, processing and value addition of natural resins and gums

Dr YSPUH & F, Solan

Bore Hole tapping of resin in chir pine

Experiment was carried out within the natural range of *Pinus roxburghii* Sargent. Investigating trees were located in the campus area of Dr Y.S. Parmar University of Horticulture and Forestry, Nauni, Solan, near Oachghat at an altitude of 1200-1225 m above mean sea level and lies at 30° 51' N latitude and 76° 11' E longitude. This represents a transitional zone between subtropical and temperate region of the state of Himachal Pradesh. The collection of oleoresin was made from 146 trees of *Pinus roxburghii*. The oleoresin collected from each tree was weighed and recorded. Based on oleoresin yield 75 trees were selected and classified into three broad oleoresin yield classes viz.; Low resin yielders (LRY) i.e. below 1200 gm, Medium resin yielders (MRY) i.e. 1200-2000 gm, and High resin yielders (HRY) i.e. above 2000 gm.

Trees were located as natural stand in the university campus, which were marked and numbered. The diameter of the trees at breast height was measured in these categories. However, the diameter classes up to 55 cm were used for comparison of resin yield in different diameter classes. The method employed for oleoresin collection was bore hole method (Fig. 45). The data pertaining to relationship of oleoresin yield to some physical parameters have been collected, statistically analyzed and results are reported below.



Fig. 45 Bore hole method of oleoresin tapping in chir pine

Effect of tree diameter on oleoresin yield

The data revealed that maximum oleoresin yield of 2.24 kg/tree was recorded in 40-45 cm diameter class which was statistically at par with 45-50 cm (2.13 kg/tree) and 50-55 cm (2.00 kg/tree) diameter classes. Minimum oleoresin yield of 1.35 kg/tree was recorded in 30-35 cm diameter class which was statistically at par with 35-40 cm (1.54 kg/tree) diameter class.

Effect of DBH on oleoresin yield per hole

The data revealed that the oleoresin yield per bore hole was significantly influenced by the DBH. The DBH showed significant effect on oleoresin yield. The maximum oleoresin yield of 741g/hole was recorded in 40-45 cm diameter class which was statistically at par with 45-50 cm diameter class (709.7 g/hole). The minimum oleoresin yield of 450g/hole was observed in 30-35 cm diameter class which was statistically at par with 35-40 cm diameter class (512 g/hole).

Technological gaps identified during 2009-10

1. The oleoresin extracted by using rill method contains impurities (sucky) (Fig. 46 & 47).



Fig. 46 Impurities (dust, bark, needles, etc.) in oleoresin extracted by Rill method



Fig. 47 Clear oleoresin extracted in Bore hole method

2. Persons engaged by contractors in tapping work are not skilled and require proper training (Fig. 48 & 49).



Fig. 48 Tapping of under sized trees by unskilled persons



Fig. 49 Uncontrolled blaze sizes made by unskilled persons

3. Containers used for collection and storage are vulnerable to loss of turpentine content and forest fires.

4. Tins used for storage and transportation also spoils the quality of both turpentine and rosin.

CAZRI, Jodhpur

Standardization of gum arabic-inducer dose

An experiment was carried out using different concentration of ethephon to work out the medium dose. It was observed that maximum gum was produced when plants were treated with ethephon @ 780 mg/ 4ml of gum inducing solution. The study

concluded that 780 mg/ 4ml is most suitable dose for getting higher gum production from *A. Senegal*.

Standardization of time of application of gum arabic-inducer

A. Senegal trees were treated with gum inducer during different months to work out the appropriate period of treatment. The higher gum production was recorded from February to June and maximum gum was produced during April and minimum during September (Table 35). In case of untreated (control) plants, gum exudation occurred in March and April, which was almost negligible in terms of quantity.

Table 35. Monthly variation in the gum production of *Acacia Senegal* trees after treatment with gum inducing chemical and without treatment.

| Month | Average production of gum/plant (g) | |
|-----------|-------------------------------------|--------------|
| | Treated with gum inducing chemical | No treatment |
| August | 5-10 | - |
| September | 0-3 | - |
| October | 6-12 | - |
| November | 7-14 | - |
| December | 20-40 | - |
| January | 25-80 | - |
| February | 50-300 | - |
| March | 45-500 | 0-5 |
| April | 100-1000 | 5-15 |
| May | 30-250 | - |
| June | 15-150 | - |
| July | - | - |

Mechanization of treatment procedure

Under normal course, a hand drill commonly known as Girmit is used to make hole in tree trunk to inject gum inducer (ethephon). A person using such drill can treat 20-25 trees/day. To enhance the speed for treatment battery operated drill was used first time. A person can make hole on tree trunk within 10 seconds. Using battery operated drill entire treatment operation can be completed within 2 minutes (Fig. 50). This can facilitate rapid treatment of trees in desertic terrain with minimal labour. A person can treat 100-150 trees/day without any problem



Fig. 50 Hole making in tree trunk with battery operated drill to inject gum inducer

Gum production from *A. leucopholia*

The plant (*A. leucopholia*) is a very prominent species of tropical dry thorn forest. It is found in abundance in eastern and south eastern margin of arid tract of Rajasthan. The gum of the species is edible having high viscosity and therefore, preliminary trial was done at Pali and Jadan area in Pali district which borders with Aravali ranges. The soil at Pali area is sandy clay with a kankar pan at 45 – 65 cm depth. The trees were treated during second week of March and gum exudation was started after 7-9 days (Fig. 51). In three pickings average 70 g gum/tree was harvested. At Jadan area where the soil quite shallow and topography is rocky stony, the gum production ranged between 10.6 and 66.1 g/tree. The average production was of very low order (19.5 g/tree).



Fig. 51 Gum tears from *A. leucopholia*

JNKVV, Jabalpur

Tapping Device

A simple rolling type tapping device has been developed for tapping of *guggul* (Fig. 52). The device has a circular plate of 4 cm diameter and 2 mm thick with sharp blade on its outer edge. Initial testing of the device was carried out on *guggul* plantation and found effective. The effect of blaze shape and size, direction of blazes, time of tapping on yield of gum karaya have been studied in order to develop protocol for safe tapping and maximum yield of gum karaya.



Fig. 52 Rolling type tapping device for *guggul* gum tapping

MAU, Parbhani

Guar Germ Meal

- Method has been standardized for the extraction of guar gum (95% purity) from the seed.
- Experiments on fortification of bread and cookies with 0.5%, 1%, 1.5% and 2% guar germ meal was carried out (Fig. 53). Bread and cookies containing 1% Guar germ meal were found acceptable



Fig. 53 Fortification of bread and cookies with guar meal

- Guar meal is the by-product of the Guar gum Industries, is rich in protein (~55%).

NRC-AF, Jhansi

Different Agro- forestry models were developed and tree seedlings were planted in Centre Research farm.

Development of Agro-forestry models

Agri-horti-silviculture

| | |
|-------------------------|---|
| <i>Acacia senegal</i> | : 10 x 20 m (28 trees) |
| Lemon (<i>Kagazi</i>) | : 5 m in the middle with in the <i>Acacia senegal</i> rows (24) |
| <i>Bael</i> | : 10 m between the <i>Acacia senegal</i> rows Two varieties (14 trees of CISH B1 & CISH B2 each) |
| <i>Karonda</i> | : In the boundary 1m (35 trees), 1.5m (56 trees) & 2 m (32 trees) |
| Annual crops | : Black gram (PU 19)-Mustard (Pusa Jagannath) |
| Area | : 0.5 ha |
| Date of planting | : 15.07.09 |



Fig. 54 Agri- Horti- Silviculture

Horti-Silviculture-I

| | |
|-------------------------|---|
| <i>Acacia senegal</i> | : 6 x 6 m (41 trees) |
| Lemon (<i>Kagazi</i>) | : 6 x 6 m (42 trees) two rows with one row of <i>Acacia senegal</i> |
| <i>Acacia senegal</i> | : In the boundary 2 m (47 trees) |
| Area | : 0.36 ha |
| Date of planting | : 15.07.09 |



Fig. 55 Horti-Silviculture-I

Horti-Silviculture-II

Acacia nilotica : 6 x 6 m (31 trees)

Guava (*Allahabad safeda*) : 6 x 6 m (48 trees) two rows
with one row of *Acacia nilotica*

Acacia senegal : In the boundary 2 m (30 trees)

Area : 0.39 ha

Date of planting : 15.07.09



Fig. 56 Horti-Silviculture-II

Horti-Silviculture-III

Acacia catechu : 6 x 6 m (23 trees)

Moringa (perennial) : 6 x 6 m (23 trees) alternate row
with *Acacia catechu*

Acacia senegal : In the boundary 2 m (54 trees)

Area : 0.2 ha

Date of planting : 15.07.09



Fig. 57 Horti-Silviculture-III

Block plantation

Acacia senegal : 6 x 6 m (131 trees)

Area : 0.50 ha

Date of planting : 24.07.09 and gap planting:
14.08.09

Survival per cent of *A. senegal* seedlings were 92.4 %
in the hilly area.

Canopy management in established *Anogeissus* plantation

i) *Anogeissus pendula* : 5 x 5 m (91 trees)

Canopy management : 100 % pruning in the two
middle rows

Annual crops : Black gram (T-9)- Taramira
(Karan)

Area : 0.30 ha

Date of planting : 1998

ii) *Anogeissus latifolia* : 5 x 5 m (72 trees)

Canopy management : 100 % pruning in the two
middle rows

Annual crops : Guar-Taramira (Karan)

Area : 0.25ha

Date of planting : 1998

At farmer's field

i). *Takur Das, GKD WS (Horti-agri-silviculture)*

Acacia nilotica : In the boundary (only in 2 sides)
at 5m spacing (14 trees)

Guava (*Allahabad safeda*) : 9 x 6 m (31 trees)

Annual crops : Green gram/Black gram- Wheat/
Mustard

Area : 0.36 ha

Date of planting : 28.07.09

ii). *Hanumanth, GKD WS (Horti-silviculture)*

Acacia senegal : In the boundary (all 4 sides) at
5m spacing (35 trees)

Karonda : In the boundary between *Acacia
senegal* (29 trees)

Guava (*Allahabad safeda*) : 6 x 6 m (55 trees)

Area : 0.30 ha

Date of planting : 28.07.09

iii). *Saligram, GKD WS (Horti-agri-silviculture)*

Acacia nilotica : In the boundary at 5-7 m spacing
(8 trees)

Aonla : 7 x 6 m (18 trees)

Lemon : 7 x 6 m (10 trees)

Annual crops : Green gram/Black gram-Wheat/
Mustard

Area : 0.13 ha

Date of planting : 28.07.09

iv). *Himmanth, GKD WS (Horti-agri-silviculture)*

Acacia Senegal : In the boundary (all 4 sides) at
5m spacing (46 trees)

Karonda : In the boundary between *Acacia
senegal* (43 trees)

Aonla : 8 x 8 m (54 trees) planted during
2006

Annual crops : Ground nut/Black gram-Wheat/
Mustard

Area : 0.47 ha

Date of planting : 28.07.09 except Aonla.

Standardization of gum extraction technique in *Anogeissus pendula*

Spacing : 3 x 2 m

Area : 1.00 ha

No. of trees : 924

Date of planting : 04. 09.1994 & 04.08.1995, 15
years old

Treatments

Chemical : Gum inducing chemical
(Ethephone 39 EC)

Concentrations : Three (390 mg, 780mg, 1170mg)

Quantity : 4 ml/ tree

Duration : at 15 days interval, once in a tree
per year.

No. of trees per treatment : Five

Biochemical analysis : Sugar content in the wood
samples before injection and after 15 days will be
collected and estimated.

Video production on gum and resin yielding trees

A short film on gum and resin yielding trees and tree-
crop combinations were made. The commentary in
English was completed while the commentary in
Hindi to be carried out and submitted.

IGKVV, Raipur

Method of karaya gum tapping

During survey, it was found that the gum pickers are
not dependent on gum collection only. The normal
practice is that while going for other work they
collect Gums as a side work in which not much time is
involved. Gum Pickers make blaze with the help of an
Axe or 'Kulhadi' on trunk of the tree. The three types
of blazing have been observed during the survey:

- They make 2-3 blazes of around 10 cm x 20 cm
size on the tree at different places at a time.
Collect gum from it after 7-8 days and again
make another 2-3 blaze or more and sometimes
even more.
- They make around 10-20 cuts on the tree trunk
at a time; gum is collected after 7-8 days and
make another 10-20 cuts on the tree trunk.
- They make a big blaze and collect the gum after
7-8 days. At the time of collection, they make
another blaze just after it leading to girdling.



Fig. 58 Karaya gum exudate from *Sterculia urens*

Production of karaya gum

The karaya gum trees are found in the forest areas of Dandewada district of Chhattisgarh state. Along with this, a few number of Karaya gum trees have also been found in Kanker, Jagdalpur, Bijapur, Dantewada, Sukuma, Korea and Gariyaband forest. Table 36 gives an idea about the Karaya gum collection in Chhattisgarh state based on the information provided by the Department of Forest.

Table 36. Karaya gum collection from potential areas of Chhattisgarh

| Sl. No. | Division | Year wise collection (in quintals) | | |
|--------------|-----------|------------------------------------|---------------|----------------|
| | | 2005-06 | 2006-07 | 2008-09 |
| 1 | Sukuma | 144.34 | 135.00 | 393.86 |
| 2 | Bijapur | 275.15 | 65.16 | 306.02 |
| 3 | Dantewada | 222.30 | 214.80 | 350.00 |
| Total | | 641.79 | 414.96 | 1049.88 |

Technological gaps/problems in tapping and production

1. Continuous blazing in unscientific method kills the tree in 6-7 years or in less than that.
2. The blazing with axe cut the skin as well as cambium, which is regenerating tissue of the tree. This prevents the healing and further growth of tree. If the blazing continues for long tree dies. This also causes the release of other secretions like

tannin from the bark of the tree. These tannins discolour the gum and turn into yellow, brown or red from white.

3. Tree bark also comes along with gum when gum is collected with knife. The tree bark releases tannin, which discolour the gum.
4. Due to collection in leaf, leaf part remains in the gum. This adds to impurity as well as release the tannin, which lead to the problem of discolouration of gum.
5. Due to collection in plastic bag, there is no proper air and sun light and lead to more moisture which attracts fungus attack.

Processing of gum karaya

Information on primary processing at harvesters/ traders level along with machinery/gadgets.

Drying

Drying of the karaya gum in whatever form available with the collectors/middleman/stockiest is done basically for the reduction of moisture content as well as to have easiness in the cleaning. The drying is mostly done by female. For drying, the gum is spread on cleaned floor or tiled/thatched roof in the sunlight. It takes 3-4 days for drying depending on the moisture content.

Cleaning

Gum pickers normally do not perform cleaning process, but they remove the bark and other unwanted materials and dirt sticking to the gum lumps. However, the most of the cleaning work is done while drying. In some cases, the gum lumps are placed over a fine screen to remove the fine dirt particles.

Grading

Gum pickers or collectors normally do not perform grading of the gum. However, the grading of gums are done at traders level as prices are different for different grades of gums. Mostly this gum is graded into two categories (A and B). These categories are not based on any scientific recommendations, but with respect to trader's interest and a slight difference in sale price.

Method of storage

In village or hilly area mostly the gum pickers keeps the dry gum in jute or plastic bags and they store these bags into a dry and shaded place. A few collectors also use the plastic recycled fertilizer bags for the storage of gums.

Technological gaps

- Due to drying in open space chances of impurities added in the gum.
- There is no specific method of grading of gum.
- The high moist gums should not be stored in plastic bags unless it is dried well.
- The well dried cleaned gum should be stored in air tight containers.

- The mechanical drying of gums should be attempted to avoid contaminations of impurities, possibilities of discoloration and reduction in drying time

Development of protocol for safe tapping

Methods of tapping of gum from the karaya plants are being tried in the field in order to see the effect of method of tapping, the trees of different age group has been selected in two distinct region/ area of Chhattisgarh namely Gariyaband and Korea. The other variants are the time of tapping / blazing. Immediately after the rainy season its tapping was started from the month of October, 2009 at a regular interval of one month.

4. APPROVED ON-GOING RESEARCH PROJECTS



| Sl. No. | Project | Principal Investigator |
|-------------------------------|---|------------------------------|
| 4.1 Insect Improvement | | |
| 1 | Collection, conservation, characterization and documentation of lac insect bio-diversity | Dr KK Sharma |
| 2 | Field evaluation of promising lac insect races, lines and breeds for higher productivity and superior performance | Dr Md Monobrullah |
| 3 | <i>In Vitro</i> culturing of lac insect cells | Dr Thamilarsi, K |
| 4 | To understand the nature of diversity in lac insects of <i>Kerria spp.</i> in India and the nature of insect x host interaction (NAIP- Component -4) | Dr R Ramani/ Dr KK Sharma |
| 4.2 Host Improvement | | |
| 5 | Collection, conservation, characterization and documentation of lac host bio-diversity | Dr Vaibhav D Lohot |
| 6 | Host plant evaluation and improvement for lac productivity & summer sustainability | Dr S Ghosal |
| 4.3 Crop Production | | |
| 7 | Development of <i>kusmi</i> lac cultivation technology on <i>Albizia procera</i> | Dr AK Jaiswal |
| 8 | Management of sooty mould causing lac insect death and failure of lac crop | Dr AK Singh |
| 9 | Soil fertility management of <i>ber</i> (<i>Z. mauritiana</i>) for shoot growth and lac yield (<i>aghani</i>) | Dr S Ghosal |
| 10 | Production of quality <i>Kusmi</i> broodlac at Institute Research Farm (IRF) | Dr KK Sharma |
| 11 | <i>Rangeeni</i> lac insect survival on <i>ber</i> and <i>palas</i> in relation to season, physiology of host plant and soil moisture stress: a biochemical approach from host plant perspective | Mr Anees K |
| 12 | Evaluation of mulches for enhancing lac production on <i>palas</i> , <i>ber</i> and <i>Flemingia semialata</i> under rainfed condition | Mr RK Singh |
| 13 | Development of lac production system using high density <i>ber</i> plantation under semi protected conditions (NABARD sponsored) | Dr R Ramani |
| 14 | Production of summer <i>kusmi</i> broodlac on <i>kusum</i> for promotion of lac cultivation in Gujarat with farmer's participation. (Forest Department, Silva Division, Gujarat) | Mr RK Singh |

4.4 Synthesis and Product Development

| | | |
|----|---|----------------|
| 15 | Synthesis of thiosemicarbazide and thiadiazole from aleuritic acid and testing of its antifungal/ hypoglycemic/ antinemic activities | Dr Divya |
| 16 | Comparative evaluation of physico-chemical, anti-inflammatory and hypolipidemic properties of oleo gum resin of <i>Boswellia serrata</i> , <i>Commiphora mukul</i> , <i>C. wighii</i> | Dr MZ Siddiqui |
| 17 | Synthesis of hydrogel from gum acacia and gum karaya for their comparative evaluation in drug release | Shri SKS Yadav |

4.5 Surface Coating and Use Diversification

| | | |
|----|---|----------------|
| 18 | Development of surface coating formulation based on shellac synthetic resin/polymer blend | Dr MF Ansari |
| 19 | Preparation and market evaluation of heat & water proof shellac varnishes for wooden surfaces & air drying type shellac based glazing varnishes | Dr MZ Siddiqui |

4.6 Processing and Storage

| | | |
|----|---|-------------|
| 20 | A value chain on lac and lac based products for domestic and export markets. (NAIP Component-2) | Dr N Prasad |
|----|---|-------------|

4.7 Human Resource Development

| | | |
|----|--|---------------|
| 21 | Training, demonstration, extension education and information service on lac culture, processing and product development | Dr AK Jaiswal |
| 22 | Enhancing livelihood options for poor tribal families of the Jharkhand state through capacity building in cultivation of lac and its value addition (JLDS) | Dr KK Sharma |
| 23 | Developing sustainable farming system models for prioritized micro water shed in rainfed area in Jharkhand with BAU, Ranchi. (NAIP component - 3) | Dr AK Jaiswal |
| 24 | Improving rural livelihood security through sustainable integrated farming system model and allied enterprises in Bastar region of Chhatisgarh with IGKVV, Raipur. (NAIP component -3) | Dr AK Jaiswal |
| 25 | National Action Plan (NAP) for sustainable income generation of tribals through cultivation and processing of lac. | Dr JP Singh |

4.8 Technology Assessment, Refinement and Dissemination

| | | |
|----|---|-------------|
| 26 | Evaluation of some newer insecticides & bio pesticides for eco-friendly management of insect pests associated with lac insect & host plants | Dr JP Singh |
| 27 | Lac based agro forestry in Bundelkhand region: Introduction & evaluation. (NRCAF Collaborative Project) | Dr S Ghosal |

| | | |
|----|---|----------|
| 28 | Study and documentation of cultivation & processing of lac in Chhattisgarh & market survey on lac based products (MFP Chhattisgarh Govt.) | Dr G Pal |
|----|---|----------|

4.9 Liaison, Information and Advisory Services

| | | |
|----|---|-------------|
| 29 | Network project on harvesting, processing and value addition of natural resin and gums (ICAR) | Dr N Prasad |
|----|---|-------------|

4.10 Exploratory trial

| | | |
|----|--|--------------|
| 30 | Impact of pitcher fertigation (urea) on shooting response and <i>Kusmi</i> lac yield on <i>ber</i> | Mr RK Singh |
| 31 | i) Trials of fruit coating formulation (developed earlier) on shelf life of pomegranate ii) Trials of fruit coating formulation (developed earlier) on shelf life of mandarin oranges | Dr PC Sarkar |
| 32 | Improvement in Nail Polish | Mr MF Ansari |
| 33 | Shellac modification by tamarind gum and guar gum | Dr KP Sao |
| 34 | Effect of salt on scraped lac during storage | Mr MF Ansari |



5. PUBLICATION AND PUBLICITY

5.1 Publications

5.1.1 Research papers

- Ghosal S, Ramani R, Monobrullah M and Singh JP 2010. Lac encrustation thickness in relation to spray of *Bacillus thuringiensis var kurstaki*. *Ann. Entomol.* **28** (2): 45-47.
- Ghosal S and Singh JP 2010. Settlement pattern of *rangeeni* form of lac insect *Kerria lacca* as influenced by location of broodlac placement. *Ann. Entomol.* **28** (1): 27-30.
- Giri SK, Ansari MF and Baboo B. 2010. Effect of storage methods on quality of lac - a natural resin. *Journal of Agricultural Engineering.* **47** (1) : 22-26.
- Mishra YD, Baboo B, Singh HS, Sisodiya SP, Singh RK and Amin AJ. 2010. *Kusmi* lac cultivation on *Prosopis juliflora* (ganda bawel), a derided weed in Gujarat. *Indian Forester.* **136** (3) : 393-396.
- Pal G, Bhagat ML and Bhattacharya A. 2009. Economics and resource use efficiency of lac cultivation in Jharkhand. *Indian Journal of Forestry.* **32** (1) : 95-98.
- Pal G, Jaiswal AK and Bhattacharya A. 2009. An analysis of price spread in marketing of lac in Madhya Pradesh. *Indian Journal of Forestry.* **32** (4) : 581-584.
- Pal G. 2010. Growth and Instability in production and export of Indian lac. *Indian Forester.* **136** (9) : 1235-1240.
- Pal G. 2010. An economic analysis of lac marketing in Kanker District of Chhattisgarh. *Agricultural Economics Research Review.* Vol. 23 (Conf. No.): 546.
- Pal G, Jaiswal AK and Bhattacharya A. 2010. An analysis of trend and variation in prices of lac at different levels of market in West Bengal. *Indian Journal of Agricultural Marketing.* **24** (1) : 1-5.
- Pal G, Jaiswal AK and Bhattacharya A. 2010. Estimation of lac production and processing in India. *Environment and Ecology.* **28** (1B) : 572-576.
- Patil PM, Ansari MF and Prasad KM. 2010. Effect of urea and thio-urea on the performance of water soluble lac varnishes. *Paint India LX* (1) : 77-82.
- Prasad N and Giri SK. 2010. Harvesting/tapping techniques for production of natural resins and oleo-resins – A Review. *Journal of Non-Timber Forest Products,* **17** (2) : 135-146.
- Singh BP, Ghosal S, Singh AK and Mishra YD. 2008. Weeds of rainy season in plantations of five lac host species. *Indian Journal of Weed Science.* **40** (1-2) : 52-54.
- Singh BP, Mishra YD and Yadav SK. 2008. Effect of intercropping of vegetable crops on growth of *Flemingia semialata* Roxb. and lac yield under irrigated conditions. *Ann. Entomol.* **26** (1-2) : 39-46.
- Singh RK, Mishra YD and Baboo B. 2010. Impact of pitcher irrigation and mulching on the summer season (*jethwi*) lac crop sustainability and pruning response on *ber* (*Ziziphus mauritiana*). *Indian Forester.* **136** (12) : 1709-1712.
- Srivastava S and Ray DP. 2009. Mosquito (*Anopheles stephensi*) larvicidal activity of essential oils of curry leaf (*Murraya koenigii* (L.) Spreng.). *Pesticide Research Journal.* **21** (2) : 148-149.

5.1.2 Papers presented/contributed in conferences/symposia/seminars

- Monobrullah Md. "Bio-efficacy of some selected insecticides against pentatomid bug, *Tessaratoma javanica* Thunb.: A sporadic pest of *Kusum* (*Schleichera oleosa*)" in 8th National Symposium on Problems and Perspectives in

Eco-friendly Innovatives to Plant Protection during January 24-25, 2010 at Kanpur. 71-72 pp.

- Singh RK, Baboo B and Singh BP "Micro-catchment rain water conservation for increased soil moisture level and growth and development of lac host *Ber* (*Ziziphus mauritiana*) under rainfed condition" in Regional Seminar on Exploration, Development and Management of Ground Water in Hard Rocks with special reference to Jharkhand State during March 25-26, 2010 at Ranchi 61 p.
- Siddiqui MZ "Jal, Jeevan aur Jan-Chetna" in 12th *Rashtriya Krishi Vigyan Sangoshthi on Satat Krishi Utpadan, Sanvardhan avum Sanrakshan hetu Prakirtik Sansadhamo ka Prabandhan* during April 22-24, 2010 at Karnal (Haryana), 157-158 pp.
- Siddiqui MZ "Manav Sansadhamo Ke Ubherthe Aayaam" in 12th *Rashtriya Krishi Vigyan Sangoshthi on Satat Krishi Utpadan, Sanvardhan avum Sanrakshan hetu Prakirtik Sansadhamo ka Prabandhan* during April 22-24, 2010 at Karnal (Haryana), 168-169 pp.
- Prasad N, Bengali Baboo and Pandey SK "Empowering lac grower through small scale lac processing unit" in National Seminar on Engineering Intervention to Enhance Income of Small and Marginal Farmers during Sept.29-30, 2010 at Delhi. 220-227 pp.
- Singh RK, Singh BP and Baboo B. Soil Moisture Dynamics as Influenced by *in-situ* moisture conservation practices in *Ber* (*Ziziphus mauritiana*) plantation under rainfed condition in National Conference on Watershed Management on Sloping Lands for Environment and Livelihood Security during November 11-12, 2010 at Shillong. 36 p.
- Ghosal S and Sharma KK. 2010 Soil fertility amelioration and its effect on winter season *kusmi* lac cultivation and shoot growth in *ber* (*Ziziphus mauritiana*). In: Recent Advances in Lac Culture. Sharma KK and Ramani R (eds.). Indian Lac Research Institute, Ranchi.
- Goswami DN, Ansari MF and Srivastava S. 2010. Spectral characteristics of lac. In: Processing, Chemistry and Applications of Lac. Baboo B and Goswami D N (Eds.). DIPA, ICAR, New Delhi.
- Gupta RK and Monobrullah Md. 2010. Jammu: Current status of lac production, issues, remedial measures and support system for development. In: Current Issues Related to Lac Production. Monobrullah Md, Singh JP, Kumar Anjesh, Ramani R (Eds.). IINRG, Ranchi 49-51 pp.
- Jaiswal AK 2010. Capacity building on lac production technologies- Status and future thrusts. In: Current Issues Related to Lac Production. Monobrullah Md, Singh JP, Kumar Anjesh, Ramani R. (Eds.). IINRG, Ranchi. 30-31 pp.
- Jaiswal AK and Singh JP. 2010. How to culture lac insect on *Ziziphus mauritiana* – Indian Plum tree. Technical Bulletin. 24 pp.
- Jaiswal AK and Singh JP. 2010. How to culture lac insect on *Schleichera oleosa* (*Kusum*) tree. Technical Bulletin. 20 pp.
- Jaiswal AK and Singh JP. 2010. How to culture lac insect on *Butea monosperma* – Flame of Forest tree. Technical Bulletin. 24 pp.
- Sharma KK and Ramani R (eds.) 2010. Recent Advances in Lac Culture. Indian Institute of Natural Resins and Gums, Ranchi. i-x + 319 pp.
- Mishra YD and Sharma KK. 2010. Improved technology of lac cultivation on *Kusum*. In : Recent Advances in Lac Culture. Kumar KK, Ramani R and KK Sharma (eds.) IINRG, Ranchi 146 -156 pp.
- Monobrullah Md, Singh JP, Kumar A and Ramani R. 2010. Current Issues Related Lac Production.

5.1.3 Books/book chapters/bulletins/training manuals

- Baboo B and Goswami D N 2010. Processing, Chemistry and Applications of Lac. DIPA ICAR, New Delhi.

Compilation of talks IINRG, Ranchi 56 pp.

- Pal G, Jaiswal AK and Bhattacharya A. 2010. Lac Statistics at a Glance 2010. IINRG, Ranchi 16 pp.
- Ramani R. 2010. National strategy for enhancing lac production. In: Current Issues Related to Lac Production. Monobrullah Md, Singh JP, Kumar Anjesh, Ramani R (Eds.). IINRG, Ranchi. 1-3 pp.
- Ramani R and Sharma KK. 2010. Lac insect genetics. In : Recent Advances in Lac Culture. Sharma KK and Ramani R (eds.). IINRG, Ranchi. 52-56 pp.
- Ramani R, Sharma KK and Kumar KK. 2010. Indian Institute of Natural Resins and Gums : History, mandate and activities. In : Recent Advances in Lac Culture. Sharma KK and Ramani R (eds). IINRG, Ranchi. 1-10 pp.
- Sharma KK and Ramani R. 2010. Intensive lac cultivation - Kusmi lac production on *Flemingia semialata*. In : Recent Advances in Lac Culture. Sharma KK and Ramani R (eds). IINRG, Ranchi. 180-188 pp.
- Sharma KK and Ghosal S. 2010. Lac cultivation on plantation basis- kusmi lac production on *Ziziphus mauritiana*. In: Recent Advances in Lac Culture. Sharma KK and Ramani R (eds.). IINRG, Ranchi.
- Srivastava S, Ansari MF and Goswami DN. 2010. Chemistry of lac dye and lac wax. In : Processing, Chemistry and Applications of Lac. Baboo B and Goawami DN (Eds). DIPA, ICAR, New Delhi.

5.1.4 Popular articles

- Pal G and Bharati P. 2010. Marketing of lac in Chhattisgarh. *Agriculture Today*, September 2010, 45-46 pp.
- Siddiqui MZ. 2009. Guggul - vahupayogi aushdhiya vividhtayen. *Krishak Vandana*, 12: 15-16
- Siddiqui MZ. 2010. *Boswellia serata*-vahupayogi aushdhiya sambhavnayen. *Krishak Vandana*, 7:21-22
- Singh BP. 2009. *Kusum ke Bagan Lagane Kee*

Bidhi. Laksha, 14-15 pp.

- Singh RK. 2009. *Jal Sanrakshan - Samay Ki Aawshyakta. Laksha*, 31-32 pp.
- Singh RK. 2009. Rain water harvesting programmes of Jharkhand through participatory approach. *Chhotanagpur Horticulture*, 23 (1-4) : 13-14.
- Singh RK and Pal G. 2009. *Lakh Ki Gramin Arthavyavastha Mein Bhagidari. Pathari Krishi*, Jan-Dec, 2009, 30-31 pp.
- Singh RK and Kumar A. 2010. *Krishi me jal sanrakshan - Aawshyakta avam upay. Rashtriya Krishi*, 5 (1) : 35-36.
- Singh RK and Monobrullah Md. 2010. *Ber – A multipurpose tree. Rashtriya Krishi*, 5 (1) : 28-29.
- Srivastava S, Baboo B and Pal G. 2009. *Jaiv rang-ek surakshit khadya rang. Laksha*, 28-30 pp.
- Srivastava S, Pal G and Yadav SKS. 2009. *Khadya aur dava udyog me bahupyogi gwar gond. Laksha*, 24-27 pp.
- Srivastava S and Baboo B. 2010. Biocolours-Safe food colours. *Science Reporter*, 45- 46.
- Thomas M, Shrivastava A. and Tomar SS. 2010. Guggul: Production and conservation. JNKVV, Jabalpur, MP (India). 39 pp.
- Thomas M, Shrivastava A and Tomar SS. 2010. Guggul (Hindi). JNKVV, Jabalpur, MP (India). 25 pp.

5.1.5 Institute publications

- Current issues related to lac production. Compilation of talks. 2010, 56 pp.
- How to culture lac insect on *Ziziphus mauritiana* – Indian Plum tree. Technical Bulletin, 2010, 24 pp.
- How to culture lac insect on *Schleichera oleosa* (*Kusum*) tree. Technical Bulletin, 2010, 20 pp.
- How to culture lac insect on *Butea monosperma* – Flame of Forest tree. Technical Bulletin, 2010, 24 pp.
- Improved lac based wood varnish (Heat and

water proof). Extension Folder, 2010, 4pp.

- IINRG Annual Report, 2009-10, 130 pp.
- IINRG - *Natural Resins and Gums Newsletter*, 13 (4), 16 pp.
- IINRG - *Natural Resins and Gums Newsletter*, 14 (1), 16 pp.
- IINRG - *Natural Resins and Gums Newsletter*, 14 (2): 8 pp.
- IINRG - *Natural Resins and Gums Newsletter*, 14 (3), 20 pp
- Lac based water thinnable interior paints. Extension Folder, 2010, 4pp.
- Laksha – Annual Hindi Magazine, 2009, 76 pp.
- Lac Statistics, 2010- At a Glance 2010, 16 pp.

5.2 Publicity

5.2.1 Participation in *Kisan Melas* and Exhibitions

- Sh SKS Yadav, Scientist presented the technology of lac based fruit coating formulation for kinnow in the National *Kisan Mela* and *Sabji* exhibition organized by IIVR, Varanasi during January 30-31, 2010.
- Dr BP Singh, Principal Scientist and Dr JP Singh, Sr Scientist participated in the *Kisan Goshti* at Khelgaon, Lagam (Silli) on February 06, 2010 on the eve of *Pratibha Darshan Mahotsav*.
- Dr Md Monobrullah, Sr Scientist and Shri MF Ansari, Scientist (SS) participated and put up Institute stall in Island Agriculture Fair 2010 during February 09-10, 2010 organized by the CARI, Port Blair.
- Sri DK Singh, Technical officer participated in the *Kisan Goshti* organized by RK Mission at Getalsud, Ranchi on February 11, 2010
- Dr BP Singh, Principal Scientist, Sri AK Sinha, Technical officer and Sri K Sharan, SSS participated and put up the Institute Stall in Agro-Tech 2010 *Kisan Mela* at BAU, Kanke, Ranchi during March 06-08, 2010.

5.2.2 Tours/visits

- Dr Md Monobrullah, Sr Scientist, visited Putidih, Ranidih, Bhusudih and Jargo, district Purulia for monitoring and assessment of *rangeeni* lac insect mortality on January 3, 2010.
- Sh MF Ansari, Scientist (SS) visited YS Parmar University of Horticulture and Forestry, Solan and Rosin & Turpentine Factory, Bilaspur as well as two dealers of rosin and turpentine oil at Delhi to discuss the activities being carried out at one of the Network project centre and to collect information on Rosin during January 10-18, 2010. He also visited Pyrex exports, Roorkee and MDM Corporation, Delhi regarding dental plate preparation and explore possibility for transferring the technology.
- Dr BP Singh, Principal Scientist and Dr S Ghosal, Senior Scientist visited the *Flemingia semialata* plantation raised by an NGO in Chandrakona Block in West Midnapur District of West Bengal during January 11-12, 2010.
- Sh SKS Yadav, Scientist visited the Indira Gandhi Krishi Viswavidyalaya, Raipur for collecting information on natural gums in general and gum karaya in particular during January 20-21, 2010.
- Dr G Pal, Scientist (SS) and Sri Madan Mohan (T-2) visited Kanker, East and West Bhanupratappur, Narayanpur, Rajnandgaon and Khairaghat during 22-30 January, 2010 and Jagdalpur, Bijapur, Dantewara, Sukma and North & South Kondagaon of Chhattisgarh during March 15-22, 2010 for collection of data and information regarding progress made in the different projects/activity on lac for documentation purpose.
- Dr Md Monobrullah, Sr Scientist and Shri MF Ansari, Scientist (SS) visited Andaman & Nikobar Islands to explore possibilities of lac cultivation and to promote/popularize varnishes in the islands during February 11-12, 2010.
- Dr BP Singh, Principal Scientist and Sh ML Rabidas, Technical Officer visited Gangcha (Chandrakona), Distt - West Midnapur (WB) to

provide *kusmi* broodlac and technical know - how for summer season lac cultivation (*Jethwi*) on *F semialata* during February 25-26, 2010.

- Dr Md Monobrullah, Sr Scientist visited Putidih, Ranidih, Bhusudih and Jargo of district Purulia for monitoring and assessment of *rangeeni* lac insect mortality on March 04, 2010.
- Sri RK Singh, Scientist (SS) and ML Rabidas, Technical officer visited Malegaon and around to supervise the summer *kusmi* lac crop inoculated on *kusum* trees during April-May, 2010.
- Dr A Bhattacharya, Principal Scientist, Dr BP Singh, Principal Scientist and Sri DK Singh, Technical officer visited Latehar, Satbarwa, Lali and Chandwa for lac crop monitoring and survey of probable lac growing areas on May 14, 2010.
- Mrs Bharati Patel, RA visited Durg, Kawardha, Marwahi and Bilaspur of Chhattisgarh for collection of data and information regarding progress made in the different projects/activity on lac for documentation purpose during May 22-27, 2010.
- Dr A Bhattacharya, Principal Scientist, Dr BP Singh, Principal Scientist, Dr S Ghosal, Sr Scientist and Sri DK Singh, Technical Officer visited Chandrakona Block in West Midnapur District of West Bengal for the inaugural function for lac cultivation on *Flemingia semialata* on 25 acre land and for monitoring of summer *kusmi* lac crop on *Flemingia semialata* under FLD programme during May 23-24, 2010.
- Sh SB Azad, T-4, TOT Division visited Yawatmal district of Maharashtra to impart On-farm training on 'Scientific method of lac cultivation during June 23-July 02, 2010'. During the visit, three Tehsils (Arni, Ghatanji and Jormoha) were covered and about 850 lac cultivators attended the programme.
- Dr SC Sharma, Scientist visited Dr Yashwant Singh Parmar University of Horticulture and Forestry, Nauni, Solan (Himachal Pradesh) for exploring the possibility of improvement in

techniques and devices for resin tapping from *Pinus roxburhii* during July 18- 24, 2010.

- Dr SC Sharma, Scientist visited Central Arid Zone Research Institute (CAZRI), Jodhpur for exploring the possibility of improvement in techniques and devices for tapping karaya gum during August 12- 21, 2010.
- Dr S Srivastava, Sr. Scientist and M F Ansari, Scientist (SS) participated in 2nd Coordination committee meeting of Network project 'Harvesting, Processing and Value addition of Natural Resins and Gums" held at YSPUH&F Nauni, Solan during August 17-18, 2010.
- Dr G Pal, Scientist (SS) and Sh Madan Mohan (T-2) surveyed three forest divisions (Dharamjaigarh, Raigarh and Champa) and two districts (Raigarh and Janjgir-Champa) for collection of information on lac related activities and progress in different divisions/districts of Chhattisgarh during August 24- 28, 2010.
- Dr A Bhattacharya, Principal Scientist, Sri DK Singh, Technical Officer and Sri RP Srivastava (T-5) carried out a survey in the coastal Balasore district of Orissa during Sept 6-7, 2010. Trivoltine lac insect colonies were observed on the rain tree (*Albizia saman*). A very large number of *Prosopis spp.* (approx. one lakh) plants, raised by the Govt. department were observed on both sides of the embankment to check soil erosion in the estuary region of river Subarnarekha. These plants can be exploited for lac cultivation.
- Dr JP Singh, Sr. Scientist and Dr G Pal, Scientist (SS) visited Balrampur and Midnapur of West Bengal for market survey as well as crop monitoring in terms of pest incidence and management practices during September 27- 28, 2010. Presence of *Siris* host in plenty at road side and agricultural field was observed during the visit, however, there was no scientific lac cultivation on *Siris* host.
- Dr M Z Siddiqui, Sr Scientist visited Tropical Forest Research Institute (TFRI), Mandla Road, Jabalpur

(M.P.) for extraction of essential oils from guggul (*Commiphora wightii*) exudates on Clevenger apparatus during November 12-13, 2010.

5.2.3 Radio/TV talks

- Dr S Ghosal, Sr Scientist delivered a TV talk on 'Scientific lac cultivation in reference to selection of lac hosts' on June 10, 2010 in Annadata programme of ETV.
- Dr Govind Pal, 2010 *Lakh Ki Bazar Vyavastha*. AIR, Ranchi on October 12, 2010
- Dr R Ramani, Director, IINRG educated the farmers on lac cultivation on phone- in *Krishi Darshan*, DD Kendra, Ranchi.

5.2.4 Commercialization of technologies

- Training on Aleuritic acid and Dewaxed Bleached lac was imparted to 8 entrepreneurs of Balrampur Shellac cluster group (SPV) under sponsorship of Directorate of Micro and Small Scale Enterprise, Govt. of West Bengal cluster development programme from April 28 to May 03, 2010.
- Technologies of water soluble lac and Gasket shellac cement compound was transferred to an entrepreneur Mr. Punit Vayada, M/s Roneet Enterprises, Ghatkopar, Mumbai (Maharashtra during Sept 6-8, 2010.
- Process know how & Technology of water soluble lac was transferred to Miss Renuka Jadhao, M/s Kosmochemicals, Mumbai during October, 2010
- Technology of Gasket shellac cement compound was transferred to Mr Srinivas Vandanapo, of M/s Sri Polymers, Hyderabad during November, 2010.
- Pilot scale training on aleuritic acid manufacturing was imparted to an entrepreneur, Mr Vibek Jaiswal from Balarampur, West Bengal during November 23- December 04, 2010.

5.2.5 Lac promotion activities

- About 615 kg broodlac was sent to Dang area of Gujarat for summer broodlac production on

kusum for promotion of lac cultivation in Gujarat with farmers" participation. It was inoculated on 500 *kusum* trees.

- Field demonstration of *F. semialata* was carried out in Kharsidag village of Ranchi district under Jharkhand Lac Development Scheme. 40.0 kg of *kusmi* broodlac was inoculated in July 2009 on 1202 *F. semialata* plants in the field in collaboration with SEEDS, an NGO. 333 kg broodlac and 45 kg scraped lac was harvested in February 2010 giving an output:input ratio of 8.32 for broodlac.
- Demonstration for three lac cultivation technologies have been carried out in three states (Jharkhand, Odisha, Chhattisgarh) in association with KVKs, NGOs and progressive farmers.
- Seventy kilogram each of three productive breeds (Kulajanga, Nawadih and late variety) have been inoculated at Mangobandh (20 kg each), Chitir (30 kg each) villages in Ranchi district and Chitramu (20 kg each) village of Khunti district under Jharkhand Lac Development Scheme. 191 kg broodlac of Kulajanga, 207 kg of Nawadih and 174.5 kg of late variety respectively was harvested at Mangobandh village besides 33 kg of sticklac. Yield was affected due to incessant rain during settlement in the late stock.
- From 372 kg broodlac supplied, 558 kg broodlac and 159 kg immature lac was harvested from village of Ranchi district and from 600 kg broodlac supplied, 343 kg broodlac and 109 kg immature lac was harvested from villages of Khunti district under NAIP (A value chain on lac and lac based products for domestic and export markets)

5.2.6 Success story

Shri Soni Ram Puro, a young farmer (education 5th standard) of village Bayanar, block Bhanupratappur, district Kanker, Chhattisgarh had been doing lac cultivation for long back by traditional method (only inoculation and harvesting of lac, no intermediate crop operation/pest management) and getting

very less income, about Rs. 2,000 annually from lac. He attended one On-farm training programme on 'Scientific methods of lac cultivation' conducted by IINRG, Ranchi at Bhanupratappur during the year 2005 and started scientific lac cultivation adopting improved techniques. He owns 30 *Palas*, 2 *Ber* and 40 *Kusum* trees available for lac cultivation. Besides this he has taken 20 *Ber* trees on lease basis (half output basis). Agriculture, lac and minor forest produces are the major source on income of his family. He has 4 acres of irrigated agricultural land in which paddy, coarse cereals, vegetables are grown in majority. Sh Puro started scientific lac cultivation from the year 2005 and produced 250 Kg *Kusmi* broodlac and 35 Kg sticklac (worth ₹ 33,000) from 6 *kusum* trees. Production of lac increased gradually in the coming years and during the year 2008-09 he produced 540 Kg broodlac and 65 Kg. sticklac (worth ₹ 55,300) from 14 *kusum* and 20 *palas* trees.

With the scientific methods of lac cultivation, his earning from lac has increased tremendously from ₹ 2,000-76,000 per annum within a span of 3-4 years. He has taken imitative to increase the host trees and planted 800 *F. semialata* for this purpose. He sells broodlac with the help of forest department, Kanker and sells sticklac in the local *haat*. With the earning from lac, he has purchased one motor cycle, mobile phone and also made a tubewell in his field. He has motivated several other farmers of his own and neighboring villages as well, for lac cultivation adopting scientific method. Sh Puro is now a source of inspiration to other farmers in that area for lac cultivation.

5.2.7 Awareness/exposure programme/ educational tours

| Date of visit | Sponsoring agency / from | No. of participants |
|---------------|---------------------------------|----------------------------|
| 11.1.10 | RK Mission, Ranchi | 28 |
| 11.1.10 | The Art of Living, Ranchi | 10 |
| 25.1.10 | St. Xavier College, Ranchi | 4 |
| 11.2.10 | Cambridge School, Ranchi | 63 |
| 12.2.10 | ICAR RCER, Plandu, Ranchi | 27 |
| 18.2.10 | Shisuvan School, Maharashtra | 72 |
| 20.2.10 | IDPWA, Ranchi | 16 |
| 10.3.10 | IDPWA, Ranchi | 13 |
| 12.3.10 | St Xavier's College, Ranchi | 47 |
| 15.3.10 | IDPWA, Ranchi | 15 |
| 22.3.10 | IDPWA, Ranchi | 7 |
| 29.3.10 | ICAR RCER, Plandu, Ranchi | 22 |
| 5.4.10 | IDPWA, Namkum | 15 |
| 7.4.10 | IDPWA, Namkum | 40 |
| 12.4.10 | IDPWA, Namkum | 15 |
| 15.4.10 | IDPWA, Namkum | 18 |
| 15.5.10 | Firayalal Public School, Ranchi | 39-Students; 10-Faculty |
| 29.5.10 | BHU, Varanasi | 6 |
| 24.6.10 | CWD, Torpa | 9 |

6. PARTICIPATION OF SCIENTISTS IN CONFERENCES/MEETINGS/SEMINARS/SYMPOSIA/WORKSHOPS/TRAININGS



6.1 Participation in Conferences / Meetings / Seminars etc.

6.1.1 By Director

- SREP-SEWP meeting with Principal Secretary, Agric., Govt. of Jharkhand on January 08, 2010.
- Joint Meeting for finalization of the DPR for Balarampur Shellac Cluster at Balarampur on January 08, 2010.
- Jharkhand State Credit Seminar 2010-11 organized by Jharkhand Regional Office, NABARD, Ranchi in Hotel Capitol Hill, Ranchi on January 15, 2010.
- IE (I) meeting with Engineers on January 17, 2010.
- CAC meeting NAIP- Value Chain on January 23, 2010.
- ISAE 44th Annual Convention, New Delhi during January 28-30, 2010.
- Director's Conference at New Delhi during February 15-16, 2010.
- VC Conference at New Delhi on February 17, 2010.
- Progress Review Meeting of Network Project at New Delhi on March 18, 2010.
- Lac Industry-Institute Interface Meet at Dhamtari on March 28, 2010.
- Lac Cell Meeting at Raipur on April 08, 2010 organized by Chhattisgarh Minor Forest Produce (T & D) Cooperative Federation Ltd.
- Research Advisory Committee meeting at Central Tasar Research and Training Institute (CTR&TI), Hehal, Ranchi on April 21, 2010.
- Brainstorming Meeting at CIPHET, Ludhiana during May 1-2, 2010.
- Second State Level Monitoring Committee (SLMC) at Rural Development Department, Govt. of Jharkhand, Dhurwa, Ranchi on May 7, 2010.
- XXIII Extension Education Council Meeting at BAU, Kanke, Ranchi on May 13, 2010.
- Directors' Annual Meet at Shinde Symposium Hall, NASC Complex on July 15-16, 2010.
- ICAR-Industry Meet at NASC Complex, New Delhi on July 28-29, 2010 in which selected lac-based technologies were showcased in the theme area of PH Engineering and Value Addition of Cotton, Jute, Resin and Gum Products.
- Valedictory Function of Refresher Course in Life Science organized by ASC, Ranchi University as Chief Guest on August 25, 2010 at Academic Staff College, RU, Ranchi.
- Second Coordination Meeting of NABARD-RIF lac programme on September 4, 2010 at NABARD, Ranchi.
- QIP-2010 on Lead Discovery Approaches from Natural and Synthetic Sources on September 09, 2010 and delivered a lecture on 'Natural resins and gums as source of pharmacologically active compounds' at BIT, Mesra.
- Hindi *Karyashala* at ICAR Research Complex for Eastern Region, Research Centre, Ranchi on September 25, 2010 as Chief Guest and delivered a talk.
- *Subji Soyabean Mahotsava* on September 27, 2010 as Special Guest at ICAR Research Complex for Eastern Region, Research Centre, Ranchi and delivered a talk.

6.1.2 By others

- Dr AK Jaiswal, Principal Scientist and CO-PI of NAIP attended a meeting of Consortium partners on 11th January, 2010 at Horticulture and Agro forestry Programme, Plandu, Ranchi.
- Dr AK Jaiswal, Principal Scientist and Head delivered a lecture on 'Broodlac quality evaluation and its marketing' to lac facilitator

and executives at SG College of Agriculture Kumhrawand, Jagdalpur, Chhattisgarh' on January 14, 2010.

- Dr AK Jaiswal, Principal Scientist and CO-PI of NAIP attended a meeting of Consortium partners on January 15, 2010 at SGCARS, Jagdalpur, Chhattisgarh.
- Dr AK Jaiswal, Principal Scientist and CO-PI of NAIP attended a meeting of CIC on February 03, 2010 at Zonal Research Station, Birsa Agriculture University, Dumka.
- Dr AK Jaiswal, Principal Scientist and Head, delivered a lecture on 'Strategies for enhancing lac production in Chhattisgarh' to Sub DFO, Range Officers and DFO at Forest Training centre, Pandri, Raipur on February 08, 2010
- Dr AK Jaiswal, Principal Scientist and CO-PI of NAIP attended a workshop on 'Research on sustainable Rural livelihood Security' BAIF, Pune on February 10-11, 2010.
- Dr AK Jaiswal, Principal Scientist and CO-PI of NAIP attended a meeting of CIC on February 18, 2010 at Birsa Agriculture University, Ranchi.
- Dr AK Jaiswal, Principal Scientist and Head TOT attended a lecture on 'Agro biodiversity and farmers right' on February 18, 2010 by Dr NN Singh, Vice Chancellor at Birsa Agriculture University, Ranchi.
- Dr AK Jaiswal, Principal Scientist and CO-PI of NAIP attended a workshop on 'ICAR Zonal Technology Management & Business Planning Development organized by NIRJAFT, Kolkata at IINRG, Ranchi on February 19-20, 2010
- Mr RK Singh, Scientist (SS) delivered a lecture on the topic 'Water Management Strategies for Establishment and Management of Fruit Orchards' under a training programme on 'Management of Old and Newly Established Orchards' at ICAR Research Complex for Eastern Region, Ranchi centre on February 19, 2010.
- Dr AK Jaiswal, Principal Scientist and CO-PI of NAIP attended a regional workshop of

Component-3 at Birsa Agrl. University on March 04-05, 2010.

- Dr R Ramani, HOD & CPI, NAIP C3007, attended the Annual Workshop of NAIP Project Component 4 during March 5-6, 2010 at NBPGR, New Delhi.
- Dr (Miss) MZ Siddiqui, Sr. Scientist attended National Seminar on Productivity Enhancement & Value Addition of Bamboos, March 09-10, 2010, Ranchi.
- Anees K, Scientist, delivered a lecture on River linking in India: boon or bane? at Academic Staff College, Ranchi university on March 10, 2010 in connection with a refresher course on environmental protection and biodiversity conservation.
- Dr R Ramani, HOD delivered a lecture on 'Insects and Climate Change' at the Academic Staff College, Ranchi university on March 15, 2010 under a refresher course on 'Environmental protection and biodiversity conservation'.
- Dr R Ramani, HOD acted as resource person and delivered lecture in the National Seminar on 'Application of Biotechnology and the Development of Bihar' at Central University of Bihar, Patna on March 22-23, 2010.
- Mr RK Singh, Scientist (SS) attended a regional workshop on 'Exploration, Development and Management of Ground water in Hard Rocks with Special Reference to Jharkhand State' and presented a paper on 'Micro-catchment Rain Water Conservation for Increased Soil Moisture Level and Growth and Development of Lac Host *Ber (Ziziphus mauritiana)* under rainfed condition' held at Ranchi during March 25-26, 2010, organized by Ministry of Water Resources, Central Ground Water Board, Government of India.
- Sh M F Ansari, Scientist (SS) presented lecture on 'Lac and lac based products: Entrepreneurship potential' in Institute-Industry interface meeting held on March 28, 2010 at Dhamtari (Chhattisgarh)
- Dr R Ramani, Head, Lac Production Division

actively participated in the Stakeholder Institutes' Meet related to agrobiodiversity at NBPGR, New Delhi on April 7 and made a presentation on 'Development of Insect Genetic Resources' with special emphasis on lac insect genetic resource development.

- Mr RK Singh, Scientist (SS) attended a workshop on 'Perspective Plan/DPR/MIS for Development of Rainfed and Watershed Areas in Jharkhand' on April 16, 2010 at KGVK- Rukka, Ranchi organized by National Rainfed Area Authority and Jharkhand State Watershed Mission.
- Dr A Bhattacharya, Principal Scientist, Dr BP Singh, Principal Scientist and Sh DK Singh, Technical Officer attended the meeting with Sh Rahul Kumar Purwar, DC and three NGOs and other officials at Latehar on May 14, 2010 for discussion on the action plan for promotion of lac cultivation in the district.
- Dr R Ramani, Head, Lac Production Division attended the 'National Consultation on Agrobiodiversity' held at NAAS Auditorium, New Delhi during May 26-27 as expert panel member of agriculturally important insects group and presented his views.
- Dr N Prasad, Senior Scientist and Sh SK Pandey, Scientist (SS), attended Entrepreneurs Meet at NIRJAFT, Kolkata on June 18, 2010.
- Dr A Bhattacharya, Principal Scientist and Er SK Pandey, Scientist (SS) attended the meeting at Purulia on June 22, 2010 for discussion on the prospects of promotion of lac cultivation and lac industry in Purulia district under the Chairmanship of Sh Basudeb Achari, Hon'ble MP and other Govt. officials.
- Dr A Bhattacharya, Principal Scientist attended the meeting at NABARD, Ranchi on July 02, 2010 for discussion on the presentation by the NGO PRADAN, Ranchi on the Innovative project on *kusmi* lac cultivation on *ber*. The role of the Institute would be to provide necessary consultancy in the project.
- Dr AK Jaiswal, Principal Scientist and CO-PI of

NAIP attended a meeting of CIC on July 19, 2010 at Birsa Agriculture University, Ranchi.

- Sh Anees K, Scientist has attended two day interaction session on 'Biotechnology Research in ICAR' at NASC, New Delhi from July 26-27, 2010.
- Sh MF Ansari, Scientist (SS) and Dr N Prasad, Sr Scientist participated and presented the commercialisable technology of the division in 'ICAR – Industry Meet 2010' held at NASC complex, Delhi during July 28-29, 2010. Three technologies *i.e.* Small Scale Lac Processing Unit, Fruit Coating Formulation and Shellac Emulsion Paint developed by the Institute were displayed in the Meet.
- Dr (Miss) MZ Siddiqui, Sr Scientist delivered a lecture on 'Immunotoxins and their effects' on August 9, 2010 in AICTE sponsored QIP 2010 programme organized by Department of Pharmaceutical Sciences, BIT, Mesra, Ranchi (Jharkhand) from August 02-14, 2010.
- Anees K, Scientist, delivered a lecture on 'Protein interaction: Techniques in practice' in connection with the refresher course on life sciences at UGC Academic Staff College, Ranchi University on August 12, 2010.
- Dr A Bhattacharya, Pr. Scientist attended the Research Advisory Committee meeting of KVK, Divyayan, Ramakrishna Mission, Morabadi, Ranchi on August 12, 2010.
- Sh MF Ansari, Scientist (SS) participated in 2nd Coordination committee meeting of Network project 'Harvesting, Processing and Value addition of Natural Resins and Gums' held at YSPUH&F Nauni, Solan during August 17-18, 2010.
- Sh SKS Yadav, Scientist made a presentation on 'Hydrogel and its Applications' to the Institute Management Committee (IMC) meeting on August 25, 2010 organized at IINRG, Ranchi.
- Mr RK Singh, Scientist (SS) attended a National meet on 'Strategies for Enhancing Lac Production' at IINRG, Ranchi on September 20, 2010.

- Dr AK Jaiswal PS and Head, delivered a lecture on 'Capacity Building in Lac Production' organized by IINRG, at Hotel Ashoka on September 20, 2010
- Dr AK Jaiswal, Principal Scientist and Head (TOT) attended a workshop on 'Promotion of Lac Based Livelihood' and delivered key- note address on November 18-19, 2010 at hotel Suryansh organized by RCDC, Bhubaneshwar, Odisha.
- Sh SK Pandey, Scientist (SS) participated in 'ICAR-Industry Meet' organized by ZTM-BPD unit at ICAR (RC) NEH Region, Barapani, Shillong on November 18-19, 2010 for presentation and demonstration of five shortlisted technologies given earlier to ZTM-BPD unit.
- Sh SC Lal, Asstt. participated in 3 days Workshop on 'Noting and Drafting at ISTM' at New Delhi during September 6-8, 2010.
- Dr SC Sharma, Scientist attended two weeks training on 'Pro Engineer CAD Software (Pro Engineer Wildfire-5.0)' at Central Institute of Agricultural Engineering, Bhopal during November 09-22, 2010.
- Dr R Ramani, Director attended the training programme 'Employees Perspective on Labour Related Laws' at NAARM, Hyderabad during November 11-13, 2010.
- Dr SK Giri, Scientist (SS) attended One week training on 'Flexible Packaging' at Indian Institute of Packaging, Hyderabad during November 16-20, 2010.
- Dr A Mohanasundaram, Scientist attended the training programme of 'Data Analysis Using SAS' during December 13-18, 2010 at DWM, Bhubaneshwar.

6.2 Human Resource Development

- Dr SK Giri, Scientist (Sr. Scale) underwent training under NAIP on 'Non-chemical/non-thermal processing and membrane technology' at School of Food Science, Washington State University, Pullman, USA during March 07 – May 26, 2010.
- Dr N Prasad, Senior Scientist under went training under NAIP on 'Smart Packaging' from January 22, 2010 to April 20, 2010 (3 months) at School of Packaging, Michigan State University, East Lansing, MI, USA.
- Sh SC Meena, Scientist has undergone FOCARS training for four months from May 01 to December 29, 2010 at NAARM, Hyderabad.
- Sh P Singh, AAO participated 5 days training programme on 'Establishment Rules at ISTM' New Delhi from May 10- 14, 2010.
- Dr S Ghosal, Sr. Scientist attended workshop on 'Leadership for Transition to NAIS' (Sponsored under NAIP, NAARM) at National Academy of Agricultural Research Management, Rajendranagar, Hyderabad during August 6-11, 2010.
- Dr AK Singh, Principal Scientist attended training on 'Science Administration and Research Management' at Administrative Staff College of India, Hyderabad during September 6-17, 2010.

6.3 Honours/Awards/Recognitions

- Dr Md Monobrullah, Senior Scientist was conferred 'Fellow Award 2009' for his outstanding contribution in the field of Applied Entomology by the Society of Plant Protection Sciences on January 24, 2010 during the 8th National Symposium held on January 24-25, 2010 at CSA University of Agriculture & Technology, Kanpur.
- Dr JP Singh, Sr Scientist was conferred 'Prof MM Alam Medal Award' by Bioved Research Society, Allahabad for 'Lac pest management' on February 22, 2010.
- Dr AK Jaiswal, Principal Scientist was conferred 'Distinguished Scientists Award' by Bioved Research Society, Allahabad to for 'Promotion of lac in the country'.

6.4 Achievements in Sports

- A team comprising of 32 contingents represented the institute in the ICAR sports meet for eastern zone at CRRRI Cuttack from 1st to 5th February, 2010. The team was successful in bagging 4th

position in the total medal tally with 23 points (Two gold, two silver and three bronze medals) behind CRR I Cuttak, IVRI Izatnagar and ICARNEH, Barapani. Sh Anees K., Scientist, bagged four individual medals with first place in long jump, second place in 800m race, third place in 100m and 200m race. Sh Arjun Gope won first prize in Shot put and second prize in Discuss throw. IINRG team comprising of Sh Balram Ram, Sh R C Mandap, Sh B Oraon and Sh Anees K., bagged silver medal in 4 x 100m relay race.



IINRG Team receiving silver medal for 4x100m relay race

- Subsequently, in the ICAR Inter-Zonal Tournament (2010) held at CAZRI, Jodhpur from 9th -13th November 2010 Sh Anees K won Silver medal in long Jump competition.

6.5 Capacity Building

- Dr Thamilarasi K, Scientist, guided a M.Sc. (Biotechnology) student for a three-month project work on the topic 'Identification of parasite, *Aprostocetus purpureus* from infected lac insect samples using molecular tools'.
- Dr Md Monobrullah, Sr Scientist, guided two M.Sc. students, from Ranchi Women's College, Ranchi for three months dissertation work on 'Life history and morphology of Indian lac insect, *Kerria lacca* Kerr. (Tachardiidae: Homoptera)' and 'Indian lac insect, *Kerria lacca* Kerr. (Tachardiidae: Homoptera) and associated biotic fauna', respectively.
- Sh Anees K, Scientist guided 13 students (10 Graduate and 3 post-graduate) to complete project work on five different topics.



7. EVENTS

7.1 Meetings-cum-Workshops on IPR

The meetings-cum-workshops on 'Intellectual Property Rights of ICAR Zonal Technology Management (ZTM) & Business Planning and Development (BPD)' for East Zone were organized at IINRG, Ranchi, during February 19-20, 2010. The meeting was attended by 60 participants belonging to various ICAR Institutes and Agricultural Universities. This auspicious occasion was marked by the inaugural speech of Chief Guest Dr NN Singh, Vice-chancellor, Birsa Agricultural University, Ranchi. Three Technical sessions were held in the two days meeting and plenary session was chaired by Dr S Maurya, ADG (IP & TM), ICAR, New Delhi.

The first Technical session showcased the basis of ZTM & BPD and was presented by IP & TM Unit ICAR. Objectives and role of NAIP in BPD convergence were also discussed in this session. The Technical session II dealt with IP Assessment Management which included overview of ICAR's IP assets viz. IPR Portfolio and IP Portfolio patents, Plant varieties, Copyrights, Trademarks etc. which was presented by ZTM & BPD Unit. Third Technical session was about Planning and Development of IP Business and was presented by Dr R Kalpana Sastry of NAARM, Hyderabad, Dr RC Agrawal of NBPGR, New Delhi and Dr Himanshu of ICAR, New Delhi. Special lecture on the theme IPT & BPD was delivered by Dr Anil Wali of IIT Delhi.

7.2 Regional Agricultural Fair-2010

Institute organized Regional Agricultural Fair-2010 at campus on February 22-24, 2010 with a view to promote and to showcase latest agricultural production and processing technologies among the farmers of the region. Four states i.e. Jharkhand, Bihar, Odisha and West Bengal were represented in the fair sponsored by the Department of Agriculture and Cooperation, Govt. of India, New Delhi. The Mela was inaugurated by Sh Mathura Prasad Mahto, Hon'ble Agricultural Minister, Govt. of Jharkhand and presided over by Dr NN Singh, VC, Birsa Agricultural

University in the presence of Dr A Bhattacharya, Director, IINRG and Shri Harinder Patanga, Joint Director (Agricultural Information), Directorate of Extension, New Delhi.

Hon'ble Agricultural Minister in his inaugural address urged the farmers to incorporate advanced technologies developed by the various Institutes of the region and exhorted the NGO to play a vital role in promoting the various techniques.

Dr A Bhattacharya, in his welcome address urged the farmers to make full use of developed agricultural technologies for economic development. He stressed upon them to exploit quick growing lac hosts also and to integrate lac cultivation with other crop for better and assured returns. Sh Harinder Patanga threw light on the objectives of the Regional Agricultural Fair and hoped that the fair will meet the expectations of the farmers. He said that such fairs act as harbinger of awareness among the farmers.

While delivering his presidential address, Dr NN Singh stressed upon spreading awareness among the farmers, promoting technologies as small scale industries to increase employment opportunities and judicious exploitation of the natural resources.

Ten progressive farmers (one each from Bihar, Odisha and West Bengal and seven from Jharkhand) nominated by various Institutions were awarded for their excellent performance in adoption of the technologies in the various fields of lac and agriculture.

Various Government and Non Government Organizations and private firms put up more than 50 stalls exhibiting the latest technologies and products related to agricultural operations. Five stalls were given prizes for product and technologies displayed and services rendered to the farmers. Two publications viz., **Lac in Jharkhand – A status report** and **Directory of Gums and Resins related Organizations** were released on the occasion. *Kisan Goshthis* were organized in the fair on different themes on all the three days wherein the queries

of the farmers were answered by experts from different institutions. Nearly 1500 farmers from various parts of Jharkhand, Bihar, Odisha and West Bengal participated in the Fair. Sh Chandreshwar Prasad Singh, Hon'ble Speaker, Jharkhand Assembly was the Chief Guest of the concluding function was organised on February 24 at 2.30 pm.



Inaugural session of RAF-2010



A gathering of stakeholders on the occasion of RAF

7.3 Institute-Industry Interface Meeting

An Institute-Industry interface meeting was organized in association with the Dhamtari Lakh Udyog Sangh, Dhamtari on March 28, 2010 at Dhamtari, Chhattisgarh. More than 50 representatives, lac industrialists, forest officials, traders, progressive farmers etc. participated in the meeting. The major problems faced by the entrepreneurs were: requirement of analytical method to address the problem of adulteration in lac, drying of seedlac during rainy season, mechanization of removal of woody matter from seedlac, utilization of gummy mass after isolation of aleuritic acid, requirement of cheaper alternatives

for charcoal and possible mechanization of the process, to address problems of charcoal and unavailability of labourers in manufacture of button lac.

7.4 International Biodiversity Year 2010

International Biological Diversity Year was observed at the Institute on 7 July, 2010 with a programme to create awareness among the staff about the importance of biodiversity. Dr Vaibhav D Lohot and Mr Anees K conducted a quiz for institute employees and organized a guest lecture by Dr JB Tomar, NBPGR, Ranchi Centre on Biodiversity.



Dr JB Tomar distributing prize to winners of quiz competition on biodiversity

7.5 Launch of NABARD Sponsored Project

Launch of NABARD sponsored project on innovations for livelihood enhancement in lac was organized at IINRG, Ranchi on 20 July, 2010. Dr Ram Dayal Munda, Member, Rajya Sabha was the Chief Guest during the function. The project is being implemented by NGOs Pradan, Udyogini, Mahila Jagriti Sangh (MJS) in the districts of Ranchi, Khunti, Godda and West Singhbhum. IINRG is a partner in the project for technical advice.

7.6 Co-ordination Committee Meeting of Network Project

The 2nd Co-ordination Committee meeting of the network project on HPVA of NRG was organized at Dr YSP University of Horticulture and Forestry, Solan during August 17-18, 2010. The meeting was attended by PIs of the network project centers. In

the meeting, progress during year 2009-10 was reviewed and the XII Plan proposals prepared by the centers were discussed. During the two-day meeting, the delegates were demonstrated different methods of pine resin tapping and laboratories of College of Forestry and Horticulture were shown.



Co-ordination committee meeting of Network Project HPVA of NRG at Solan (HP)

7.7 MoU between IINRG and TRIFED

A MoU was signed between IINRG, Ranchi and Tribal Co-operative Marketing Development Federation of India (TRIFED) Ranchi on 1st September, 2010. A collaborative project entitled 'National Action Plan (NAP) for sustainable income generation of tribal through cultivation and processing of lac' was undertaken by TRIFED with a budgetary provision of Rs. 4.05 crores. IINRG will be responsible for capacity building, technical guidance and crop monitoring. The project will benefit 6,600 tribal families of six states viz., Jharkhand, West Bengal, Odisha, Madhya Pradesh, Chhattisgarh and Andhra Pradesh.

7.8 Hindi Diwas Celebration

Hindi diwas was organized in the Institute on September 13, 2010 at 02.30 pm under Hindi Chetna Mass being observed during September 01-30, 2010. Chief guest Sh Ranendra Kumar renowned litterateur and Joint Director, SKIPA, Ranchi and Guest of honour Dr MK Singh, Assoc. Professor, Department of Hindi, Ranchi University, Ranchi delivered their views in the lecture organized on the topic of '*Kaljayi kaviyon ka shatabdi varsh*'. In his address Director Dr R Ramani discussed activities of the Institute and use of official language. Dr Divya, Chairperson, Hindi Diwas celebration

organizing committee and Senior Scientist delivered welcome speech. Dr Anjesh Kumar, TO concluded the programme with Vote of thanks .

7.9 Lectures Delivered

7.9.1 Lecture on 'Work culture'

A guest lecture on 'Work culture' was delivered by Dr MJ Modayil, Member ASRB, ICAR, New Delhi on 18 September, 2010. In his brief lecture he covered the main theme of organizational culture, values & assumptions and beliefs. He opined that organizational culture comprises innovation and risk taking, attention to details, outcome and orientation etc. He has also thrown light on work culture prevailing in different countries and emphasized that our country needs to imbibe good character from those countries in our work culture to make our system more efficient.



Lecture on 'Work culture' delivered by Dr MJ Modayil

7.9.2 Lecture on 'Antique restoration using shellac'

Miss Juliane Derry, Technical Expert for restoration, conservation and gilding from Antique Restoration, Oslo, Norway delivered a talk on antique restoration and use of shellac in restoration of wooden antiques on November 30 2010 at the conference hall which was attended by the Scientists and Technical Officers of the Institute .

7.10 MoU between IINRG and MDM Corporation

For the commercialization of institute technology, a Memorandum of Understanding (MoU) was signed between IINRG, Ranchi and MDM Corporation,

New Delhi on the foundation day of the Institute (September 20, 2010) for transfer of technology of 'Lac based multi-coloured dental plate' developed by Shri MF Ansari, Scientist (SS) of the Institute.

The technology of water soluble lac and Gasket shellac cement compound was transferred to Ms Renuka Jadhao, M/s Moj Engineering System Ltd, Pune (Maharashtra) and Mr Srinivas Vandanapo, M/s Sri Polymers, Hyderabad (Andhra Pradesh) respectively. Process (Know how) was transferred to the entrepreneurs during October and November, 2010.

7.11 IINRG Foundation Day Celebration

The Institute organized a two-day conference of stakeholders on 'Issues related to lac production' on September 20, the 87th Foundation day of Institute with NABARD, Ranchi as a partner. The conference was inaugurated by Chief Guest Sh. Wilfred Lakra, IAS(Retired) and former Advisor to Governor of Jharkhand. Dr MJ Modayil, Member, ASRB, New Delhi and Guests of Honour Sh MV Ashok, CGM, NABARD, Ranchi. A compilation of the talks of the conference and three extension bulletins on lac cultivation technologies were released at the occasion of inaugural ceremony. The awardees included; Dr BK Diwedi, Bio-Ved Research Society, Allahabad, Uttar Pradesh for promotion of value addition of lac at village level in Uttar Pradesh; Sh HK Pandey, DFO, Korba for excellent growth of lac production in Korba Division, Chhattisgarh and Sh Rajesh Sahay, F& AO, IINRG for his contribution towards financial management of the Institute. Besides, Bio-Ved Research Society also felicitated other workers for lac promotion.



IINRG Foundation Day Celebration on September 20, 2010

The event was attended by 130 participants including scientists, lac farmers, entrepreneurs, exporters, officials from NGOs, State forest departments and financial institutions from Jharkhand, Chhattisgarh, Madhya Pradesh, Odisha, West Bengal, Andhra Pradesh, Maharashtra and Uttar Pradesh. A leading shellac manufacturer from Germany presented importer's perspective on the issues.

These sessions were chaired by Dr Suresh Prasad, Chairman, RAC; Dr KK Kumar, Former Director, NRC Litchi; and Dr NPS Sirohi, ADG (Engg.), ICAR, New Delhi. The following recommendations emerged from the suggestions given by the distinguished guests, invited speakers and deliberations during concluding session.

1. Need for policy paper on lac and establishment of Lac Directorate/ Board.
2. Lac should be treated as farm produce and free movement (inter-state) should be allowed within the country.
3. Research for tackling lac crop failure due to climate change especially in Jharkhand and West Bengal.
4. Development of information network for crop management and availability of broodlac.
5. Financial support including credit and crop insurance with Government subsidy for supporting farmers; price support to farmers during bumper production.
6. Boost to domestic consumption including lac-based cottage industries for rural employment
7. Need to promote private investment in lac production on contractual basis with investment in action research for developing knowledge partnership amongst different stakeholders.
8. Measures to ensure sustainability in production, stability in supply and price.

7.12 Hasya Kavi Sammelan

Hasya Kavi Sammelan was organized in the Institute campus on the eve of September 20, 2010 (IINRG foundation day). Several known poets presented their composition which includes Sh Salim Shivalgi (Varanasi), Sh Kumar Brijendra (Ranchi),

Sh Kameshwar Srivastava Nirankush (Ranchi), Sh Basant Joshi (Dhanbad), Sh Jahid Aish (Jharia), Sh SS Mandal (Dhanbad) and Dr Anjesh Kumar & Sh CL Meena from Institute. They entertained the gathering by their satirist poetries. Dr NPS Sirohi, ADG (Engg.) ICAR, New Delhi felicitated the poets. Dr R Ramani, Director, Dr S Prasad, Chairman RAC and staff members were present in this programme.

7.13 Launch of two Lac based Varnishes on Commercial Scale

Two lac based products namely Spiritless Wood Varnish (MSV005) and Multipurpose Glazing Varnish have been launched as brand name 'Extra Gloss' and 'Gelwo' respectively by the firm M/s PNP Corporation, Mumbai, Maharashtra. Process Know-how and

training for manufacturing of the varnishes was given to the firm in the month of November, 2009. Continuous suggestions and advice were given to the firm for preparation and launching of the products on commercial scale. The firm reported that the products 'Extra Gloss' and 'Gelwo' received good response from the market.



Lac based varnishes in commercial packing

8. MEETINGS OF IMPORTANT COMMITTEES



8.1 Institute Management Committee

The 43rd Institute Management Committee meeting was held on March 11, 2010 at Kusmi conference hall under the chairmanship of Dr. Ajoy Bhattacharya, Director and following members attended the meeting:

1. Dr A Bhattacharya, Director, IINRG & Chairman, IMS
2. Dr NPS Sirohi, ADG (Engg), ICAR, New Delhi
3. Dr KP Tripathi, Pr Sc, CSWCRTI, Dehradun
4. Dr HA Khan, Pr Sc, CAZRI, Jodhpur
5. Dr AK Sarkar, Dean (Ag) BAU, Ranchi
6. Dr DN Choubey, Member, Gurunanak Ward, Giridih
7. Er M Prasad, Pr Sc & I/c Head, PPD, IINRG
8. Dr AK Jaiswal, Pr Sc & I/c, RMU, IINRG
9. Sh Ashok Ghosh, Adm Officer, IINRG

Invited Members

1. Dr R Ramani, Head, LPD, IINRG
2. Sh R Sahay, F&AO, IINRG
3. Sh KK Prasad, I/c Adm III, IINRG

The following recommendations emerged out in IMC meeting:

1. Electrical renovation of LP/PPD/TOT Divisions
2. Purchase/replacement of equipments
3. Purchase of equipment for Network Project
4. Disposal of unserviceable stores of PD Unit of Division
5. Recruitment of Head, PPD Division & Scientists (Org Chem)
6. Construction of Conference / Meeting Hall for PPD Division

The Chairman concluded IMC meeting with his valuable remarks as follows:

- Complete status paper on technology of glazing

varnish developed by the institute should be prepared.

- To enhance marketing of the products / produce/technologies, it is required to sign MoU with leading manufacturers/agencies.
- Efforts should be made to increase revenue generation.
- Tie-up with private agencies for increasing sale of products already developed by the institute.
- More focus should be there on marketing & commercialization of lac based products/ technologies already developed by the institute.
- Efforts should be made for collecting the data on lac from fields in Chhattisgarh/Jharkhand & documentation in proper manner.

The 44th IMC meeting was held on 25th August, 2010, under the Chairmanship of Dr R Ramani, Director, IINRG, Ranchi. The Chairman welcomed all the members and thereafter Dr AK Jaiswal PS & I/c PME cell briefly presented the achievements of the institute under different core programmes being conducted in all three divisions since last meeting. A scientific presentation was also made by Sh SKS Yadav, Scientist, PPD division on the topic 'Hydrogel & its application'. Presentations on financial status & administration were made by FAO & AO respectively.

The following recommendations were given in IMC meeting:

- Approval of network work project on *in-situ* conservation of lac insects
- Purchase of Pan Encapsulating Unit
- Construction / extension of Guest House
- Construction of boundary wall of riverbed pump house
- Construction of a Conference hall

- Procurement of scientific equipment namely Stereo Zoom Microscope by import through letter of credit
- Disposal of un-serviceable equipments of LPD

Chairman concluded IMC meeting while thanking members of IMC for their cooperation & valuable suggestions given during deliberations for better management of institute.



43rd Institute Management Committee meeting on 11th March 2010

8.2 Research Advisory Committee

XV meeting of Research Advisory Committee was held on April 23-24, 2010 at IINRG. Following members were present :

| | |
|---|------------------|
| Prof Suresh Prasad Department of Agricultural & Food Engineering, Indian Institute of Tech Kharagpur | Chairman |
| Dr NPS Sirohi, ADG (Engg) ICAR, New Delhi. | Member |
| Dr GP Gupta, Retd Professor Division of Entomology, IARI, New Delhi | Member |
| Dr AB Rodge Department of Food Security & Nutrition, MAU, Parbhani, Maharashtra | Member |
| Dr A Bhattacharya Director, IINRG | Member |
| Dr KP Sao Principal Scientist, PPD, IINRG | Member Secretary |

Invited Members

1. Dr R Ramani, PS & Head, LPD, IINRG

2. Er M Prasad, PS & I/c Head, PPD Division, IINRG
3. Dr AK Jaiswal, PS & I/c RMU, IINRG

The major recommendations given by RAC :

- Two RAC meetings may be held in a year.
- Institute should specify at least five flagship or major projects as current contemporary & futuristic planning.
- Environmental factors should be given more attention in lac production. Eco-friendliness of newer insecticides should be taken into consideration.
- Emphasis should be given on guar gum for (i) application in food & cosmetics and (ii) removal of toxic material dioxin.
- Processing and storage of natural resin & gums should be given more importance.
- Value addition after research should result in pilot plant development.
- Assessment on impact of technologies developed and transferred during last five years should be carried out.
- For outreach programme, RAC recommended adoption of ten villages.
- International seminar/conference on Natural resins & gums should be organized during 2012.
- More emphasis should be given on HRD development activities

XIV meeting of Research Advisory Committee was held on September, 21-22, 2010. Following members were present :

| | |
|--|------------------|
| Prof Suresh Prasad Department of Agricultural & Food Engineering, Indian Institute of Tech. Kharagpur | Chairman |
| Dr NPS Sirohi, ADG (Engg) ICAR, New Delhi | Member |
| Dr R Ramani Director, IINRG | Member |
| Dr KP Sao Principal Scientist, PPD, IINRG | Member Secretary |

Invited Members :

1. Dr AK Jaiswal, Head, TOT Division, IINRG
2. Dr AK Singh, PS & Head, IINRG
3. Er M Prasad, PS & I/c Head, PPD Division, IINRG
4. Dr A Bhattacharya, PS & I/c RMU, IINRG

The following major recommendations were made during RAC meeting :

- Nine out of 10 new research projects under regular research programme and network projects have been approved with specific suggestions.
- The core programmes to be revised in light of suggestions.
- The priority areas, research programme of the Institute as well as programme of network projects on natural resins & gums & *in-situ* conservation of lac insects were endorsed.
- Emphasize should be laid on research on production & application in participatory & partnership mode with farmers & industry.
- The flagship or projects should reflect major thrust areas of the institute.
- Priority should be given to climate resilient studies as related to the production system.
- The pilot plants of the institute may be planned for utilization as technology incubators for entrepreneurs.
- Initiative should be taken for starting a Journal on natural resins & gums to facilitate publication of research findings on the subject.

8.3 Institute Research Committee

The Institute Research Committee (IRC) meeting for the year 2009-2010 was held during April 19-20, 2010

under the Chairmanship of Dr Ajoy Bhattacharya, Director, IINRG in the Institute Conference Hall to review the progress of institutional research projects. In his opening remarks, Dr A Bhattacharya, Chairman IRC welcomed HODs, MS, IRC and scientists present in the meeting. He emphasized on initiating action research on natural resins & gums by scientists. Heads of all divisions presented the progress report of respective divisions. Thereafter progress reports of ongoing research projects were presented by PIs. The overall progress presented by the PIs was remarked to be fairly good by Chairman, IRC. After deliberations for two days, the Chairman emphasized that in view of XIIth plan, necessary planning & thorough thinking process should be initiated at this moment. He also suggested that scientists who have submitted RPF III or completed in hand projects, should present new project at earliest. In the end, he motivated the scientists to contribute & give their best in R&D activities.

Second Institute Research Committee was held on 21-22nd December, 2010 to review the progress of the institutional projects. Dr R Ramani, Chairman IRC, in his welcome address greeted HODs, Member Secretary IRC & Scientists present in meeting. He opined that scientists should give a lot of thinking before proposing new projects considering QRT/ RAC recommendations. He indicated that PPD division has to play major role for commercialization of technologies. He suggested that monthly reports should be brief & informative. After valuable remarks of the Chairman, progress of the projects were presented by respective PIs. The overall progress presented by PIs was felt to be satisfactory. The suggestion from members of IRC for improving the research output included that all projects may be concluded in March whatever the date may be of initiation. Head TOT was requested to organize separate training programme for KVK staff to sensitize lac production.

9. DISTINGUISHED VISITORS

Visitors

| Date | Visitors |
|-----------|--|
| 16.02.10 | Mr Rod Chistine Turnbull, Canada |
| 19.02.10 | Dr S Maurya, ADG (IP & TM), ICAR, New Delhi |
| 19.02.10 | Dr NN Singh, Vice-Chancellor, Birsa Agricultural University, Ranchi |
| 22.02.10 | Mr Harinder Patanga, Joint Director (Agricultural Information), Directorate of Extension, New Delhi |
| 22.02.10 | Mr Mathura Prasad Mahto, Hon'ble Agricultural Minister, Govt of Jharkhand |
| 24.02.10 | Mr Chandreshwar Prasad Singh, Hon'ble Speaker, Jharkhand Assembly |
| 02 .07.10 | Dr M Neelima Kerketta, IAS, Tribal Welfare Commissioner, Govt of Jharkhand |
| 20 .07.10 | Dr Ram Dayal Munda, Member, Rajya Sabha |
| 22 .07.10 | Mr Ranjan Chatterjee, IAS, Consultant, Planning Commission |
| 30 .07.10 | Mr SS Bist, PCCF and MD, WB Forest Dev Corp, Kolkata |
| 05 .08.10 | Mr MOH Farooq, His Excellency Governor of Jharkhand |
| 12 .08.10 | Mrs V Vishwanath, CEO, Udyogini, New Delhi |
| 13 .09.10 | Mr Ranendra Kumar, Joint Director, SKIPA, Ranchi |
| 18 .09.10 | Dr MJ Modayil, Member ASRB, New Delhi . |
| 20 .09.10 | Wilfred Lakra, IAS(Retired) and former Advisor to Governor of Jharkhand, Dr MJ Modayil, Member, ASRB, New Delhi and Mr MV Ashok, CGM, NABARD, Ranchi, Dr NPS Sirohi, ADG (Engg), ICAR, New Delhi, Dr KK Kumar, former Director, NRC Litchi and Dr Suresh Prasad, Chairman, RAC |
| 06. 10.10 | Dr B Meena Kumari, DDG (ICAR), New Delhi |
| 02.11.10 | Mr Ravindra Verma, CVO/HEC Ltd. Ranchi |
| 16.11.10 | Ms Juliane Derry, Technical Expert (Restoration, Conservation and Gilding), Norway |

10. SUPPORT SERVICES



10.1 Institute Research Farm

Institute research farm is field laboratory. Keeping in view the field research, the farm is managed and maintained to minimize experimental error due to farm conditions. The following activities were carried out during the period under report

- Landscaping/development of the vacant/unutilized plot no. 55,56,60 and part of 61
- Construction of On-farm training hall and Green poly house
- Renovation of two water tanks

- Repair of 4 major roads, sides of *pucca* roads and 15 bunds
- Treatment of 200 termitorium with Biflex TC
- Transplantation of 17 coconut plants of improved variety from Kerala at the bunds of earthen pond
- 126 papaya & 200 *F. semialata* plants were planted at plot no. 38
- 100's of each teak and *gamahar* plants were transplanted as gap filling around the boundary wall

Resource generation

| Broodlac | Fuel wood | Water & Fuel charge | Other produce | Total |
|---------------|-------------|---------------------|---------------|---------------|
| ₹ 2,32,999.00 | ₹ 36,117.00 | ₹ 33,250.00 | ₹ 75,818.00 | ₹ 3,78,184.00 |

10.2 Quality Evaluation Lab

During the report period, a total no. of 73 samples of lac and lac based products have been received from Government organizations/private industries. Various divisions of IINRG and in all 315 tests have been carried out and a sum of ₹ 6,509/- has been earned and a sum of ₹ 7,005/- is due against JHASCOLAMPF and ₹ 15,497/- against NAIP projects. In addition 9 persons have been trained in the determination of Bleach Index and one in the manufacturing of Dewaxed Decolourized Lac.

DARE report to the Council, information related to SMD meeting etc.

- Management of HRD programmes of scientists and other staff of the institute
- Maintenance of research project files of the institute
- Processing of research/routine activities submitted for publication in journals etc.
- Providing LAN and internet connectivity to the Divisions and Sections of the institute
- Providing e-mail services to the scientist
- Annual maintenance of computer system & Local Area Networking (LAN) of the institute
- Power point presentations during meetings, seminars etc.
- Maintenance of Conference Hall
- Maintenance of RAC, QRT and SRC files
- Maintenance of database for Personnel information Management System Network (PERMISNET) and Intelligent Reporting System

10.3 Prioritization, Monitoring and Evaluation Cell

The activities performed by Prioritization, monitoring and evaluation cell during the report period were:

- Correspondence and sending important reports to the Council
- Compilation and preparation of various reports to the Council like monthly report, monthly report for Cabinet Secretariat, quarterly progress report, six monthly report of the scientists and

- Processing requests under Right to information
- Maintenance of database for Project Information Management System (PIMS Net-ICAR) a web based software
- Updation of institute website (General information, Tenders, Vacancy) from time to time
- Development of application software for record keeping of institute publication and HRD

The PME cell presently maintains three servers namely, proxy server for providing internet connectivity to various Divisions/Section, Mail Server for providing e-mail facilities and Apache Web Server for hosting website.

10.4 Library and Documentation Centre

The library of the Institute plays an important role in meeting the information needs of its 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 parts of the country.

The library maintained adequate linkage with leading reference libraries for strengthening the information resources. The library also supplies photocopies of rare research articles to NISCAIR, New Delhi from time to time against payment.

Advance/Full Text/Abstract access of 2743 journals from several publishers has been made available online through Consortium for e-Resources in Agriculture (CeRA) to scientists from other institutes during the year.

Revenue generated ₹ 8,570.00 from the sale of publications and reprographic services during the year.

The library also exchanges institute publications with the scientific institutions in and outside the country.

Services provided by the Library to its users

- E-journals access

- CD Searches
- Document Delivery Services
- Reprographic Services
- Bibliographic Services
- Current Awareness Services
- Inter Library Loan Services for resource sharing
- Sale of Institute Publications

Journals and periodicals subscribed/received

- Foreign Periodicals (Subscribed) - 08
- Foreign Periodicals (Gratis/exchange) - 02
- Indian Periodicals (Subscribed) - 45
- Indian Periodicals (Gratis/exchange) - 18

Library holdings (as on 31.12.2010)

| Documents | Additions | Total Holdings |
|-------------------|-----------|----------------|
| Books | 56 | 7700 |
| Bound Journals | 45 | 21386 |
| Annual Report | 82 | 4776 |
| CD-Rom | - | 123 |
| IS-Specification | 18 | 157 |
| Maps | - | 37 |
| Patents (Foreign) | - | 327 |
| Patents (Indian) | - | 15 |
| Thesis | 01 | 10 |

10.5 Estate Section

The Estate section takes care of essential services such as security of institute premises, water and power supply as well as infrastructure development work of the institute including the engineering research work.

Civil & Water supply

A. Completion of work through CPWD

1. AR & MO of residential Quarter
 - Type-III 9 & 11 in main campus
 - Type-IV 1 & 2 in Main Campus
 - Type-II 1-12 in Main Campus

- Type-V 3&4 in Main Campus
- Bungalow No.1
- Construction of plinth protection of PPD Division.
- Laying of water pipe line in main campus is in progress.

B. Work carried out departmentally

- Distempering of small hall in PD unit.
- Weather coat painting of Bungalow No. 2 from outside.
- Electrical renovation of estate section.
- Electrical renovation of residential quarter Type III-14 to 17 and Type II-21 to 36 in PDU Campus.
- Laying of power cable for power supply to IRF and pump house at IRF.

C. Work proposed for year 2011

- AR & MO of riverbed pump house.
- Connectivity of bore well in PDU Campus to water pump through pipe (departmentally)
- Roof treatment of Bungalow No.1, Purchase Section, Central Store, PME Cell Building.
- AR & MO of pump house in main campus and PDU Campus.

Total number of jobs entered in various units of Estate section are :

- Carpentry works- 351 jobs
- Welding works- 183 jobs
- Electrical works- 870 jobs
- Turner works- 435 jobs

Electrical and Genset

A. Completion of work through CPWD

- Electrical renovation of PPD Division.
- Electrical renovation of LPD Division
- Laying of underground power cable & installation of feeder and distribution panel.

- Electrical renovation of residential quarters Type-V 3&4, Type-IV 1&2, Type-III 9&11 and Type-II 1-2 in main Campus.

B. Work carried out departmentally

- Electrical renovation of TOT Division and Riverbed pump house.
- Electrical renovation of residential quarter Type III 1 to 8 departmentally.
- Electrical renovation of Bungalow No. 2 departmentally.

Other activities

- Fabrication of canopy for panels of bore well in PDU Campus.

10.6 Health Care

The institute is running its own dispensary in the campus. AMA Dr Anil Kumar and the lady doctor AMA Dr (Mrs) Vipula Verma are working as a part time Medical Officer on Contractual basis on alternate days. Most of the cases were handled in the dispensary itself except complicated cases which are referred to authorized hospitals in the city for expertise treatment. The dispensary is well equipped with all instruments/accessories to handle the cases of general/minor dressing, first aid, physical examination of the gents/ladies patient and determining BP, Pulse, Weight, Blood Sugar. During this period around 8100 patient were attended in the IINRG dispensary. Most of the medicines prescribed by AMAs were made available to the patients from dispensary itself. Apart from regular employees, contractual staffs of our institute are also looked after by them.

10.7 Institute Technology Management Unit

Participation was done in three ICAR-Industry meet for commercialization / promotion of technologies held at ICAR (RC), NE Region, Barapani, DWM, Bhubaneswar and BAU Ranchi in the year 2010-11.

A two day Meeting Cum Workshop of ZTMC, NIRAJFT, Kolkata was organized at IINRG, Ranchi in

Feb 2010 in which 54 members of different ITMUs and BPD Units participated.

Participation in Nature Fest was made at Salt Lake, Kolkata which was organized by NABARD from October 25-November 03, 2010 and stall was put up for demonstration of technology of scientific lac cultivation and lac products.

Patent search (05 nos.) under sub-project of Network Project was done on: Mince meat production, Bore hole technique, Aromatic compounds of *guggul*, Enzymatic method for removal of residual gum in guar meal and patent search was also done for gum moringa and various patents on guar gum.

Documentation and compilation for filling patent application of Food Grade preparation of Lac Dye was done.

ITMC meeting was held on 29th November 2010 to discuss and finalize reserve price of technology of fruit coating formulation for Kinnow and mode of its technology transfer.

ATR preparation and compilation of the proceedings of the 2nd and 3rd Central Technologies Management Committee (CTMC) meeting held on June 02 and July 14, 2010 respectively was done and sent to the ADG, IPR. Compilation of information regarding the technologies generated from research output of institute from year 2005-2010 was done along with their techno-economic valuation and sent to headquarter.

Preparation and reporting on self review of the XI-Plan scheme Intellectual Property Management & Transfer/Commercialization of Agricultural Technology was done in December, 2010 to ADG, IPR

MoU for commercialization of shellac based dental plate was prepared and signing of MoU with MDM Corporation, New Delhi was done.

Drafting of MoU with Govt. of Gujarat Knowledge Application Centre on Collaboration & Cooperation on Research & Entrepreneur development on Lac & Gums related fields was done in January, 2011.

Extension materials were prepared on potential commercialisable lac based technologies; Fruit coating formulation for Kinnow, Small scale lac processing unit, Improved lac based wood varnish, Lac based water thinnable paint, recovery of by-product lac dye, glazing varnish, lac wood shine etc.

10.8 Agrometeorology

Agrometeorology Unit of the Institute is situated at 23° 23' N latitude, 85° 23' E longitude and 650 m altitude.

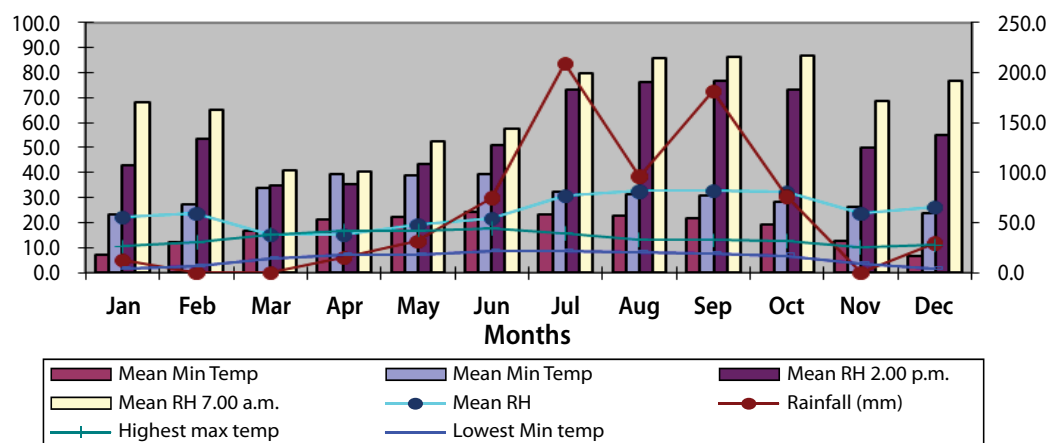
Total rainfall recorded was 724.7 mm, which was 34.3 % less than the previous year (1103.8 mm). The highest rainfall (208.7 mm) was recorded during July month, while February, March and November experienced no rains. The maximum number of rainy days was observed in July (13). The maximum one-day rainfall event occurred on September 14th amounting to 46.0 mm. Monsoon months (June to September) alone accounted for 560.7 mm (77.4 %) of the total yearly rainfall. The yearly rainfall analysis for last year indicates that the mean annual rainfall of Namkum, Ranchi is 1291.03 mm and the region receives more than 84 per cent of annual rainfall during the months of June to September. Thus, this year has recorded 566.3 mm less rainfall (56.1%) and even monsoon season (June-September) has recorded 6.6% less rainfall.

The highest mean maximum temperature (39.5°C) was observed in the month of April and the lowest mean minimum temperature (6.4°C) during December. June 3, 13 and 14 were recorded as the hottest and December 26, 27 and 31 were recorded as the coldest day of the year with a temperature of 44.0°C and 4.0°C, respectively.

Meteorological data recorded at Agro-Met Unit of the Institute during 2010

| Month | Mean Temperature (° C) | | Highest Max Temp (° C) | Lowest Min Temp (° C) | Relative Humidity (%) | | Mean Relative Humidity (%) | Total Rainfall (mm) |
|-----------|---------------------------|---------|---------------------------------|--------------------------------|--------------------------|-----------------------|-------------------------------------|---------------------------|
| | Maximum | Minimum | | | 7.00 a.m. | 2.00 p.m. | | |
| January | 23.1 | 6.9 | 26.0 | 4.0 | 68.0 | 43.1 | 55.5 | 12.0 |
| February | 27.5 | 11.9 | 30.0 | 6.1 | 65.0 | 53.8 | 59.4 | 0.0 |
| March | 33.8 | 16.9 | 38.0 | 14.0 | 40.9 | 34.8 | 37.8 | 0.0 |
| April | 39.5 | 21.1 | 42.0 | 18.0 | 40.4 | 35.1 | 37.8 | 15 |
| May | 38.9 | 22.4 | 42.0 | 18.0 | 52.4 | 43.6 | 48.0 | 31.3 |
| June | 39.4 | 24.2 | 44.0 | 22.0 | 57.5 | 51.2 | 54.4 | 74.7 |
| July | 32.1 | 23.1 | 39.0 | 22.0 | 80.0 | 73.1 | 76.5 | 208.7 |
| August | 31.3 | 22.7 | 33.0 | 21.0 | 86.1 | 76.1 | 81.1 | 96.0 |
| September | 30.7 | 21.8 | 32.0 | 20.0 | 86.5 | 76.8 | 81.6 | 181.3 |
| October | 28.1 | 19.4 | 31.5 | 17.5 | 86.8 | 73.0 | 79.9 | 76.2 |
| November | 26.0 | 12.6 | 25.0 | 9.0 | 68.8 | 50.1 | 59.5 | 0.0 |
| December | 23.9 | 6.4 | 27.0 | 4.0 | 76.6 | 54.8 | 65.7 | 29.5 |
| | | | | | | Total rainfall | | 724.7 |

Pictorial presentation of weather parameters recorded at Agro-Met Unit of the Institute during 2010





11. 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 तकनीकी अधिकारी (रा.भा), एक अंशकालीन तकनीकी सहायक तथा एक अंशकालीन पदचर कार्यरत हैं। संस्थान में राजभाषा संबंधी क्रियाकलापों 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 तकनीकी अधिकारी (रा.भा) सदस्य सचिव हैं।

संस्थान 'क' क्षेत्र में है, इसे राजभाषा अधिनियम की धारा 10(4) के अर्न्तगत केन्द्रीय गजट में अधिसूचित किया जा चुका है। संस्थान के चार 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 संस्थान के 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 बैठकों का आयोजन, कार्यसूची एवं कार्यवृत्त की तैयारी एवं बैठकों में लिए गये निर्णयों पर अनुवर्ती कार्रवाई।
- वार्षिक रिपोर्ट का सारांश, भा.प्रा.रा.गों.सं. समाचार पत्रिका, कार्यालय आदेश, परिपत्र, ज्ञापन, निविदा, सूचना एवं पत्राचार हेतु विभिन्न सामग्रियों का 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।
- हिन्दी दिवस, हिन्दी चेतना मास एवं योजनानुसार

नगर स्तरीय राजभाषा संबंधी प्रतियोगिता एवं कार्यशाला का आयोजन करना।

- संदर्भ साहित्य, हिन्दी पत्रिका, शब्दकोश एवं तकनीकी शब्दावली के उपार्जन हेतु कार्य
- द्विभाषी मुहरों, नामपट्ट, पत्रशीर्ष (लेटरहेड) के निर्माण अथवा सक्रिय सहयोग करना।
- प्रचार सामग्रियों के हिन्दी रूपान्तर एवं समारोहों के समाचार संकलन 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 2009 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 05.03.10 (ख) दिनांक 21.05.10

(ग) दिनांक 09.08.10 एवं (घ) दिनांक 01.11.10

जिसके अर्न्तगत निम्नलिखित प्रमुख चर्चायें हुई तथा सर्वसम्मति से निर्णय लिए गए :-

- संस्थान में हिन्दी में मूल रूप से पत्राचार बढ़ाने के लिए नकद पुरस्कार योजना का अनुपालन।
- वार्षिक कार्यक्रम 2009-10 के प्रस्ताव पर चर्चा।
- हिन्दी प्रकोष्ठ के लिए अनुबंध पर लिपिक की व्यवस्था।
- गृह पत्रिका लाक्षा 2010-11 का प्रकाशन।
- संस्थान के मुख्य द्वार पर द्विभाषी ग्लोसाईन बोर्ड लगाना।
- गोंद एवं राल के विभिन्न पहलुओं पर व्याख्यान।
- वित्त संबंधी विषय पर हिन्दी कार्यशाला का आयोजन।

- द्विभाषी मुहरों का निर्माण।
- द्विभाषी नामपट्ट की व्यवस्था।
- राजभाषा प्रकोष्ठ को प्रचार संबंधी कार्य का दायित्व।
- हिन्दी दिवस/हिन्दी चेतना मास/हिन्दी प्रतियोगिताओं का आयोजन।
- संस्थान पुस्तकालय के माध्यम से हिन्दी पुस्तकों का उपार्जन।
- परिसर के शेष वृक्षों पर नामपट्ट लगाना।
- स्वास्थ्य संबंधी विषय पर हिन्दी कार्यशाला।
- हिन्दी में वैज्ञानिक संगोष्ठी का आयोजन।
- जाँच-विन्दु का निर्धारण।
- हिन्दी की-बोर्ड का परिचालन।
- सभी कम्प्यूटरों में हिन्दी फॉन्ट लगाना।

राजभाषा प्रकोष्ठ की उपलब्धियां

- “ग्वार गोंद के विभिन्न आयाम” विषय पर दिनांक-12.05.2010 को वैज्ञानिक हिन्दी संगोष्ठी का आयोजन किया गया।
- “स्रेत पर आयकर की कटौती” विषय पर दिनांक-08.11.2010 को हिन्दी व्याख्यान का आयोजन किया गया।
- “प्राकृतिक राल एवं गोंद- भा.प्रा.रा.गों.सं. समाचार पत्रिका” का सम्पूर्ण अनुवाद एवं वार्षिक प्रतिवेदन के सारांश का हिन्दी अनुवाद किया गया।
- संस्थान के मुख्य द्वार पर द्विभाषी ग्लोसाईन बोर्ड लगाया गया।
- संस्थान की वार्षिक हिन्दी पत्रिका लाक्षा के दूसरे अंक का जुलाई 2010 में 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।

- सतर्कता जागरूकता सप्ताह के अवसर पर दिनांक 02.11.2010 को सतर्कता जागरूकता सप्ताह की उपादेयता एवं आवश्यकता विषय पर व्याख्यान का आयोजन किया गया।
- वर्ष 2010 में राजभाषा प्रकोष्ठ की पहल पर विज्ञान एवं साहित्य तथा नियमों से संबंधित कुछ हिन्दी पुस्तकों का उपार्जन किया गया।
- 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।
- सरकारी काम काज मूल रूप से हिन्दी में करने हेतु संस्थान में नकद पुरस्कार योजना लागू की गई। इसमें वैज्ञानिक, तकनीकी एवं प्रशासकीय वर्ग के कुल 06 अधिकारियों/कर्मचारियों ने भाग लिया।

कार्यक्रम

हिन्दी दिवस समारोह

भारतीय प्राकृतिक राल एवं गोंद संस्थान में राजभाषा अधिनियम के अनुपालन एवं कार्यालय कार्य में राजभाषा के प्रयोग में उत्तरोत्तर वृद्धि के लिए संस्थान में दिनांक-01.09.2010 से 30.09.2010 तक हिन्दी चेतना मास का पालन तथा दिनांक-13.09.2010 को अपराह्न 02.00 बजे हिन्दी दिवस समारोह का आयोजन किया गया।



हिन्दी दिवस समारोह

हिन्दी दिवस समारोह के अवसर पर मुख्य अतिथि के रूप में उपस्थित श्री रणेन्द्र कुमार, वरिष्ठ साहित्यकार एवं संयुक्त निदेशक, श्री कृष्ण लोक प्रशासन संस्थान (ए.टी.

आई.) राँची ने कालजयी कवियों के शताब्दी वर्ष विषय पर व्याख्यान दिया। इस विषय पर बोलते हुए उन्होंने स्व. श्री सच्चिदानन्द हीरानन्द वात्स्यायन 'अज्ञेय', एवं स्व. श्री शमशेर बहादुर सिंह का हिन्दी काव्य साहित्य में योगदान का उल्लेख किया एवं उनकी कुछ रचनाओं की समीक्षा की। श्री कुमार ने उनकी कविताओं में छिपे जीवन मूल्यों को उकेरा और कहा कि हिन्दी साहित्य सदैव उनका श्रुणी रहेगा। उन्होंने हिन्दी को एक समृद्ध भाषा बताया एवं इसे जीवन के हर क्षेत्र में अपनाने की सलाह दी।

इस अवसर पर उपरोक्त विषय पर बोलते हुए विशिष्ट अतिथि डॉ. मिथिलेश कुमार सिंह, सह प्राध्यापक, हिन्दी विभाग, राँची विश्वविद्यालय, राँची ने स्व. श्री बैजनाथ मिश्र 'यात्री' उर्फ बाबा नार्गाजुन एवं स्व. श्री केदार नाथ अग्रवाल के जीवनी एवं हिन्दी काव्य में उनके योगदान पर प्रकाश डाला। डॉ. सिंह ने उनकी रचनाओं में ग्रामीण परिवेश की विविधता के विशद विवरण की चर्चा की तथा बताया कि बहुत कम लोगों ने गरीबी और अभाव का ऐसा सजीव चित्रण किया है।

संस्थान के निदेशक, डॉ. रंगनातन रमणि 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। हमने हिन्दी के अतिरिक्त अन्य भारतीय भाषाओं जैसे बांग्ला, उड़िया एवं नागपुरी में भी पत्रक प्रकाशित किए हैं। संस्थान में ज्यादातर प्रशिक्षण कार्यक्रम हिन्दी में ही चलाए जाते हैं। हमारा पुस्तकालय वैज्ञानिक साहित्य की दृष्टि से बहुत समृद्ध है, साथ ही यहाँ प्रचुर संख्या में हिन्दी की पत्रिकाएं/पुस्तक/पुस्तिकाएं उपलब्ध हैं। संस्थान में ढेर सारे दुर्लभ वृक्ष हैं, जिनपर द्विभाषी नामपट्ट लगाया गया है।

हिन्दी चेतना मास की अवधि में दिनांक— 01—02 सितम्बर 2010 को हिन्दी टिप्पण, प्रारूप लेखन, निबंध, अंताक्षरी, पर्याय एवं हिन्दी सुलेख प्रतियोगिताओं का आयोजन

किया गया। जिसमें डॉ एम जेड सिद्दीकी, सर्वश्री विनोद कुमार सिंह, मो फहीम अंसारी, कृष्ण मुरारी कुमार, कामेश्वर उरांव, विनोद कुमार, रंजय कुमार सिंह, कवल किशोर प्रसाद, मदन मोहन, रघुनाथ महतो, प्रहलाद सिंह, मुन्ना लाल रविदास, अर्जुन गोप, शरत चन्द्र लाल, अरुण कुमार त्रिपाठी, अनिल कुमार सिन्हा इत्यादि को पुरस्कार प्रदान किया गया।

भारतीय कृषि अनुसंधान परिषद, नई दिल्ली के साथ-साथ संस्थान के हिन्दी प्रकाशनों की एक प्रदर्शनी लगाई गई। सभा संचालन डॉ अंजेश कुमार, तकनीकी अधिकारी एवं धन्यवाद ज्ञापन समारोह की अध्यक्ष एवं वरिष्ठ वैज्ञानिक डॉ दिव्या ने किया।

दिनांक—01.09.2010 से 30.09.2010 तक मनाए जा रहे हिन्दी चेतना मास के अन्तर्गत दिनांक—20.09.2010 को संस्थान में हास्य कवि सम्मेलन का आयोजन किया गया जिसमें श्री कुमार वृजेन्द्र, राँची; श्री कामेश्वर श्रीवास्तव, 'निरंकुश', राँची; श्री सलीम शिवाल्गी, बनारस; श्री जाहिर ऐश, झरिया, झारखण्ड; श्री शम्भुशरण मंडल, धनबाद; श्री छुट्टन लाल मीणा व डॉ अंजेश कुमार, भा प्रा रा गों सं ने अपनी रचनाएं प्रस्तुत कीं एवं लोगों को हंसा कर प्रसंशा बटोरी। इस अवसर पर संस्थान के अधिकारियों/कर्मचारियों/परिवारजनों के अतिरिक्त निदेशक डॉ रंगनातन रमणि, सहायक महानिदेशक (पी ई) डॉ एन पी एस सिरोही, संस्थान के अनुसंधान परामर्शदातृ समिति के अध्यक्ष, डॉ सुरेश प्रसाद के साथ ही संस्थान के स्थापना दिवस पर आयोजित राष्ट्रीय सम्मेलन के प्रतिनिधिगण भी उपस्थित थे। कार्यक्रम के अन्त में सहायक महानिदेशक महोदय ने कवियों को सम्मानित किया।

संस्थान के हिन्दी/द्विभाषी प्रकाशनों की सूची

1. प्राकृतिक राल एवं गोंद—भा प्रा रा गों सं समाचार पत्रिका (द्विभाषी) अंकों की संख्या—05, पृष्ठों की संख्या—52
2. गृह पत्रिका लाक्षा, पृष्ठों की संख्या—80
3. ईयर प्लानर सह प्रचार पत्रक (द्विभाषी), पृष्ठों की संख्या—28

संस्थान राजभाषा कार्यान्वयन समिति की तिमाही बैठकों में लिए गए निर्णय एवं की गई कार्रवाई

| क्रम सं. | लिए गए निर्णय | अनुपालन/की गई कार्रवाई |
|----------|--|--|
| 1. | राजभाषा प्रकोष्ठ को प्रचार संबंधी कार्य का दायित्व | राजभाषा प्रकोष्ठ को प्रचार संबंधी कार्य का दायित्व दिया गया है तथा तकनीकी अधिकारी (राजभाषा) को प्रचार अधिकारी का प्रभार दिया गया है। |
| 2. | द्विभाषी मूहरों का निर्माण | मांग-पत्र के अनुसार द्विभाषी मूहरों का निर्माण किया गया है। |
| 3. | सभी कम्प्यूटरों में हिन्दी सॉफ्टवेयर लगाना | वैज्ञानिक उपकरणों से जुड़े कम्प्यूटरों को छोड़कर संस्थान के कुछ अन्य कम्प्यूटरों में हिन्दी फॉन्ट लगा दिये गये हैं। |
| 4. | संस्थान की हिन्दी पत्रिका लाक्षा का प्रकाशन | संस्थान की हिन्दी पत्रिका लाक्षा का प्रकाशन जुलाई 2010 में कर लिया गया है। |
| 5. | हिन्दी प्रतियोगिताओं का आयोजन | संस्थान में टिप्पण, प्रारूप लेखन, निबंध, श्रुतिलेख, अंताक्षरी इत्यादि हिन्दी प्रतियोगिताओं का आयोजन किया गया। |
| 6. | हिन्दी चेतना मास एवं हिन्दी दिवस समारोह का आयोजन | हिन्दी चेतना मास एवं हिन्दी दिवस समारोह का आयोजन किया गया। |
| 7. | हिन्दी कार्यशाला/संगोष्ठी का आयोजन | वित्तीय विषय पर हिन्दी कार्यशाला एवं वैज्ञानिक विषय पर संगोष्ठी का आयोजन किया गया। |
| 8. | नकद पुरस्कार योजना लागू करना | हिन्दी में मूल पत्राचार को बढ़ावा देने के लिए नकद पुरस्कार योजना लागू की गई है। |
| 9. | जाँच-विन्दु का निर्धारण | राजभाषा अधिनियम के प्रावधानों के अनुरूप जाँच-विन्दु का निर्धारण किया गया है। |
| 10. | कम्प्यूटर पर कार्य करने के लिए हिन्दी की-बोर्ड की व्यवस्था | कम्प्यूटर पर कार्य करने के लिए हिन्दी की-बोर्ड की व्यवस्था कर सभी विभागों/अनुभागों को परिचालित किया गया है। |
| 11. | मुख्य द्वार पर द्विभाषी ग्लोसाईन बोर्ड की व्यवस्था | मुख्य द्वार पर द्विभाषी ग्लोसाईन बोर्ड लगा दिया गया है। |

अन्य गतिविधियां

- केन्द्रीय मनश्चिकित्सा संस्थान, कांके में दिनांक-28.01.2010 एवं दिनांक-25.08.2010 को आयोजित राँची नगर राजभाषा कार्यान्वयन समिति की बैठक में संस्थान का प्रतिनिधित्व डॉ अंजेश कुमार, तकनीकी अधिकारी (रा भा) ने किया तथा बैठक में संस्थान की गतिविधियों की जानकारी दी तथा सचिव, नगर राजभाषा कार्यान्वयन समिति के विशेष अनुरोध पर दोनों बैठकों का संचालन भी किया गया।
- डॉ अंजेश कुमार, तकनीकी अधिकारी (रा भा) को दिनांक- 16.03.2010 से प्रचार अधिकारी का अतिरिक्त प्रभार दिया गया।
- केन्द्रीय रिजर्व पुलिस बल प्रशिक्षण महाविद्यालय, तिरिल, राँची द्वारा संस्थान के तकनीकी अधिकारी (रा भा) को हिन्दी दिवस के अवसर पर विशिष्ट अतिथि के रूप में आमंत्रित किया गया।



PERSONNEL

Sanctioned strength of Scientific, Technical, Administrative and Supporting staff as on 31.12.2010

Scientific

| | |
|---------------------|-----------|
| R M P | 01 |
| Principal Scientist | 04 |
| Senior Scientist | 11 |
| Scientist | 31 |
| Total | 47 |

Technical

| | |
|--------------|-----------|
| Category-I | 41 |
| Category-II | 21 |
| Total | 62 |

Administrative

| | |
|------------------|-----------|
| A O | 01 |
| F & A O | 01 |
| A A O | 02 |
| A D (O L) | 01 |
| Sr P A | 01 |
| Security Officer | 01 |
| P A | 02 |
| Assistant | 09 |
| Sr Clerk | 13 |
| Jr Clerk | 03 |
| Steno Gr III | 01 |
| J A O | 01 |
| Total | 36 |

Skilled Supporting Staff

| | |
|--------------------|------------|
| SSG-IV | 10 |
| SSG-III | 20 |
| SSG-II | 34 |
| SSG-I | 17 |
| Total | 81 |
| Grand Total | 226 |

| Cadre | Sanctioned | In position |
|------------|------------|-------------|
| Scientific | 47* | 29* |
| Technical | 62 | 56 |

| | | |
|----------------|------------|------------|
| Administrative | 36 | 23 |
| Supporting | 81 | 62 |
| Total | 226 | 170 |

* Including RMP

Dr R Ramani

Director

Lac Production Division

Disciplines

| | |
|----------------------------|--------------------|
| Dr AK Singh, PS & Incharge | Plant Pathology |
| Dr KK Sharma, PS | Agril Entomology |
| Dr Soumen Ghosal, Sr Sc | Agronomy |
| Dr (Md) Monobrullah, Sr Sc | Agril Entomology |
| Sh RK Singh, Sc (SS) | SWCE |
| Dr Vaibhav D Lohot, Sc | Physiology |
| Sh Anees K, Sc | Plant Biochemistry |
| Dr (Ms) Thamilarasi K, Sc | Biotechnology |
| Dr A Mohanasundaram, Sc | Agril Entomology |
| Sh SC Meena, Sc | Agril Entomology |
| Sh RL Ram, T-5 | F/F Tech |
| Sh ML Ravidas, T-5 | F/F Tech |
| Sh PA Ansari, T-5 | F/F Tech |
| Sh Binod Kumar, T-5 | F/F Tech |
| Sh RK Swansi, T-4 | F/F Tech |
| Sh KA Nagruwar, T-4 | F/F Tech |
| Sh SK Tripathi, T-2 | F/F Tech |
| Sh Bhupal Kumar, T-1 | Lab Tech |

Processing & Product Development Division

| | |
|---------------------------------|---------------|
| Sh Murari Prasad, PS & Incharge | Chemical Engg |
| Dr KP Sao, PS | Physics |
| Dr N Prasad, PS | ASPE |
| Dr PC Sarkar, Sr Sc | Org Chem |
| Dr S Srivastava, Sr Sc | Org Chem |
| Dr MZ Siddiqui, Sr Sc | Org Chem |
| Dr Divya, Sr Sc | Org Chem |
| Sh SK Pandey, Sc (SS) | Mech Engg |
| Sh MF Ansari, Sc (SS) | Org Chem |
| Sh SKS Yadav, Sc | Org Chem |
| Dr SC Sharma, Sc | FMP |
| Sh DD Singh, T(7-8) | Lab Tech |

| | |
|----------------------|----------|
| Sh KK Prasad, T(7-8) | Lab Tech |
| Sh TK Saha, T-6 | Lab Tech |
| Sh Bhola Ram, T-5 | Lab Tech |
| Smt Prabha Devi, T-4 | Lab Tech |
| Sh Binod Kumar, T-2 | Lab Tech |
| Sh SK Tirkey, T-2 | Lab Tech |
| Sh Ajay Kumar, T-2 | Lab Tech |
| Sh RK Rai, T-2 | Lab Tech |
| Sh Anup Kumar, T-2 | Lab Tech |

Transfer of Technology Division

| | |
|--------------------------|---------------|
| Dr AK Jaiswal, PS & Head | Agril Ento |
| Dr A Bhattacharya, PS | Agril Ento |
| Dr BP Singh, PS | Agronomy |
| Dr JP Singh, Sr Sc | Agril Ento |
| Sh PM Patil, Sc (SS) | Physical Chem |
| Dr G Pal, Sc (SS) | Agril Eco |
| Sh RP Srivastava, T-5 | Photographer |
| Sh DK Singh, T-5 | F/F Tech |
| Sh AK Sinha, T-5 | F/F Tech |
| Smt Ratna Sen, T-5 | Lab Tech |
| Sh P Pattamajhi, T-5 | F/F Tech |
| Sh SB Azad, T-4 | F/F Tech |
| Sh Madan Mohan, T-2 | Lab Tech |

Prioritization, Monitoring and Evaluation Cell

| | |
|-----------------------|----------|
| Dr A Bhattacharya, PS | I/C RMU |
| Sh AK Sahay, T(7-8) | F/F Tech |
| Sh D Ganguly, T-6 | Lab Tech |
| Sh KM Sinha, T (7-8) | Lab Tech |
| Sh Sunil Kumar, T-5 | Lab Tech |

Quality Evaluation Lab

| | |
|------------------------|----------|
| Dr S Srivastava, Sr Sc | I/C, QEL |
| Sh D Ghosh, T (7-8) | Lab Tech |
| Sh BK Singh, T-2 | Lab Tech |

Library

| | |
|-------------------------------|-------------------------|
| Sh VK Singh, T(7-8), I/C, Lib | Library & Documentation |
| Sh Binod Kumar, T-4 | Library & Documentation |

Institute Research Farm

| | |
|------------------------|----------|
| Sh LCN Shahdeo, T(7-8) | F/F Tech |
| Sh M Surin, T-3 | F/F Tech |
| Sh Satish Kumar, T-3 | F/F Tech |
| Sh SK Mukherjee, T-2 | F/F Tech |

Estate

| | |
|--------------------------|------------------|
| Sh AK Yadav | Security Officer |
| Sh Amrendra Kishore | AAO |
| Sh HL Bhakta, T-4 | Workshop Tech |
| Sh Binay Kumar, T-3 (JE) | Workshop Tech |
| Sh Arjun Sharma, T-2 | Workshop Tech |
| Sh RK Ravi, T-2 | Workshop Tech |
| Sh K Tirkey, T-2 | Workshop Tech |
| Sh BS Choudhary, T-2 | Workshop Tech |
| Sh PVD Tirkey, T-2 | Workshop Tech |
| Sh Ramakant Singh, T-1 | Workshop Tech |
| Sh AK Sharma, T-1 | Workshop Tech |
| Sh M Mahto, T-1 | Workshop Tech |

Official Language Cell

| | |
|----------------------|-------------------|
| Dr Anjesh Kumar, T-5 | Press & Editorial |
|----------------------|-------------------|

Dispensary

| | |
|-------------------------|------------------|
| Dr S Srivastava, Sr Sci | I/C Dispensary |
| Dr Anil Kumar | AMA (Part time) |
| Dr Vipula Verma | AMA (Part time) |
| Sh CK Singh | Pharmacist (T-3) |

Administration

| | |
|----------------|------------------------|
| Sh Ashok Ghosh | Administrative Officer |
|----------------|------------------------|

Admin-I

| | |
|-----------------|-----------|
| Sh SC Lal | Assistant |
| Sh RN Mahto | Assistant |
| Sh RK Toppo | Sr Clerk |
| Sh KM Kumar | Jr Clerk |
| Sh Bandhu Mahto | Jr Clerk |

Admin-II

| | |
|--------------------|--------------------|
| Sh Dipak Ghosh, TO | DDO |
| Sh BK Rajak | Assistant |
| Sh Bihari Sahu | Assistant |
| Sh AK Tripathi | Assistant |
| Sh Samal Kumar | Sr Clerk (Cashier) |
| Sh KK Deonath | Sr Clerk |

Admin-III

| | |
|------------------|-----------|
| Sh Prahlad Singh | A.A.O. |
| Sh Ravi Shankar | Assistant |
| Sh Thibu Minz | Assistant |
| Sh Ashwini Kumar | Jr. Clerk |

Steno Pool

| | |
|--------------|--------------------|
| Smt S Prasad | PS to the Director |
| Sh AK Sinha | PS |
| Sh SK Yadav | PA |

Audit & Accounts Section

| | |
|--------------------|----------------------------|
| Sh Rajesh Sahay | Finance & Accounts Officer |
| Sh CL Meena | JAO |
| Sh Kameshwar Oraon | Assistant |
| Sh Anant Pandey | Assistant |
| Sh Arjun Gope | Assistant |
| Sh KP Kashi | Sr Clerk |

Transport

| | |
|--------------------------|----------|
| Sh SC Sharma, Scientist | Chairman |
| Sh Arbind Kumar, T-3 | Driver |
| Sh Mandeshwar Singh, T-3 | Driver |
| Sh RK Yadav, T-3 | Driver |
| Sh J Tiwari, T-3 | Driver |

Promotion

| |
|---|
| Sh Bihari Sahu, Sr Clerk promoted to the post of Assistant wef 18.02.2010 |
| Sh Arun kumar Tripathi, Sr clerk promoted to the post of Assistant wef 18.02.2010 |
| Sh KP Kashi, Jr Clerk promoted to the post of Sr Clerk wef 18.02.2010 |
| Sh Sunil Kumar, T-4 promoted to next higher grade T-5 wef 27.03.2008 |
| Sh P Pattamajee, T-4 promoted to next higher grade T-5 wef 26.07.2008 |
| Sh KA Nagruwar, T-3 promoted to next higher grade T-4 wef 03.02.2005 |
| Sh Arbind Kumar, T-2 promoted to next higher grade T-3 wef 29.06.2006 |
| Sh Mandeshwar Singh, T-2 promoted to next higher grade T-3 wef 19.06.2009 |
| Sh Rajesh Kr Yadav, T-2 promoted to next higher grade T-3 wef 22.06.2009 |
| Sh Mahavir Mahto, SSS promoted to the post of T-1 wef 23.06.2010 |
| Sh Sukra Ekka, SSS promoted to the post of T-1 wef 23.06.2010 |
| Sh Bandi Lakra, SSS promoted to the post of T-1 wef 23.06.2010 |

Sh Jhiringa Oraon, SSS promoted to the post of T-1 wef 23.06.2010

Shri KM Sinha, T-6 promoted to next higher grade T (7-8)3 wef 03.02.2005

Smt Sushanti Prasad promoted to the post of T (7-8) wef 03.02.2005

Sh Shatrughan Kumar Yadav, Steno promoted to the post of PA wef 01.07.2010

Dr Niranjana Prasad, Sr scientist promoted to the post of Pr Scientist on 01.09.2010

Sh Arjun Kumar Sinha, PA promoted to the post of Private Secretary wef 10.12.2010

Sh Arjun Gope, Sr Clerk promoted to the post of Assistant wef 10.12.2010

Clearance of probation/confirmation

Sh CL Meena, JAO wef 02.07.2009

Sh Binay Kumar, T-3 wef 16.04.2009

Sh KM Kumar, Jr Clerk wef 04.06.2009

Sh Jhiringa Oraon, SSS wef 04.04.2009

Appointment/Joining

Dr Vaibhav D Iohot joined the Institute as Scientist on 01.01.2010

Sh Ashwani Kumar joined as a Jr Clerk wef 15.02.2010

Dr R Ramani took over the charge as Director on 14.05.2010

Dr SC Sharma joined as scientist on 24.04.2010

Sh SC Meena joined as scientist on 18.05.2010

Dr AK Jaiswal took over the charge as Head TOT on 25.08.2010

Dr A Mohanasundaram joined as scientist on 27.08.2010

Relieving

Dr Bengali Baboo, Ex Director relieved from the Institute wef 27.01.2010 to join as National Director NAIP, ICAR, New Delhi

Retirement

Sh SC Srivastava, Sr Scientist on 31.03.2010

Sh Lakhan Nayak, SGIV on 31.03.2010

Sh KM Sinha, T(7-8)retired on 31.12.2010

Sh KM Prasad, Pr Scientist on 30.06.2010

Sh R Ravidas, PS on 30.06.2010

Smt Sushanti Prasad , PS on 31.03 2010

Sh PM Patil, Scientist (SS) on 30.11.2010

Institute Joint Staff Council (IJSC)

1. Tenure of IJSC w.e.f. 1.4.2007 to 31.3.2010

Chairman

Dr Bangali Baboo, Director

Member (Official side)

Dr KP Sao, Member

Sh RK Singh, Member

Dr SK Giri, Member

Dr Govind Pal, Member

Administrative Officer

F & A/cs Officer

Secretary (Official side)

Dr KP Sao, Principal Scientist

Member (Staff side)

Sh Binod Kumar, Member

Sh Ajay Kumar, Member

Sh RK Toppo, Member

Sh Arjun Gope, Member

Sh Lodo Lakra, Member

Sh Nayeem Ansari, Member

Secretary (Staff side)/Member, CJSC

Sh Binod Kumar, Sec.(SS)

Sh RK Toppo, Member, CJSC

(2) Tenure of IJSC w.e.f. 1.4.2010 to 31.3.2013

Chairman

Dr R Ramani, Director

Member (Official side)

Dr A K Singh, Member

Dr Md Monobrullah, Member

Dr JP Singh, Member

Sh SKS Yadav, Member

Administrative Officer

F & A/cs Officer

Secretary (Official side)

Dr A K Singh, Principal Scientist

Member (Staff side)

Sh M L Ravidas, Member

Sh Binod Kumar, Member

Sh R K Toppo, Member

Sh Arjun Gope, Member

Sh Lodo Lakra, Member

Sh Nayeem Ansari, Member

Secretary (Staff side)/Member, CJSC

Sh M L Ravidas, Sec. (SS)

Sh Arjun Gope, Member, CJSC

Institute Grievance Committee

Dr R Ramani, Director, Chairman

Administrative Officer, Member

F & A/cs Officer-Member

Dr J P Singh, Member

Sh Rajkumar Rai, Member

Sh Bihari Sahu, Member

Md Nayeem Ansari, Member

AAO (Admin-I), Member Secretary



INDIAN INSTITUTE OF NATURAL RESINS AND GUMS

(Formerly Indian Lac Research Institute)

Namkum, Ranchi - 834 010 (Jharkhand)