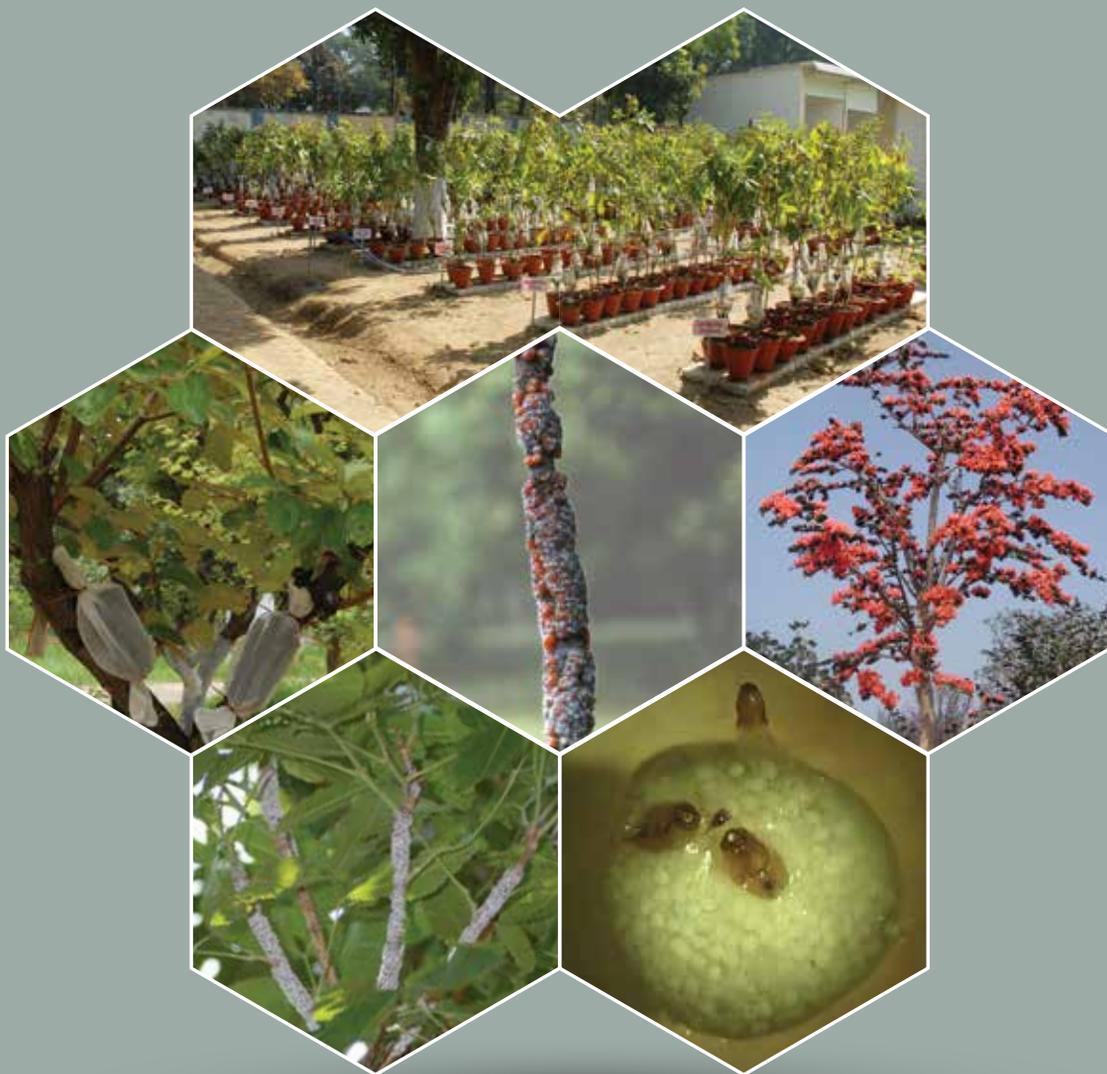




# Network Project

Conservation of Lac Insect Genetic Resources



Lead Center



**INDIAN INSTITUTE OF NATURAL RESINS AND GUMS**  
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**Network Project on Conservation of Lac Insect Genetic Resources**

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## Network Project on Conservation of Lac Insect Genetic Resources

### Introduction

Lac-insects are the crowning glory of India's rich insect fauna. Of the nine genera and 99 species of lac-insects reported from all over the world; two genera and 26 species are found in our country, representing 26.3% of the known lac-insect species diversity. These insects are exploited for their products of commerce *viz.*, resin, dye and wax. Besides Indian lac insect, *Kerria lacca* which is the most exploited lac insect; *K. chinensis* and *K. sharda* are two other important lac producing insects. India is privileged in being the largest producer of the lac in the world. Lac insects are known to feed & breed on more than 400 plant species.

Lac-insect genetic resources in the country exist in the form of a vast array of populations which have evolved and adapted over many centuries, to the range of environmental conditions encountered throughout the country resulting in several breeds, types and strains, each with their own genetic make-up, and each adapted to its own specific niche. The future improvement and development of lac-insects is dependent upon the availability of this genetic variation, which is its principal resource.

The lac-insect genetic resources available throughout the country are under threat due to the disappearance of a substantial number of local populations, with the consequent loss of their inherent genetic adaptation to their local environments. Particular concern has been growing with respect to the speed at which uncharacterized breeds are disappearing in some regions where climatic, parasitic or disease pressures could have produced important genetically adapted breeds. Unimproved indigenous landrace stocks contain genetic variations, which often include resistance to such parasites. The potential and actual use of these genes for resistance, for incorporation into the production stocks need to be realized.

Conservation is of particular concern in regions of rapid agricultural change, where indigenous stocks and farming methods are being replaced. Areas where climatic extremes or particular parasitic conditions have resulted in genetically modified and unique local stocks should be a high priority. Such conservation efforts are particularly important in the light of predicted global climate change, and the ability of microbial and insect parasites to evolve and adapt to modern chemical control methods.



## Conservation issues

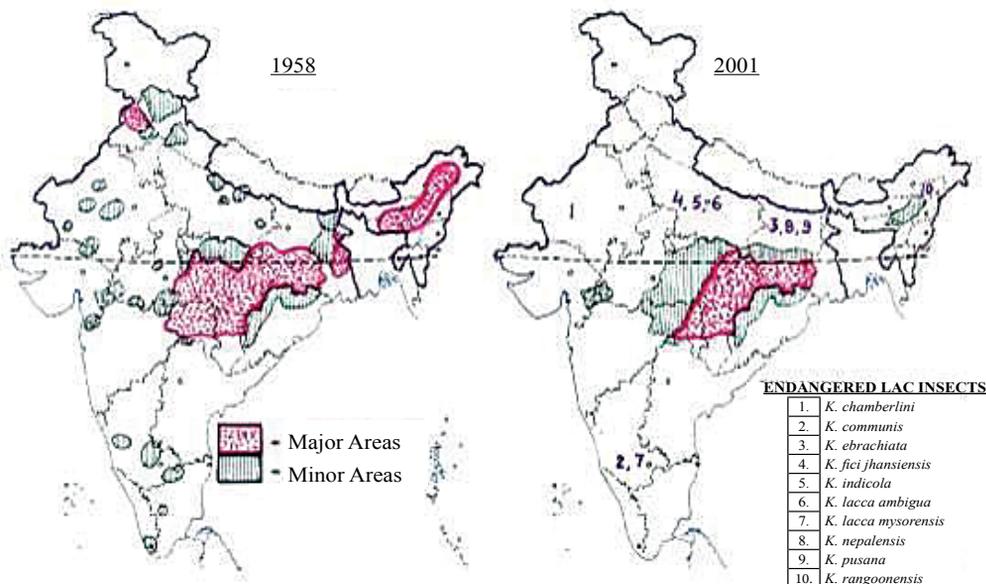
Not long ago, cultivation of lac was carried practically throughout the country. Though lac-insects are still found in nature all over the country, its cultivation is now restricted only to Jharkhand and Chhattisgarh, and certain pockets of Madhya Pradesh, Maharashtra and West Bengal. As a result, many species of lac insects have either become extinct or are in the ‘waiting list’ of extinction. With abandoning of lac cultivation, unutilised lac-hosts are frequently cut for timber and fuel wood etc. Out of more than 400 plants on which lac insects have been observed, only about two dozen are utilised for lac production as commercial lac cultivation on other plants is economically not viable. Moreover, lac-host plants exploited for commercial production of lac vary from region to region. Danger looms large on other host-plants whose economic importance remains to be realized.

Future of various flora and fauna associated with lac is thus, intricately linked to the fate of lac cultivation. Fast shrinking area of lac cultivation is a serious threat to the biodiversity of lac-insect ecosystem.

Some of the important issues at stake are:

- Of the 26 species of lac-insects reported from the country, mainly *Kerria lacca* is exploited for commercial production of lac. *K. chinensis* in the north-eastern states and *K. sharda* in coastal regions of Orissa and West Bengal are also cultivated to a certain extent. Potential of other lac-insect species reported from the country remains to be exploited. Wild populations of lac-insects are principally distributed in the forest and sub-forest regions. Fast depleting forest cover of the country is a serious threat to the bio-diversity of lac-insects as well as their host-plants. In the absence of human intervention, the unattended species of lac-insects and their host-plants might be lost.

### LAC GROWING AREAS OF THE COUNTRY





- Conversion of forest land for agricultural and industrial activities is eroding the lac cultivation areas. Assam, Meghalaya, Orissa, Punjab and Uttar Pradesh earlier contributed significantly in lac production but now their share is almost negligible as cultivation of lac has been abandoned. Many species of lac-insects reported from these places have thus, become endangered.
- Lac-insects infesting economically important plants, viz., *litchi* (*Litchi chinensis*), mango (*Mangifera indica*), *ber* (*Ziziphus mauritiana*), *sandal* (*Santalum album*) etc. are the direct target of pest management leading to erosion of the biodiversity of lac-insects and associated fauna.



Lac infestation on *Litchi* at Ranchi (Jharkhand)



*Paratachardina* on *Sandal* at Bangalore (Karnataka)



Lac-insect on *Ber* at Jodhpur (Rajasthan)

- Lac-insect species belonging to *Paratachardina* genus do not produce true lac of commercial importance and are pests of such important plants as *sandal* (*S. album*) and tea (*Thea chinensis*) and hence, are deliberately destroyed.
- Some of the insect fauna associated with the lac-insects are species-specific (exclusive to the lac ecosystem) and hence, loss of even one species of lac-insect poses a danger of losing many other related species.
- In agriculturally advanced states like Punjab and Haryana, wild *ber* (*Z. mauritiana*) which is one of the major lac-hosts has been replaced by high yielding fruit varieties. The trees are regularly pruned and subjected to pest management measures, which have led to the loss of lac-insects.
- In drought prone states like Rajasthan and Gujarat, twigs of lac-host trees such as *palas* (*Butea monosperma*), rain tree (*Albizia saman*) and *Ficus* spp. are utilized as cattle fodder during adverse conditions, thus preventing natural multiplication of lac-insect populations.

### Strategy to arrest decline of lac-insect biodiversity

Keeping in view the importance of lac cultivation in ecological development and livelihood generation, there is a strong need for properly identifying, documenting and conserving the lac-insects and associated fauna. The steps, which merit immediate attention, are:

- i. Strong need to undertake extensive surveys of our country and abroad to know the present status of the lac-insects and their plant-hosts bio-diversity. The reported species of lac-insects do not give any idea, hitherto, of unreported species and more importantly the infra specific genetic diversity of those species of economic value. There is a great need for properly identifying, documenting and conserving (*in-situ* and *ex-situ*) the diversity of lac-insects.
- ii. Initiation of action for building a strong infrastructure to develop regional Field Germplasm Banks to conserve at suitable places, all the recorded lac-insects and host-plants. Protected lac-insect and host-plants habitats on the pattern of sanctuaries and wild life parks in different agro-ecological zones are needed to conserve the precious wealth of our country.
- iii. Integration of lac-culture with agriculture and inclusion of multi-purpose lac-host plants in social forestry programmes of, at least, those states where lac cultivation is / was carried out as it will not only diversify land use for increased productivity but also help save lac-insect and associated flora and fauna.



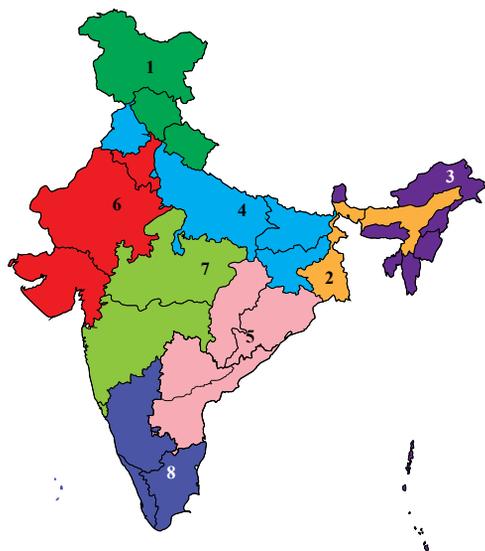
Lac Integrated Farming Model (Horticultural)



Lac bearing *semialata*

- iv. *Paratachardina* spp., though do not produce lac of commercial importance, are potential natural control agents for perennial weeds and need to be nurtured as such by making them a component in integrated pest management schedule as bio-control agents for managing weeds.
- v. Development of a database on all aspects of lac production, processing, product development, export, employment generation etc. for better policy planning.

Lac-insects are influenced by the environmental conditions. Therefore, network partners have been carefully selected from each of the eight agro-ecological regions. Ideal situation would have been to have a network partner in each of the present 21 agro-ecological regions, but keeping in view the man-power and financial constraints; initially it would suffice at the level of earlier eight agro-ecological regions of ICAR.



Network partners and agro-ecological regions assigned to them for collection, conservation and documentation of information on lac-insect resources are as under:

Sl. No.	Agro-ecological regions	Area covered	Network Cooperating Center
1	Humid Western Himalayan Region	Jammu and Kashmir, Himachal Pradesh and two hill divisions of erstwhile Uttar Pradesh, namely, Kumaon and Garhwal (Uttanchal)	Sher-e-Kashmir University of Agricultural Sciences and Technology, Jammu
2	Humid Bengal - Assam Basin	West Bengal and Assam representing the Ganga-Brahmaputra alluvial plain	Assam Agricultural University, Jorhat
3	Humid Eastern Himalayan Region and Bay Islands	Arunachal Pradesh, Nagaland, Manipur, Mizoram, Tripura, Meghalaya, and Andaman & Nicobar Islands	Central Agricultural University, Imphal
4	Sub-humid Sutlej-Ganga Alluvial Plains	Punjab, plains of Uttar Pradesh, Delhi and Bihar	Punjab Agricultural University, Ludhiana
5	Sub-humid to Humid Eastern and South-eastern Uplands	Orissa, Andhra Pradesh, Telangana and the Raipur Division of erstwhile Madhya Pradesh (Chhattisgarh)	Acharya NG Ranga Agricultural University, Hyderabad
6	Arid Western Plains	Haryana, Rajasthan, Gujarat, and Dadra & Nagar Haveli	Maharana Pratap University of Agriculture and Technology, Udaipur
7	Semi-arid Lava Plateau and Central Highlands	Maharashtra, Goa, Daman & Diu and Western and Central Madhya Pradesh	State Forest Research Institute, Jabalpur
8	Humid to Semi-arid Western Ghats and Karnataka Plateau	Karnataka, Tamil Nadu, Kerala, Pondicherry and Lakshadweep Islands	Kerala Forest Research Institute, Thrissur

## Objectives

- *In-situ* and *ex-situ* conservation of the biological diversity of lac-insects of the country
- To develop the Lac-insect Field Gene Bank of the institute as Center of Excellence on Lac Biodiversity
- To transfer the lac cultivation technologies in the *in-situ* conservation areas

## Thrust areas / Priorities

- Documentation of information in the form of bulletin(s) / books / reports on status of lac-insect and host-plants in different agroecological regions of the country
- *In-situ* and *ex-situ* conservation of the biodiversity of local lac-insect species / races and breeds
- Capacity building in lac cultivation through training of resource persons and farmers of Network Cooperating Centers
- Identification of suitable lac-insect-host plant combinations for higher and sustained yield
- Impetus for lac cultivation in areas where *in-situ* conservation will be done

## Conservation approaches

### *Ex-situ conservation*

Normally the best method of maximizing a species chance of survival (when *ex-situ* methods are required) is by relocating part of the population to a less threatened location. It is extremely difficult to mimic the environment of the original colony location given the large number of variables defining the original colony (microclimate, soils, symbiotic species, absence of severe predation, etc.). The downside to this is that, when re-released, the species may lack the genetic adaptations and mutations which would allow it to thrive in its ever-changing natural habitat. Further, diseases and pests foreign to the species to which the species has no natural defense may also cripple lac culture.



Moreover, maintenance and conservation of lac-insects is a laborious process as they have to be maintained live under protected conditions on potted plants due to their phyto-succivorous habit and associated pest complex.

National Lac Insect Germplasm Center (NATLIGEC) of the Indian Institute of Natural Resins and Gums (IINRG) maintains 72 lines of lac-insects which include 14 cultivated, 35 natural populations, 22 cross bred/ inbred/ selected and one exotic line collected from survey of 99 districts of 22 states and also two union territories. Work to further strengthen and augment the conservation of lac-insects is a regular activity of the institute.



### *In-situ conservation*

*In-situ* conservation protects the endangered species in its natural habitat, either by protecting or cleaning up the habitat itself, or by defending the species from predators. Increasingly, this term is also being applied to the conservation of agricultural biodiversity in agro-ecosystems by farmers, especially those using unconventional farming practices. One benefit of *in-situ* conservation is that it maintains recovering populations in the surrounding where they have developed their distinctive properties. Another is that this strategy helps ensure the ongoing processes of evolution and adaptation within their environments.

Recent studies have shown an integrated approach of *in-situ* and *ex-situ* conservation to be more effective. While *ex-situ* conservation of lac-insects is being taken care by NATLIGEC of IINRG to some extent, *in-situ* conservation has remained neglected. The project would be implemented through participation of all the Network Cooperating Centers. The role identified for each center is set on a time frame during the project period. Project review and reappraisal meetings will be organized to jointly implement the project to achieve the objectives. Role of each Network Cooperating Center is given in the following table.

Sl. No.	Name of the Network Cooperating Center	Role of the Center
1.	<p><b>Lead Center</b></p> <p>Indian Institute of Natural Resins and Gums (IINRG), Ranchi (Jharkhand)</p> 	<ul style="list-style-type: none"> <li>• Plan, guide, coordinate and report</li> <li>• Liaise with Cooperating Centers and the Council regarding budget requirements and its monitoring</li> <li>• Provide training on collection and conservation of lac-insects to the resource persons of the Cooperating Centers</li> <li>• Provide know-how on lac cultivation technologies on plantation scale</li> <li>• Strengthen existing Lac-insect and Host-plant Field Gene Banks of NATLIGEC</li> <li>• Molecular characterization of conserved populations at initiation and periodically for fidelity</li> </ul>

<p>2.</p>	<p>Sher-e-Kashmir University of Agricultural Sciences and Technology (SKUAS&amp;T), Jammu (Jammu &amp; Kashmir)</p> 	<p>To carry out in phased manner, the following activities in the <b>Humid Western Himalayan Region:</b></p> <ul style="list-style-type: none"> <li>• Conduct survey of the area for lac-insects and host-plants</li> <li>• Collect and conserve lac-insects under <i>ex-situ</i> conditions</li> <li>• Carry out on-farm trials on lac cultivation technologies</li> <li>• Training of adopted / selected farmers in collaboration with IINRG for <i>in-situ</i> conservation</li> <li>• Conduct need based and location specific studies on lac-insects and/ or host-plants</li> </ul>
<p>3.</p>	<p>Assam Agricultural University (AAU), Jorhat (Assam)</p> 	<p>To carry out in phased manner, the following activities in the <b>Humid Bengal - Assam Basin Region:</b></p> <ul style="list-style-type: none"> <li>• Conduct survey of the area for lac-insects and host-plants</li> <li>• Collect and conserve lac-insects under <i>ex-situ</i> conditions</li> <li>• Carry out on-farm trials on lac cultivation technologies</li> <li>• Training of adopted/ selected farmers in collaboration with IINRG for <i>in-situ</i> conservation</li> <li>• Conduct need based and location specific studies on lac-insects and/or host-plants</li> </ul>
<p>4.</p>	<p>Central Agricultural University (CAU), Imphal (Manipur)</p> 	<p>To carry out in phased manner, the following activities in the <b>Humid Eastern Himalayan Region and Bay Islands Region:</b></p> <ul style="list-style-type: none"> <li>• Conduct survey of the area for lac-insects and host-plants</li> <li>• Collect and conserve lac-insects under <i>ex-situ</i> conditions</li> <li>• Carry out on-farm trials on lac cultivation technologies</li> <li>• Training of adopted/ selected farmers in collaboration with IINRG for <i>in-situ</i> conservation</li> <li>• Conduct need based and location specific studies on lac-insects and / or host-plants</li> </ul>
<p>5.</p>	<p>Punjab Agricultural University (PAU), Ludhiana (Punjab)</p> 	<p>To carry out in phased manner, the following activities in the <b>Sub-humid Sutlej-Ganga Alluvial Plains Region:</b></p> <ul style="list-style-type: none"> <li>• Conduct survey of the area for lac-insects and host-plants</li> <li>• Collect and conserve lac-insects under <i>ex-situ</i> conditions</li> <li>• Carry out on-farm trials on lac cultivation technologies</li> <li>• Training of adopted/ selected farmers in collaboration with IINRG for <i>in-situ</i> conservation</li> <li>• Conduct need based and location specific studies on lac-insects and / or host-plants</li> </ul>



<p>6. Acharya NG Ranga Agricultural University (ANGRAU), Hyderabad (Telangana)</p> 	<p>To carry out in phased manner, the following activities in the <b>Sub-humid to Humid Eastern and South-eastern Uplands Region:</b></p> <ul style="list-style-type: none"> <li>• Conduct survey of the area for lac-insects and host-plants</li> <li>• Collect and conserve lac-insects under <i>ex-situ</i> conditions</li> <li>• Carry out on-farm trials on lac cultivation technologies</li> <li>• Training of adopted/ selected farmers in collaboration with IINRG for <i>in-situ</i> conservation</li> <li>• Conduct need based and location specific studies on lac-insects and/ or host-plants</li> </ul>
<p>7. Maharana Pratap University of Agriculture and Technology (MPUA&amp;T), Udaipur (Rajasthan)</p> 	<p>To carry out in phased manner, the following activities in the <b>Arid Western Plains Region:</b></p> <ul style="list-style-type: none"> <li>• Conduct survey of the area for lac-insects and host-plants</li> <li>• Collect and conserve lac-insects under <i>ex-situ</i> conditions</li> <li>• Carry out on-farm trials on lac cultivation technologies</li> <li>• Training of adopted/ selected farmers in collaboration with IINRG for <i>in-situ</i> conservation</li> <li>• Conduct need based and location specific studies on lac-insects and/ or host-plants</li> </ul>
<p>8. State Forest Research Institute (SFRI), Jabalpur (Madhya Pradesh)</p> 	<p>To carry out in phased manner, the following activities in the <b>Semi-arid Lava Plateau and Central Highlands Region:</b></p> <ul style="list-style-type: none"> <li>• Conduct survey of the area for lac-insects and host-plants</li> <li>• Collect and conserve lac-insects under <i>ex-situ</i> conditions</li> <li>• Carry out on-farm trials on lac cultivation technologies</li> <li>• Training of adopted/ selected farmers in collaboration with IINRG for <i>in-situ</i> conservation</li> <li>• Conduct need based and location specific studies on lac-insects and/ or host-plants</li> </ul>
<p>9. Kerala Forest Research Institute (KFRI), Thrissur (Kerala)</p> 	<p>To carry out in phased manner, the following activities in the <b>Humid to Semi-arid Western Ghats and Karnataka Plateau Region:</b></p> <ul style="list-style-type: none"> <li>• Conduct survey of the area for lac-insects and host-plants</li> <li>• Collect and conserve lac-insects under <i>ex-situ</i> conditions</li> <li>• Carry out on-farm trials on lac cultivation technologies</li> <li>• Training of adopted/ selected farmers in collaboration with IINRG for <i>in-situ</i> conservation</li> <li>• Conduct need based and location specific studies on lac-insects and / or host-plants</li> </ul>

## Year-wise milestones and deliverables of the project

Year	Milestones	Deliverables
2012-13	NA	NA
2013-14	NA	NA
2014-15	<ul style="list-style-type: none"> <li>Establishment of Centers at Network Cooperating Center</li> </ul>	<ul style="list-style-type: none"> <li>New Network Centers</li> </ul>
	<ul style="list-style-type: none"> <li>Training of resource persons of Cooperating Centers in collection and conservation of lac / host plant biodiversity</li> </ul>	<ul style="list-style-type: none"> <li>Capacity building of the resource persons of Cooperating Centers</li> </ul>
	<ul style="list-style-type: none"> <li>Survey for collection of information / lac-insects / host-plants from different parts of each Agro-Ecological Region (AER)</li> </ul>	<ul style="list-style-type: none"> <li>Documentation of information on present status of lac-insect and host-plants availability</li> </ul>
	<ul style="list-style-type: none"> <li>Identification of potential areas / farmers for facilitating natural / aided multiplication of local lac-insect populations</li> </ul>	<ul style="list-style-type: none"> <li>Potential areas and farmers for <i>in-situ</i> conservation of lac-insects</li> </ul>
2015-16	<ul style="list-style-type: none"> <li>Survey for collection of lac-insects / host-plants from different parts of the AERs</li> </ul>	<ul style="list-style-type: none"> <li>Collection of local lac-insect / host-plant populations</li> </ul>
	<ul style="list-style-type: none"> <li>Training of adopted/ selected farmers in lac cultivation techniques</li> </ul>	<ul style="list-style-type: none"> <li>Capacity building of the adopted / selected farmers</li> </ul>
	<ul style="list-style-type: none"> <li>Establishment of regional Lac-Insect Field Gene Banks</li> </ul>	<ul style="list-style-type: none"> <li><i>Ex-situ</i> conservation of lac-insects</li> </ul>
	<ul style="list-style-type: none"> <li>Study of economic attributes of collected lac-insect biodiversity</li> </ul>	<ul style="list-style-type: none"> <li>Documentation of lac-insect biodiversity</li> </ul>
2016-17	<ul style="list-style-type: none"> <li>Survey for collection of lac-insects / host-plants from different parts of the AERs</li> </ul>	<ul style="list-style-type: none"> <li>Collection of local lac-insect / host-plant population</li> </ul>
	<ul style="list-style-type: none"> <li>Multiplication of collected local lac-insect population</li> </ul>	<ul style="list-style-type: none"> <li>Impetus for <i>in-situ</i> conservation of different lac-insect populations</li> </ul>
	<ul style="list-style-type: none"> <li>On-Farm trials and demonstrations of lac cultivation technologies</li> </ul>	<ul style="list-style-type: none"> <li>Sufficient broodlac for on-farm trials</li> </ul>
	<ul style="list-style-type: none"> <li>Report writing and publication of research findings</li> </ul>	<ul style="list-style-type: none"> <li>Project report and Research publications</li> </ul>

**Budget : Rs. 592.14 lakhs**



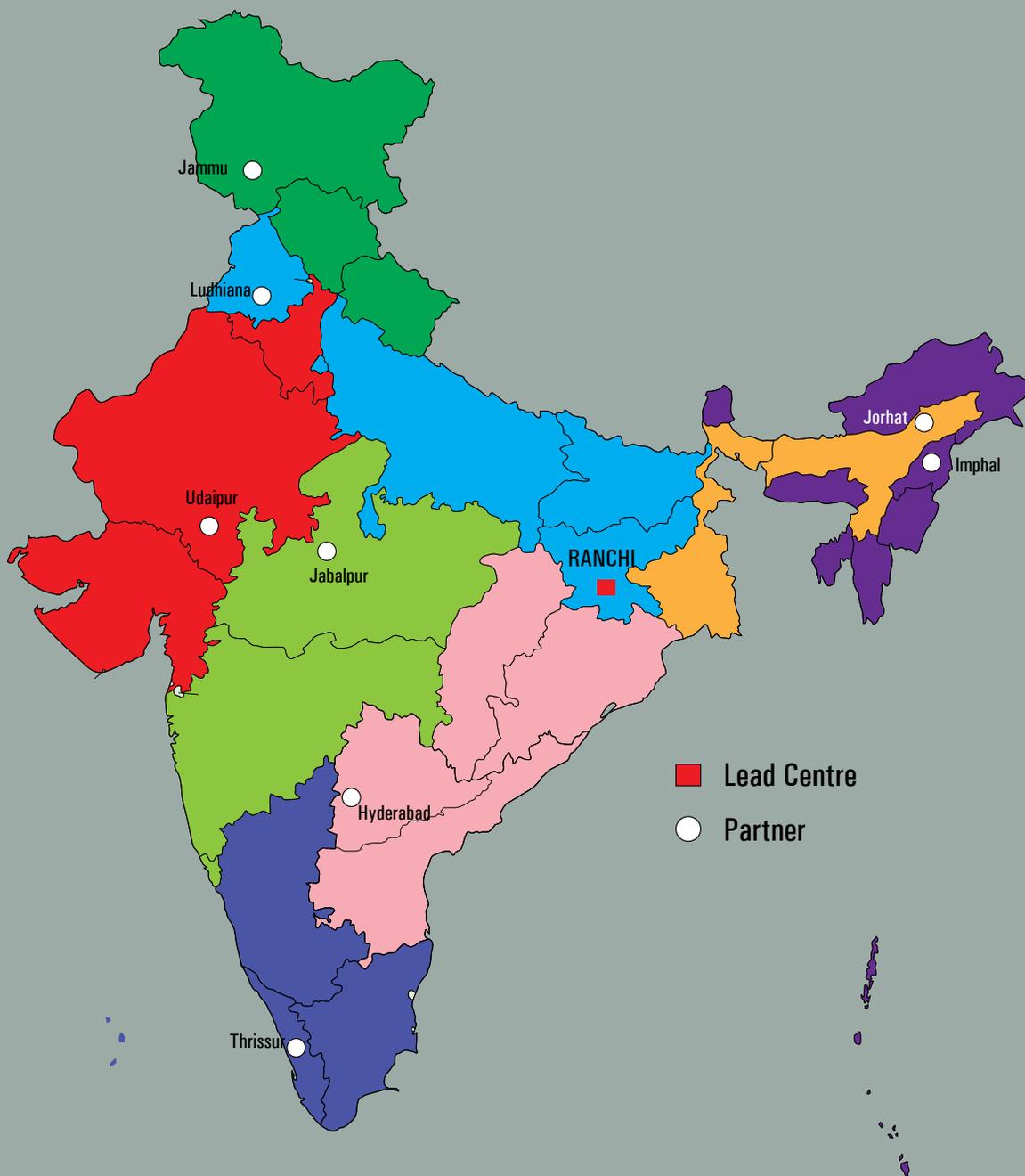
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Location of Network Cooperating Centers in different Agro-Ecological Regions of India

# NETWORK COOPERATING CENTERS

## A. State Agricultural Universities



1. Assam Agricultural University  
Jorhat - 785 013  
Assam



2. Acharya NG Ranga Agricultural University  
Rajendranagar, Hyderabad - 500 030  
Telangana



3. Central Agricultural University  
Iroisemba, Imphal - 795 004  
Manipur



4. Maharana Pratap University of Agriculture & Technology  
Udaipur - 313 001  
Rajasthan



5. Punjab Agricultural University  
Ferozpur Road, Ludhiana-141 004  
Punjab



6. Sher-e-Kashmir University of Agricultural Sciences & Technology  
Chatha, Jammu - 180 009  
Jammu & Kashmir

## B. State Forest Departments



7. Kerala Forest Research Institute  
Peechi, Thrissur - 680 653  
Kerala



8. State Forest Research Institute  
Polipathar, Jabalpur - 482 008  
Madhya Pradesh