Beneficial insects are one of the important economic components of forest ecosystem. Their exploitation had been historically linked with tribal economy especially in the Bastar Plateau and Northern Hills Sarguja Region, in which the whole of Chhattisgarh forms a part. Therefore, exploiting insects producing lac, silk and honey are important in terms reality and/or potentiality of their products. Besides, culturing of these insects is attractive in terms economic returns as well as suitable for the land and culture of people of region.

India is a major producer and exporter of Lac with an estimated annual yield which has been hovering between 15000-20000 MT during the last one decade. India contributes about 60% followed by Thailand in world Lac trade. Jharkhand, Chhattisgarh, West Bengal, Maharashtra, Orissa and Andhra Pradesh are the Lac producing states in the country. Chhattisgarh is today the major contributor of raw lac followed by Jharkhand. The average annual income from lac was around Rs. 7,000 per family. Lac was a subsidiary crop for the growers who depend on it for meeting cash expenses towards family needs and cash purchase for their house hold requirements. Lac cultivation is one of the important secondary sources of income for villagers and this is particularly more in the tribal districts. The important Lac producing areas in the state are South Bastar, Kanker, Korba, Rajnandgaon and Bilaspur. Most of the tribal population who live in or around forests was traditionally practicing Lac culture. Of late due to displacement of tribal population from forests has led to reduction in production. However those who own trees that are suitable for Lac still take up cultivation of Lac.

**KEYWORDS:** Kerria lacca Kerr., rangeeni, kusumi, broodlac, sticklac and Bastar.

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1. INTRODUCTION

Lac is a natural heritage of our country has been associated with tribal and poor people providing regular income in absence of other cash crops. Lac is produced by insect which gets its nourishment from plants.

Successful lac cultivation therefore depends on efficient and proper use of lac host plants. In view of abundant availability of naturally grown lac host plants in forest and personal holding of the farmers, raising of lac host plantation was not in practices in past. Due to massive destruction of forest resources and indiscriminate cutting of lac host trees for social, industrial and mining activities areas under lac cultivation is gradually shrinking. When we look in to the present scenario the price of lac in international market and the bright future of lac in coming years, lac cultivation will be more and more profitable. To overcome the situation we need more lac hosts tree and due to scattered nature of occurrences, their management has been a challenging problem to the lac growers.

The lac is a resin not gum and produced by tiny insect, is a soft-bodied insect belonging to Coceid group of order, Homoptera. Two genera and 19 species of lac insects have been observed in India and most common Indian lac insect of commercial importance is Kerria lacca kerr. Rangeeni and Kusami are two strains of this insect. Each of these, produce two crops in a year (bi-Voltine). Kusami insect grows well mainly on Kusum (Schleicheria oleosa) and also on a few other trees but not on palash (Butea monosperma), whereas Rangeeni strain grows well mainly on palash and also on a few other trees but not on Kusum.

Mainly India, Myanmar, Thailand, and Malaysia, parts of China, Taiwan, Vietnam and Srilanka etc are the lac producing countries. Among the above, India and Thailand are the main lacs producing countries of the world.

In India, the host plants are mainly used for growing lac cultivation in forest of Himalayan Tarai, Hilly regions of Jharkhand, West Bengal, Orissa, Chhattisgarh, Madhya Pradesh some parts of Rajasthan, Gujrat and Assam, the forests comprise trees mainly of Ber. Palash, Ficus sp., Kusum, Acasia sp. Ghont. Shorea sp. Dalbergia sp, Albizzia sp. and bushy host plants like Flemingia, Grewia and Cajanus cajan. In India about 90% lac is produced on the three conventional lac host trees i.e. Kusum, Palash and Ber.

2. STATUS OF LAC HOST POTENTIAL

Out of entire lac produced in the country, 80-85% is from rangeeni strain which is contributed mainly by palash followed by ber, the most widely spread hosts in India. However the best quality of resin produced by Kusum strain is obtained from Kusum in India followed by ber in recent scenario. The contribution in total production is about 15-20% only due to its limited distribution for rangeeni, lac production palash ranks first 60-65% and ber stands second in place (20-25%).

The distribution, size, suitable age of hosts for starting lac cultivation and proper age of shoots after pruning for inoculation of some important traditional hosts of Chhattisgarh are give in table no.1.

On the basis of preference in use for lac cultivation by Indian cultivars, centuries of practical experience and distribution in the country, the lac hosts are placed under three categories, viz., (1)Common or major hosts (2) occasional hosts and (3) rare hosts.

The first category i.e., common or major host include fourteen species in which three namely Palash, Kusum and Ber are of all India importance since these are excellent hosts wherever they occur in the country.

Based on the adoption of improved lac cultivation and pest management technology the productivity of some of the important traditional hosts in terms of the average field of stick lack and range for an input of 1 kg/tree is gives in Table no.2.

### Table 1: Important traditional hosts trees in Bastar forest Division, Chhattisgarh

<table>
<thead>
<tr>
<th>Name of host</th>
<th>Distribution</th>
<th>Size</th>
<th>Suitable age for cultivation (Year)</th>
<th>Age of shoot (Year)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Height (cm)</td>
<td>Girth (m)</td>
<td></td>
</tr>
<tr>
<td>Butea monosperma</td>
<td>All over India</td>
<td>5.0</td>
<td>1.5</td>
<td>8-10</td>
</tr>
<tr>
<td>Zizyphus spp.</td>
<td>All over India</td>
<td>7.0</td>
<td>1.5</td>
<td>5-8</td>
</tr>
<tr>
<td>Schleicheria oleosa</td>
<td>All over India</td>
<td>10</td>
<td>2.5</td>
<td>15</td>
</tr>
<tr>
<td>Acacia nilotica</td>
<td>Rajasthan &amp; Gujarat</td>
<td>7.5</td>
<td>1.5</td>
<td>8</td>
</tr>
<tr>
<td>A. cathachu</td>
<td>All over India</td>
<td>6.0</td>
<td>0.5</td>
<td>8-10</td>
</tr>
<tr>
<td>Ficus religeousus</td>
<td>All over India</td>
<td>12.0</td>
<td>3.0</td>
<td>5-10</td>
</tr>
<tr>
<td>F. glomureta</td>
<td>All over India</td>
<td>6.0</td>
<td>1.0</td>
<td>5-10</td>
</tr>
<tr>
<td>F. bengalensis</td>
<td>All over India</td>
<td>12.0</td>
<td>3.5</td>
<td>5-10</td>
</tr>
</tbody>
</table>

(Source: S.C. Shriwastava 2007)
Table 2: Average field of stick lack and range for an input of 1 kg/tree

<table>
<thead>
<tr>
<th>Crop</th>
<th>Host plant</th>
<th>Average. Stick lac/plant (kg)</th>
<th>Range (kg)</th>
</tr>
</thead>
<tbody>
<tr>
<td>3</td>
<td>Palash</td>
<td>2.6</td>
<td>1.2-2.8</td>
</tr>
<tr>
<td>8.5</td>
<td>Ghont</td>
<td>2.0</td>
<td>0.8-2.5</td>
</tr>
<tr>
<td>Kusmi</td>
<td>Kusum</td>
<td>45</td>
<td>10-100</td>
</tr>
<tr>
<td>1.8</td>
<td>Ber</td>
<td>8</td>
<td>3-12</td>
</tr>
<tr>
<td></td>
<td>Khair</td>
<td>1.8</td>
<td>1-3</td>
</tr>
</tbody>
</table>

(Source: Bangali Baboo 2007)

3. The conventional method of lac cultivation

The trees are infested with lac insect crawlers by putting broodlac sticks along with leaves attached with it on the branches of new trees to be infested, when lac crawler emergence begins. These broodlac sticks are put here and there specially between forks of branches on new trees. The broodlac sticks remain on tree for a long time even after emergence is over. These sticks are collected when the farmers get time. The lac crop is harvested whenever encrustation is thick irrespective of crop maturity. Normally crop is not harvested completely but some amount of mature lac is left on the tree to act as brood lac for developing the next crop. The summery of farmer method, its demerits and its remedy by scientific method of lac cultivation

4. Scientific method of lac cultivation

The systematic way of lac cultivation by scientific method is as follows:

a. Pruning of trees:

This is an essential operation to ensure availability of large number of succulent shoots at the time of infestation. This operation is carried out six months before infestation for raising summer crop in the month of April and for rainy season crop in February. In April, the most suitable stage of pruning is judged by appearance of pod, after shedding of flowers. The trees should not be pruned once sprouting for new leaves and shoots begin.

b. Infestation of host tree

Spreading of lac insect on succulent shoot is called infestation. In scientific method the broodlac stick of approximately 6 inch length are cut and 4-5 sticks are bundled and tied at several places over host tree. Tree should be infested in such ways that on most of the succulent shoots, lac insect are inoculated uniformly. For raising combined crop of summer and rainy season (Oct./Nov. to Oct./Nov.), estimate the requirement @ 10 gm good quality selected broodlac per meter of succulent shoots or around 400-500 gm per average size tree.

c. Removing used-up broodlac sticks

The used-up broodlac stick should be removed from infested tree as soon as emergence of lac larvae is over. Normally this period is 15-20 days after tying of bundles on trees. This period should not exceed beyond 21 days in any case.

d. Crop harvesting

The crop is harvested either as an immature summer crop (Resin value) or mature crop as broodlac (Lac insect value). If crop harvesting is carried out for broodlac purpose, the date of hatching should be kept in mind. Immature summer lac is cut at any time when encrustation becomes relatively thicker. Normally brood lac is harvested in October/November when crop mature. If during this period the atmosphere is relatively colder then harvest crop only when emergence of crawlers is initiated. But if it is little bit warmer, crop can be harvested 4-5 days prior to the expected date of emergence. Harvest the crop completely from trees meant for producing immature summer crop and simultaneously prunes the trees so that it can be re-infested after six months in October. If any trees have excess broodlac in June/July, harvest such lac at the time of maturity and it either to re-infest other trees or sell in the market.

5. Methods of growing host tree for lac crop geometry

The space recommended for the major host plants has been as 3.6 x 3.6 m for Palash, 6 x 6 m for Kusum and 4.5 x 4.5 m for ber, Khair and Ghont. Equilateral triangular system of planting has also been recommended for plantation raising of these lac hosts to promote sufficient light and air for better growth of the lac insects. Spacing requirement of various lac host is gives in table no.3.

Tables 3: Spacing requirement of various lac hosts

<table>
<thead>
<tr>
<th>Host plant</th>
<th>Spacing (m)</th>
<th>Stick Lac Yield</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tree</td>
<td></td>
<td>Q/ ha Yrs</td>
</tr>
<tr>
<td>Palash</td>
<td>3.6 x 3.6</td>
<td>1.25</td>
</tr>
<tr>
<td>Kusum</td>
<td>6 x 6</td>
<td>3.00</td>
</tr>
<tr>
<td>Ber</td>
<td>4.5 x 4.5</td>
<td>5.00</td>
</tr>
<tr>
<td>Rain tree</td>
<td>6 x 6</td>
<td>1.50</td>
</tr>
<tr>
<td>Galwang</td>
<td>1.8 x 1.8</td>
<td>0.80</td>
</tr>
<tr>
<td>Khair</td>
<td>2 x 1.8</td>
<td>1.8</td>
</tr>
</tbody>
</table>

(Source: Singh BP. 2007)

6. Manures and fertilizers application

Fertilizer trial on lac hosts in government forest areas both at Kundri (Palamau Distt of Jharkhand) and Keekhi (Orissa) showed highest lac yield in the plants with manual treatment.

Table 4: Fertilizer schedule for lac host plantation rising

<table>
<thead>
<tr>
<th>Hosts</th>
<th>Fertilizer dose (g/plant)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>N</td>
</tr>
<tr>
<td>Kusum</td>
<td>100</td>
</tr>
<tr>
<td>Palash</td>
<td>100</td>
</tr>
<tr>
<td>Ber</td>
<td>100</td>
</tr>
</tbody>
</table>

(Source: IGKV, 2010)
Use of sodium and calcium (micronutrients) is necessary for the growth of lac insects, but if Ca is applied of the plants without magnesium preponderance of males results due to unbalanced action of calcium. N has a tendency to reduce the mortality while the K increases it. The lac culture operations including spacing requirement and stick lac yield of important lac hosts are given in table no.4.

7. **Importance of Lac Cultivation**

Lac cultivation has some unique advantages, especially for our country as well as our state, some of these are –

- A good source of livelihood of resource poor farmers, tribals, inhabiting sub hilly tracts with meager investment.
- A good crop for marginal and degraded lands. No competition for land operation with agricultural/horticultural crops.
- Highly remunerative cultivation. A hectare of Ber plantation with Kusum lac cultivation can produce net return of 3-5 lakh / year (Ramani).
- It is like an insurance crop especially during drought year as the crop is very good during such adverse climate.
- Lac cultivation involves significant women participation and helps ecosystem development.
- A good number of lac host trees like Kusun, Palash, Ber etc. naturally occurring in forest and Sub forests in Chhattisgarh available for commercial exploitation.
- India (Eastern plateau) has suitable agro-climate and in Chhattisgarh North hill region is best but overall whole Chhattisgarh state favourable for its Cultivation.
- Helps maintaining good environment.
- A good source of employment generation. A hectare of Kusumi lac cultivation on ber generates 620 man days of employment in a year.
- Quality of Indian Kusumi lac is most superior in world.
- Lac is the most predominant source of natural resin and dye for various applications.
- It has high export potential. About 75% of present production is exported.
- India was and is leader in lac production and export.

8. **Commercial Application of Lac**

a. Surface Coating Industry

- Heat and water proof polish, Picture varnish, Book varnish, Water soluble lac, Shellac etch primer.

b. Adhesive industry

- Gasket shellac compound, Sealing wax, Making of bangles.

c. Electrical industry

- Insulating varnish, Mechanizes, Coating of isolators, PCBs, spark plugs etc.
  1. Pharmaceutical industry
  2. Confectionery industry
  3. Cosmetics industry
  4. Miscellaneous

9. **Future Application**

A few fields in which lac and based products possess potential for future applications are below-

1. Fruit and vegetable coating
2. Soft drinks
3. Chocolate and candy coating
4. Pharmaceutical glaze
5. Electrical components
6. Blend of shellac with different polymers
7. Lac dye for textile industry

10. **Lac Cultivation for Bio-diversity Management**

Biodiversity has direct consumptive value in food, agriculture, medicine and industry. Forest and tree cover plays a vital role in ecological balance, environmental stability, bio- diversity conservation, food security and sustainable development. Lac host plant also contributes significantly to this cause. India has about 200 million lac host trees of which only about one third are exploited. Promotion of scientific lac cultivation is an assured ecological approach for economic development.

A careful selection of suitable conventional, regional and promising lac host plants is important for a particular area, to be practiced in association with various types of forestry viz., agroforestry, social forestry, farm forestry, joint forest management, wasteland management, timber plantation, minor forest produce etc. lac plantations could be established with compatible intercrops, medicinal and aromatic plants etc., for developing lac based diversified farming system for increased productivity and profitability. Soil erosion and management, environmental and socio economic upliftment is possible with lac cultivation.

11. **Conclusion**

The lac host plants shoots be maintain properly because the lac production is totally depend on the good and vigorous of the host plants, so shoots be required fully under care and management during the cultivation.

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