Package of Practice for Lac

An initiative promoted by Udyogini for strengthening Lac value chain in India

Modus Operandi

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This documents briefs about the approach to be adopted for lac cultivation in Scientific approach.

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Standard Operational Procedure for Lac Cultivation under four different strains i.e. Kusmi on Kusum(*Schleichera oleosa)***, Kusmi on Ber***(Zizyphus mauritiana)***, Rangeeni on Palash***(Butea monosperma)* **and Rangeeni on Ber** *(Zizyphus mauritiana)***.**

The product – Lac

Local Names: Sanskrit – Laksha; Hindi – Lakh; Bengali – Gala; Gujarathi – Lak; Telugu – Kommolakka, Tamil – Komburrki; Malayalam – Arakku, Ambalu.

Lac is one of the most valuable gifts of Nature to man. It is also unique material in as much as it is the only resin of animal origin, being actually the secretion of a tiny insect, ***Laccifer lacca.*** It is remarkable that even thousands of years back, people used to collect or regularly grow and put it to diverse uses. It is, however, difficult to conjecture exactly when and how it was first exploited for utility purposes. It is not unlikely, however, that the colour which s so striking and attractive should have first drawn attention. Further, the fact that the dye can be straightway used without having to be processed in any way also suggests that the dye might have been the first to be exploited. Possibly the medicinal value was also simultaneously known. The recognition of the usefulness of the resin might have come later. As observed by Watt (1908) "Lac enters into the Agricultural, Commercial, Artistic, Manufacturing, Domestic and sacred feelings and enterprises of the people of India to an extent hardly appreciated by the ordinary observers". Yet beyond a few references in ancient literature, very little is known regarding its early history. In the Vedic period it was known as *Laksha*, a name suggestive of the labour of myriads of insects which produce it. In fact, *Suktha* number five of the fifth boo of the *Atharva Veda* bears the title "Laksha" and gives a brief account of lac, the lac insect, the medicinal use of lac and a prayer charm addressed to the fully developed adult female lac insect personified as a beautiful young maiden (Dave,1950). It is interesting to note that even in those early

days a fairly accurate knowledge of the biology of the insect was available. We read in the *Mahabharata* that the Kauravas commissioned the architect, Purochak, to design and build a palace that could be easily set ablaze so that the Pandavas could be got rid of. The architect is said to have built "Yatugriha" (or "Laksha griha"), a beautiful palace of lac which could actually be burnt down completely as planned.

The Palash tree (Butea monosperma syn. Frondosa) has been referred to as 'Lakshataru' in subsequent Sanskrit literature as it is known to be the most common lac host that sustains the lac insect. The great antiquity of lac is also proved otherwise, namely, through its numerous age-old uses, e.g. for dyeing silken *saries*, filling of hollow gold and silver ornaments by goldsmiths, in wood turnery, bangle making etc., the use of the dye under the name of *'alta'* in religious ceremonies, as well as by ladies for colouring the soles of feet and palms of hands. Coming down to the medieval age, we find that in Hindi manuscripts over 800 years old, there are references to the use of alc as a medicine (Angelo Brothers, 1956). "Abu Hanifa" also recommends its use as a medicinal thing (Misra, 1928). Records of the Mughal period include several references to lac. In the *Ain-I-Akbari*, regarded as the administration report of Akbar, the Mughal Emperor, for the year 1590, detailed recipes for the use of lac resin in conjunction with certain pigments, in varnishing chicks or screens on the doors of public buildings are given. Lac, like any other ancient commodity, in particular being the only resin of animal origin, has been subjected to numerous scientific investigations for over two centuries. A brief account of the early scientific investigations has been given by Gibson (1942). He reports that "actual scientific and quasi-scientific work done on Lac and Lac products began with the investigations of Father Tachard, missionary priest of the Society of Jesuits who in 1709 from Pondichery despatched to France his memoir on lac, giving an account of its occurrence, preparation and some of its physicochemical properties." Next work of importance is that of James Kerr (1781) who first scientifically described the lac insect. There after followed the work of Roxburgh (1790) who gave details of the life history of the insect, and of Anderson (1791) who wrote a monograph on the insect. Hamilton (1800, 1809) was the first to furnish sequent numerous

contributions to the subject, Carter's (1861) account of the life-history of the insect is very important, as this corrected several errors in the writings of previous observers. Other noted authors who have made useful contributions are O'Connor (1874), Comstock (1882), Tozetti (1894), Stebbing (1908)Maxwell-Lefroy (1909), Misra (1928), and Imms and Chatterjee (1915).

Lac is in fact the parent of modern plastics. The importance of Lac in the modern economy, particularly of India and Thailand, is quite considerable. It earns for India foreign exchange to the tune of 90 crores of rupees per annum. India's interest in lac stems from other considerations also: It provides spare-time occupation to some 5 million cultivators, mostly aboriginals who form the poorest section of the country's population. Its cultivation also does not require any capital which makes it all the more welcome to the poor ryots. Lac also provides employment to some 30,000 persons either as workers in small-scale factories or as intermediaries in the export trade and altogether accounts for a good deal of economic activities of the country. The experts of lac from India reached a quantitative peak in 1956-57 totaling 42840 Tonnes valued at Rs.23.4 million.

HOST PLANTS:

Lac insects thrive on twigs of certain plant species, suck the plant sap, and grow all the while secreting lac resin from their bodies. These plants are called host plants. Although lac insect is natural pest on host plant, these insects enjoy the privileged position not being treated as pest. This is because: i) they yield a useful product, ii) the host plants are economically not so important, and iii) the insects cause only temporary and recoverable damage to the host plants. About 113 varieties of host plants are mentioned as lac host plant. Out of which the followings are very common in India:

1. *Butea monosperma* (Vern. Palas)
2. *Zizyphus* spp (vern. Ber)
3. *Schleichera oleosa* (Vern. Kusum)
4. *Acacia catechu* (Vern. Khair)

5. *Acacia arabica* (Vern. Babul)

6. *Acacia auriculiformis* (Vern. Akashmani)

7. *Zizyphus xylopyrus* (Vern. Khatber- grown in part of M.P. & U.P.)

8. *Shorea talura* (Vern. Sal grown in mysore)

9. *Cajanus cajan* (Vern. Pigeon-pea or Arhar)

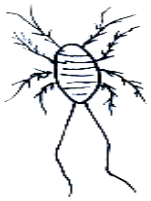
10. *Grewia teliaefolia* (Vern. Dhaman preferred in Assam)

11. *Albizzia lebbek* (Vern. Siris/Gulwang)

12. *Flemingia macrophylla* (Vern. Bholia)

13. *Ficus benghalensis* (Vern. Bargad)

14. *Ficus religiosa* (Vern. Peepal)



Of these host plants, palas, kusum, ber and khair are of major importance, while others are of regional and minor importance. It is also important to mention that the quality of lac is directly related to the host plant and to the strain of lac insects. Based on industrial parameters, **kusumi lac** is better and fetches higher price in market. In this respect, ber tree as a potential kusumi lac host is already getting momentum. This host species is available in plenty and can supplement and fulfill the kusmi brood lac requirement in many areas. Similarly, siris (*Albizzia* sp.) has also been identified as good host for kusumi brood lac. The trees can be raised and utilized within a period of 5-6 years of plantation in comparison to around 15 years for kusum. *Flemingia semialata* is a bushy host plant and has also been identified as well as established as a good kusumi lac host on plantation basis. Thus, these three hosts viz., ber, siris, semialata and lately *Prosopis juliflora* (in Gujarat areas) are expected to enhance kusumi lac cultivation. Adoption of this activity may enhance lac production to the tune of 3-4%.

Life Cycle of Lac insect

The insect starts its life as a minute boat-shaped, red coloured larva, c. 0.3 mm long and 0.25 mm broad. The larvae emerge in large numbers at certain times of the year from

the lac cells of the female insect and crawl over the surface of twigs and branches of plants they infest. A healthy female produces 300 – 1,000 larvae. After a brief period, and depending on favourable weather conditions, the larvae emerge from the cell in search of suitable places for settlement; and larval emergence may continue for several weeks. The proportion of male to female larvae in the brood varies in different crops and years, but generally it is 1:3. The density of settlement on the shoots is usually 150-180 larvae/sq. Once settled the larva does not move from its place.

A week or so after settling, the larvae start secreting lac from glands distributed under the cuticle all over the body, except the mouth parts, the two breathing pores and the anus. It thus gets encased in a cell of its own secretion, which increases in size with the growth of the insect. The larva molts thrice before reaching maturity; the duration of each of the three larval stages depends on environmental factors, such as temperature, humidity and host plant. The sex is readily recognized by the shape of the cell even in the early stages of larval development. In the case of the male cell, the growth is more along the longitudinal axis; in the case of the female cell the growth is more along the vertical axis. The differentiation between sexes is particularly marked after the first moult. The male lac cell assumes a slipper-like appearance and a loose operculum at the rear end is evident immediately after the second moult. Inside the cell, the larva casts the second moult and passes through pre - pupa and pupa stages; during these stages, the larva does not feed and the mouthparts become abortive. After the completion of the pupa stage, the adult male, which may or may not have wings (wingless males are more common) emerges by pushing open the operculum; the relative numbers of the two forms in a colony vary considerably in different seasons.

The female larva becomes swollen and assumes the form of a pear-shaped or roundish bag which completely occupies the space inside the lac cell. After the final or third moult, the female is sexually mature and is fertilized by the male which has a life of 62-92 hrs after emergence. Lac secretion by the female continues, and the size of the insect as well as that of the enveloping lac cell increases at a fast pace; the female lac cell eventually attains a size which is several times that of a male lac cell. The female

continues to secrete lac until the eggs are laid. Even the unfertilized female is as a capable of producing lac and fertile progeny as the fertilized female.

As the time for egg laying approaches, the body of the female contracts on one side (ventral), gradually vacating space inside the lac cell In which it is enclosed. Simultaneously, wax and wax filaments are secreted and shed in the vacated space, possibly to provide dry dressing and cushion for the future young larvae. The anal tubercle is then withdrawn inside the cell for laying eggs, which hatch into larvae immediately after laying.

Temperature plays an important role both in egg laying and larval emergence. Egg laying practically ceases if the temperature falls below 170 C in summer and below 15 in winter; the female, however, retain its vitality to lay eggs for 4 to 12 days. The larvae inside the lac cell become inactive below a temperature of 200 C but their capacity to produce lac subsequently under favourable conditions is not impaired. The percentage of females in the progeny is not affected by subjecting broodlac to low temperature for short periods. These factors have an important bearing on the preservation and transport of broodlac over long distances and on forcing larvae to swarm at particular periods as desired.

Objectives of the intervention:

1. To demonstrate strategic shift from traditional way to Scientific Cultivation of Lac and ensure its sustainability;
2. To create a Package of practice this can be replicated and scaled up;
3. To create a cadre of women practitioners (CRP's) who can dovetails the knowledge to their respective villages.

Services to be given:

1. Trainings as per the training calendar prepared for different strains;
2. Monitoring of growth and remedial action as and when required;

3. Market linkage for better negotiation in terms of price of Brood as well as scraped lac;
4. Logistics/implements support as per the set norms.
5. Collective marketing through Village level Service Centres to ensure maximum market price from the industry partner.
6. Time to time exposure visits for producers.

Target group:

As the name suggests Udyogini means female entrepreneur in Hindi and for this project we have targeted the women in particular and family in general.

Various Stages of operating procedure adopted by Udyogini

a) Mobilization of target group / formation of SHGs

- To formalize the intervention strategy, women need to be joined in women enterprise groups. Later on these groups can be used as a platform for delivering all the technical knowhow for lac and other enterprise activities.

b) Training for host plant selection

- Training for host plant selection is the most crucial step before starting scientific lac cultivation. For different strains of lac cultivation the trainings can be planned as follows;

Name of the strain	Suitable timing for Inoculation	Tentative timing for training
Kusmi on Kusum	January	Nov – Dec
Kusmi on Ber	July	May – June
Rangeeni on Palash	Oct	Mar – April
Rangeeni on Ber	July	May - June

e) Pruning of host plants

- Pruning [1]of host plant is essential for any strain of Lac since this is directly involved with the productivity of the particular host plant. For different strains of Lac cultivation pruning can be planned as follows;

Name of the strain	Suitable timing for Inoculation	Tentative timing for pruning
Kusmi on Kusum	January	one and a half year before inoculation
Kusmi on Ber	July	January – February
Rangeeni on Palash	Oct	February - March
Rangeeni on Ber	July	January – February

c) Grading of host plant

- Depending upon the emergence of new shoots after pruning, the host plant use to be graded as "1", "2" and "3". In case of Ber and Palash trees the significance of the these numbers are as follows;

  "3" – brood requirement of the tree varies between 0-2 kg;

  "2" – brood requirement of the tree varies between 2-4 kg;

  "1" - brood requirement of the tree is 4 kg and above.

d) Inoculation of brood

The method by which the lack insects are introduced on to a lac host is known as infection or inoculation. Inoculation should be done on trees which are being

[1] A process of cutting the stems of the trees in a given period of time

prepared for such purpose by pruning in due time. For kusum, Ber and Palash trees, the usual period of inoculation[2] is as follows:-

Name of the strain	Suitable timing for Inoculation
Kusmi on Kusum	January
Kusmi on Ber	July
Rangeeni on Palash	Oct
Rangeeni on Ber	July

1) Fully matured and healthy broodlac[3] – free from enemy insects – should be used. This will ensure maximum infection of the trees and also reduce enemy infestation of the ensuing crop.
2) Broodlac meant for inoculation cannot be kept long and should preferably be used immediately after cutting. Usually most of the Lac larvae emerge from the brood within a week or ten days from the time of first emergence and to get best result inoculation should not be delayed beyond 2-3 days of noting larval emergence from the broodlac.
3) Self-infection as far as possible should be avoided unless forced by circumstances. For instance, in localities where labour is scarce in June-July, or in very hot localities where artificial infection may not be quite successful in June-July, self-infection of trees may be found inevitable.
4) Correct amount of brood lac, neither less nor more, should be used for infection. Ordinarily a well covered healthy brood lac stick gives adequate larval settlement over 15 to 20 times its length, on the twigs of the tree to be infected and hence, brood lac at this rate should be used for infection.

[2] A method through which lac insects are introduced to new host plant

[3] Twig containing live insects

5) Selected brood lac in lengths of about 6 to 12 inches should be first tied into bundles of 2 to 3 sticks and then such bundles tied on to the branches of the trees at such places that the twigs above (with 15 to 20 times the total length of brood sticks used in the bundle) get full infection. This will ensure full and uniform distribution of the brood and consequently full and uniform infection of the tree.
6) While tying brood bundles, care should be taken to tie them securely on to the upper surface of branches and in such a way as to give maximum contact of the bundles with the branch. This prevents sagging or falling of brood bundles from the trees and allows the lac larvae to crawl to the tree easily.
7) Brood lac bundles should be kept on the tree for the minimum period required for complete infection. Ordinarily, it may not be necessary to keep the brood lac on the tree for more than two or three weeks. If kept longer i.e. even after the complete emergence of the lac larvae, there is the danger of a large number of enemy insects emerging from the empty (phunki) brood lac sticks and starting heavy infestations in the field.
8) While infection goes on, it is likely that brood bundles will fall to the ground due to a variety of causes such as the activity of squirrels and rats, and therefore, one should go round the infected trees now and then and put such fallen bundles back on the tree. Further it will also be found necessary to rotate brood bundles on the trees, so that they are shifted from places where larval settlement has taken place, to places still to be infected.
9) The quantity of broodlac used usually depends on the size of the tree. In case of Palash trees, the amount would be 300 gm. In cases of small trees and up to about 1 Kg. For large trees may be used.

e) Usage of fungicide and pesticide in standing crop:

To ensure maximum production through the standing crop need timely application of fungicides and pesticide. The tentative schedule for applying these pesticides and fungicides are as follows;

Name of the strain	Schedule for 1st spray	Pesticides/fungicides to be used	Schedule for 2nd spray	Pesticides/fungicides to be used
Kusmion Kusum	Within 30-35 days after inoculation	Nukil liquid and Bavistin powder	Within 60 - 65 days after inoculation	Nuwan Liquid and Bavistin powder
Kusmion Ber	Within 30-35 days after inoculation	Nukil liquid and Bavistin powder	After 30-35 days of first spray	Nuwan Liquid and Bavistin powder
Rangeenion Palash	Within 30-40 days after inoculation	Nukil liquid and Bavistin powder	After 30-40 days of first spray	Nuwan Liquid and Bavistin powder
Rangeenion Ber	Within 30-35 days after inoculation	Nukil liquid and Bavistin powder	After 30-35 days of first spray	Nuwan Liquid and Bavistin powder

Measures for the control of insect pests of lac are:

1) Immersion of freshly harvested stick lac, not wanted for brood, as well as phunki lac (i.e., broodlac after larval emergence is complete) in running or deep stagnant water
2) Scraping of lac from twigs immediately after harvesting and killing larvae and pupae of the pests by burning, crushing, drowning or by fumigation with carbon disulphide (1 oz. /10cu.ft. of space) before storage
3) Avoiding cultivation of early and late maturing varieties of lac, at least for brood purposes, in the same locality to prevent the spread of pests
4) Encasing of broodlac for inoculation in 60-80 mesh wire gauze baskets, c. 30 cm x 7 cm in size. The last method is particularly recommended for areas where lac cultivation is being introduced for the first time. The baskets permit free exit to lac larvae but exclude enemy insects. Proper management of host plants with a view to ensure their vitality and vigour helps to reduce damage by parasites.
5) Parasites and Predators emerge from lac cells in large numbers towards the close of the emergence of lac insect larvae. The practice of leaving broodlac on trees even after swarming is complete, therefore, favours the spread of enemy insects. To reduce the risk to the minimum, removal of *phunki* lac from inoculated trees should be completed as early as possible, i.e., within 2-3 weeks of the date of swarming. For the same reason, self or natural inoculation of host trees should be avoided except where absolutely necessary.

f) **Harvesting and Yield**

The instruments used for harvesting lac crops are those normally used for pruning; in fact, if harvesting is properly done there is no necessity for pruning the hosts. Lac required for brood purposes is cut a few days before larval emergence; broodlac meant for dispatch over long distances to other lac growing centres is cut a week or so before emergence. For dispatch to outside stations by motor, rail or air, broodlac is packed in bamboo baskets with a capacity of 15-20 kg.

Encrustations of lac from excess crop (not required for brood) are separated from the twigs by scraping. The scraped material, green lac or sticklac, as it is called, is spread thinly (10-15 cm deep) in a covered and well-ventilated place and periodically raked until dry. Broodlac twigs employed for inoculating fresh host plants are collected after the completion of swarming, and encrustations from them are also scraped out and dried. The sticklac thus obtained is then bagged for storage or for the market. Lac should not be stored in the green condition as fermentation sets in and fungus growth is favoured; lumps are formed and the quality of lac deteriorates. Long storage of even dried lac affects the solubility and other properties of lac and reduces its market value.

The yield of lac is 2 ½ - 3 times the weight of broodlac employed for inoculating the host; in really good crops, it may be as high as 5-7 times. The yield of scraped lac is usually about one-third of the harvested material (which includes twigs) in the case of *Rangeeni* crops and about one-half in the case of *Kusumi* crops.

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