

Project Report on Assistance to Farmers for Lac Culture on Indian Plum Tree

MISING AUTONOMOUS COUNCIL Gogamukh :: Dhemaji

1. Introduction

Lac is the scarlet resinous secretion of a number of species of **Lac** insects, of which the most commonly cultivated species is *Kerria lacca*. Cultivation begins by inoculating broodlac stick on tender shoots of the host plant. The broodlac stick contains eggs ready to hatch. Thousands of lac insects colonize the tender branches of the host trees and secrete the resinous pigment. The coated branches of the host trees are cut and harvested as sticklac after the maturity period.

The harvested sticklac is crushed and sieved to remove impurities. The sieved material is then repeatedly washed to remove insect parts and other soluble material. The resulting product is known as seedlac. The prefix seed refers to its pellet shape. Seedlac which still contains 3-5% impurities is processed into shellac by heat treatment or solvent extraction.

The leading producers of Lac in India are Jharkhand, Chhattisgarh, West Bengal, and Maharashtra. Lac production is also found in Bangladesh, Myanmar, Thailand, Laos, Vietnam, parts of China, and Mexico.

Lac is basically used as a dye. Other uses are production of bangle, ornaments, varnish, protective coating of fruits and vegetables etc.

2. Potentiality of Lac Culture in MAC area:

Lac culture is traditionally unknown to the people of Assam or for that matter MAC area. But the *Char* or *Chapori* areas of the Brahmaputra and Subansiri river systems and also other areas of MAC contains large numbers of naturally growing Indian Plum or Jujube fruit tree (*ber* in hindi) botanically named as *Ziziphus mauritiana*, which is very good host plant for Lac culture. Considering the potentiality of utilising these natural resources for alternative livelihood, MAC first invited a group of scientists from Indian Institute of Natural Resins and Gums (IINRG), Ranchi, Jharkhand to study the conditions. The Scientists team headed by Dr. A. K. Jaiswal, HoD of Transfer of Technology department made field visit in Dhemaji district and conducted a workshop on Lac Culture at MAC HQ. The scientist team expressed satisfaction and recommended immediate introduction of Lac Culture, particularly the Kusmi Lac. Thenceforth, two batches of youths including some Executive Councillors and General Members of MAC visited IINRG, Ranchi and under went training on Lac culture. Experimental Lac culture began in January, 2015 in MAC area and the results are encouraging.

3. Lac Cultivation Operation on *Ziziphus mauritiana*

Like other lac host tree species, lac cultivation on plum trees involves following steps:

- a. Pruning of host trees
- b. Inoculation of broodlac on lac hosts (Infestation with lac insect)
- c. Removing of used-up broodlac sticks
- d. Crop protection
- e. Crop harvesting
- f. Scraping of lac from sticks

a. Pruning of trees: It is normally carried out with a view to get tender and succulent shoots at the time of inoculation. Five months prior to inoculation is the suitable period for pruning. Sharp implements are used for smoothly cutting the branches as cuts without any adverse damage at the tip of branches. The trees are pruned either in February for inoculation in July-August for *kusmi* strain or in May for inoculation of *rangeeni* lac insect during October or November. Pruning of trees starts from lower side of canopy to upper side so that cut branches are not entangled in lower branches. Pruning is carried out in such a way a proper canopy and shape are given to a tree for easy climbing and proper facilitation of lac cultivation operations.

b. Inoculation of broodlac on host trees: Broodlac is inoculated on trees during July-August for the production of *kusmi* broodlac and during October-November for the production of *rangeeniari* lac. Inoculation may be done with broodlac @ 20 g per meter of available tender shoots. For inoculating *rangeeni* broodlac during October-November, 60 mesh net bags should be used as broodlac container. Whereas, for inoculating *kusmi* broodlac during July-August, it should be avoided in view of possibility of clogging of net bag pores with rain water due to continuous rains, which deters the settlement of lac insect on host twigs. Broodlac of 50 g bundles are prepared by tying them with plastic thread. During July-August; when broodlac is tied to the branches, it is advisable to tie single broodlac stick on shoots in order to avoid fungal growth on broodlac sticks due to continuous rain or cloudy weather. It is also advised to dip the broodlac if infested with enemy insects, recommended pesticidal formulations may be used for dipping as in case of fungicides.

c. Removing of used-up broodlac sticks: As soon as larval emergence from broodlac is completed, it should be removed from trees at the earliest. Normally it is completed within 7-10 days during July-August and 15-20 days during October-November. The used-up net bags are cleaned properly with soap solution, dried and kept for the next season. The damaged net may be repaired if possible, or can be rejected. After removing the used-up broodlac sticks, the lac is scraped from the stick which avoids multiplication of insect-predators and parasitoids harbouring lac encrusted sticks.

d. Crop protection: Lac crop protection from insect-pest and pathogens is one of the most important components which are to be adopted for sustained lac production as well as for production of quality broodlac. Predators and parasitoids associated with lac insects are the major cause of low production and productivity. In addition to lepidopteran predator, *kusmi* lac crops are more prone to neuropteran predators. So, for rainy and winter season (*kusmi*) lac crops, suitable insecticides are applied against attack of *Chrysopa* (enemy of insect) with suitable fungicides. For *rangeeni* summer *ari* crop, care is taken to save the crop from parasitoids.

e. Crop harvesting: The *rangeeni* summer crop (*baisakhiari*) is the main commercial crop and is ready for harvest during May. Similarly *kusmi* crop matures in the form of broodlac sometime during January-February. Trees are pruned simultaneously, along with harvesting of the crop. *Kusmi* broodlac which is harvested from the trees may have some dead lac insect. These are considered unsuitable to be used as broodlac and hence are sold on scraping the lac from the stick. While harvesting broodlac from plum tree, use lopping Scissor (long handled cutting scissor) may be useful. Similar to pruning, the harvesting of crop should also be carried out in an upward direction on this tree species. The number of pruned points (cut end) are counted after pruning of each tree as it helps in estimating broodlac requirements at the time of inoculation.

f. Scraping of lac from sticks: *Kusmi* broodlac is sold without scraping in the market. Scraping is required from rejected *kusmi* broodlac sticks and *rangeeni* lac harvested in the month of May for sale. Freshly harvested lac is scraped manually but scraping of dried lac sticks should be

carried out either manually or by scraping machine. Manual or electric operated machine for scraping of lac is available in the market.

4. Lac Insect and Crop Cycle

Z. mauritiana species is a potential host for raising both strains (*kusmi* and *rangeeni*) of lac insect. Besides bivoltine, it is also suitable for trivoltine lac insect, *Kerriasharda* which is abundantly available in coastal areas of Odisha state. Most of the lac growers utilize the tree for *rangeeni* lac cultivation. But in recent past *kusmi* lac cultivation is also being carried out on this species. The productivity of *kusmi* lac insect is higher than *rangeeni* strain, therefore fetching more prices from the market. Both *kusmi* and *rangeeni* strains of lac insect differ in respect to duration of life cycle, maturity time, quality and quantity of resin produced, fecundity and host preference. *Rangeeni* lac insect cannot be cultivated on *kusum* tree and this can be one of the parameter to distinguish *kusmi* and *rangeeni* strain of lac insect. The *kusmi* insect settles more closely and the resin production per insect is also relatively higher than that of *rangeeni*.

The *rangeeni* lac insect produces two crops *i.e.* summer (*baisakhi*) and rainy season (*katki*) in a year. For raising summer crop, broodlac is inoculated on host tree during October-November and the crop (insect) matures during June-July (8 months duration), while for raising rainy season crop, the trees are inoculated during June-July and crop matures during October-November (4 months duration). Similarly, there are two crops in a year from *kusmi* lac insect (i) winter (*aghani*) and (ii) summer (*jethwi*). In most lac growing tracts of the country, the winter crop begins its life cycle during June-July and matures during January-February whereas summer crop starts during January-February and matures during June-July (Medium of conventional breed).

The crop-wise, different developmental stages of *rangeeni* and *kusmi* lac insect and duration have been given in Table 1 and table 2, respectively.

Table 1. Stages of lac insects and their life span in days*

Insect (Strains)	Crop	Stage			Male		Female	
		I	II	III	Adult	Total	Adult	Total
<i>Rangeeni</i>	Rainy (<i>Katki</i>)	20 (3)	14 (2)	8 (1)	2	44 (6-7)	67 (10)	109 (16)
	Summer (<i>Baisakhi</i>)	50 (7)	40 (6)	15 (2)	3	108 (15-16)	145 (21)	(250) (36)
<i>Kusmi</i>	Winter (<i>Aghani</i>)	18 (3)	13 (2)	10 (2)	2	43 (6-7)	150 (21)	193 (28)
	Summer (<i>Jethwi</i>)	30 (4)	24 (3)	10 (2)	2	66 (9-10)	90 (13)	156 (22)

*Figures in parentheses indicate approximate duration in weeks

Table 2. Lac crops and their duration of maturity

Lac	Crop	Inoculation of broodlac	Maturity (Harvesting)	Duration in months
<i>Rnageeni</i>	Rainy season (<i>Katki</i>)	June-July	October-November	4
	Summer (<i>Baisakhi</i>)	October-November	June-July	8
<i>Kusmi</i>	Summer (<i>Jethwi</i>)	January-February	June-July	6
	Winter (<i>Aghani</i>)	June-July	January-February	6

The period of male emergence has got special significance and growers have to be skilled enough to identify this stage as it is the period when application of insecticides has to be avoided. The male emergence begins from around 42 and 105 days of inoculation for rainy season and summer crops of *rangeeni* lac insect respectively. Similarly for winter and summer crops of *kusmi* lac insect, the male emergence period starts from 41 and 65 days of inoculation respectively. This period continues from 15-20 days depending on lac crops. The male adults of lac insects are moving stage and approach the females for mating. After mating the male dies within 2-3 days of emergence from pupa. Both winged and wingless forms are found in male adults. The winged form of male adult also cannot fly but crawl on lac encrustation in search of female for mating. A single male insect can mate with about 40-45 females and *vice-versa*.

Table 3. Cultivation schedule for bi-voltine *kusmi* lac exclusively on *Z. mauritiana*

Year	Month	Group-I (Winter crop)	Group-II (Summer crop)
I	February	Pruning	
	June-July	Inoculation	Pruning
II	February	Harvesting + Pruning	Inoculation
	June-July	Re-Inoculation	Harvesting + Pruning
III	February	Harvesting + Pruning	Re-Inoculation
	June-July	Re-Inoculation	Harvesting + Pruning
IV	February	Harvesting + Pruning	Re-Inoculation
	June-July	Re-Inoculation	Harvesting + Pruning

5. Management of lac culture

- i. The broodlac obtained from one set of tree can be utilized for infesting other set of trees or can be sold in the market as *kusmi* broodlac, which fetches a higher price than *rangeeni*;
- ii. For control of enemy insect; particularly insect predators, the first spray of ethofenprox 0.02% or indoxacarb (0.007%) or fipronil (0.007%) or spinosad (0.005%) + 0.05% carbendazim formulation is done one month after inoculation for both winter and summer crop;
- iii. The spray may be repeated one month after the first spray for both crops (2-month after inoculation);
- iv. An additional spray of ethofenprox or any of the above insecticide and fungicide may be done between 38-40 days of inoculation for winter crop in order to save the crop from the attack of *Chrysopassp*;
- v. Precaution is taken by not spraying any pesticides when adult male emergence takes place (mating time). Normally this period correspond to 45-60 days in winter (Diagram 1) and 65-85 days after inoculation in summer crop (Diagram 2). However it would be better if pesticides are applied after observation status of filed emergence;
- vi. Winter crop should be harvested in in January or February only when emergence of lac larvae starts from mature lac encrustation;
- vii. As February is a suitable time for pruning plum trees, a late breed of *kusmi* broodlac (normally lac insect emerges in February) is inoculated so that the pruning and harvesting time coincide; and

viii. If kusmi insects emerge earlier than February on plum trees, then only the lac encrusted twigs are cut and final pruning done in the second fortnight of February.

Diagram 1. Spray schedule for *kusmi* winter crop on plum tree

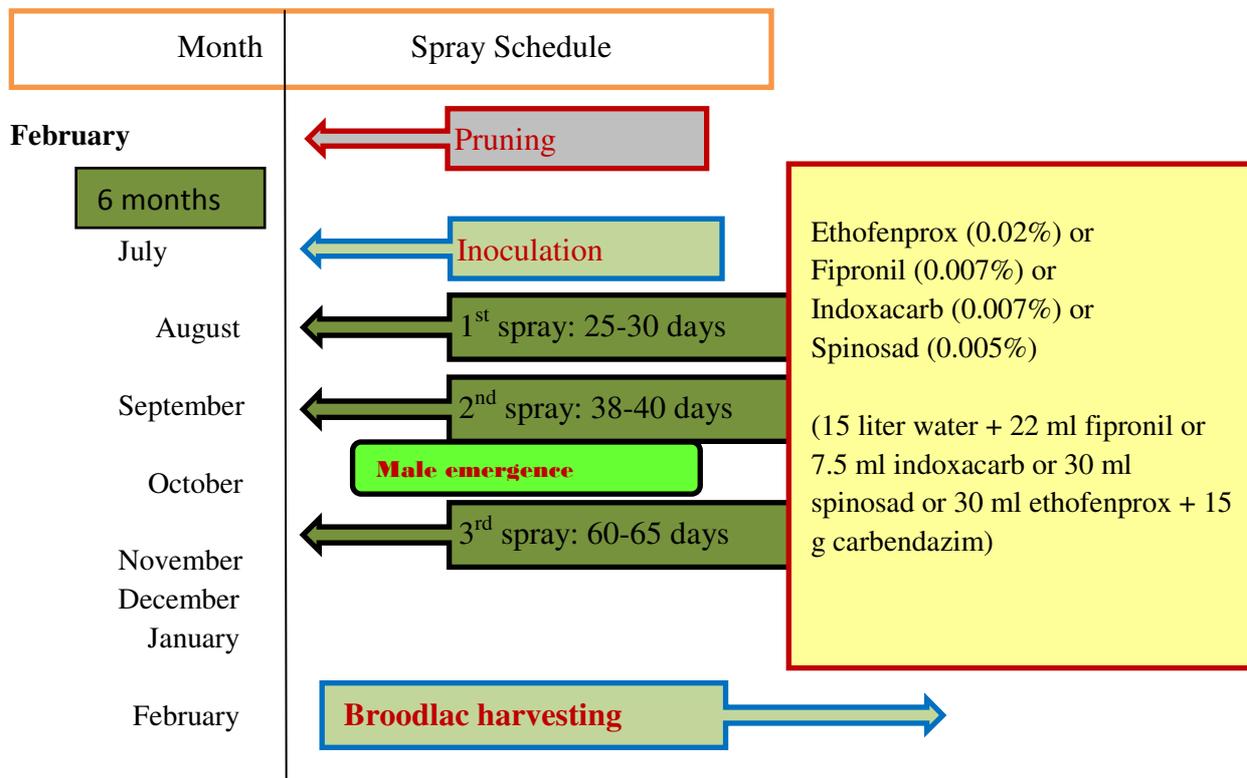
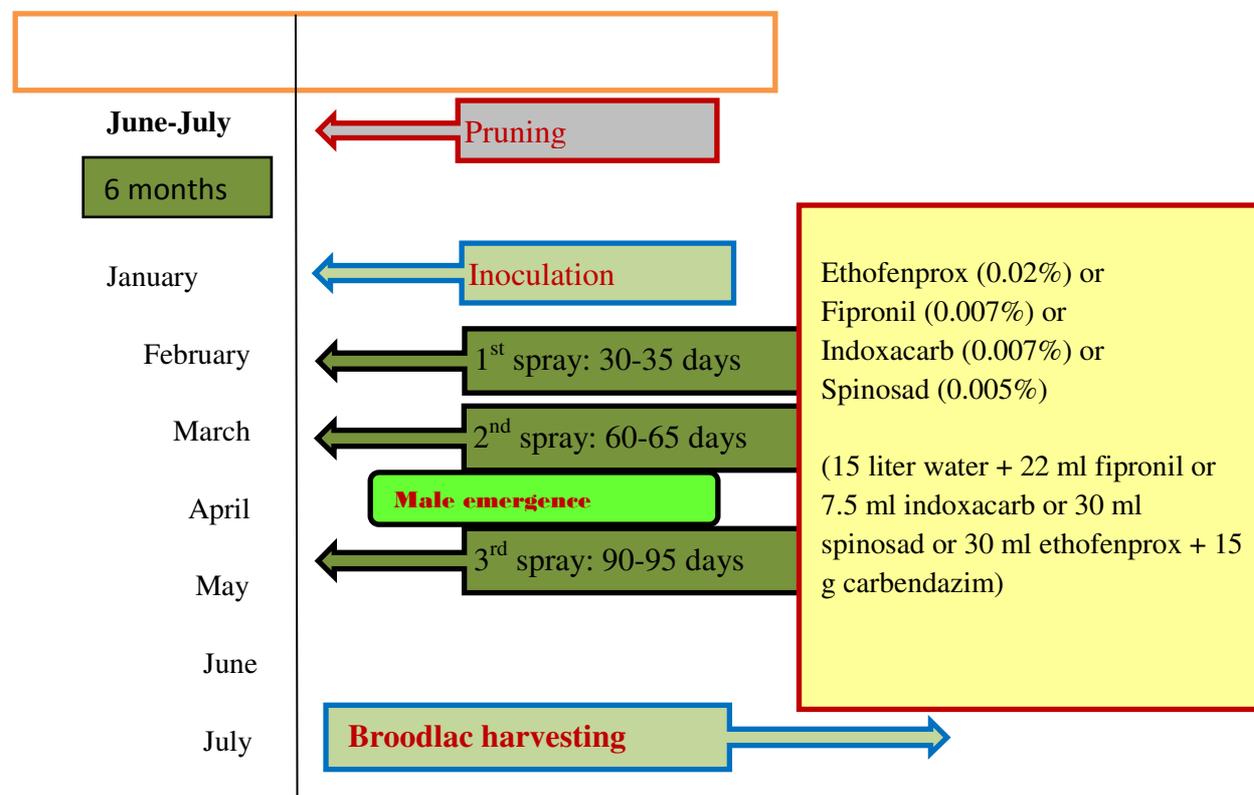


Diagram 2. Spray schedule for *kusmi* summer crop on plum tree



6. Economics of lac Production *Kusmi* Broodlac on *Z. mauritiana*

b. *Kusmi* broodlac

Although about 2000 gm or 2 Kg of *Kusmi* broodlac can be inoculated on a single Indian Plum tree, the scientist team from IINRG has recommended inoculation of only 500 gm of *Kusmi* broodlac to begin with. The detailed cost of cultivation of *kusmi* lac on 100 Indian Plum trees is as follows:

(Number of trees under operation = 100)

SI	Particulars	Nos.	Cost (Rs.)
I	Non- Recurring Expenditure (Input material)		
1	Secateur	10	3000
2	Dauli	8	1200
3	Scraping knife	10	1000
4	Rocking sprayer	1	6500
5	Bucket (GI) 15 L	4	680
6	Synthetic netting bag	0	0
7	Balance (Spring & Monopan)	2	2000
8	Rickshaw trolley (Heavy duty)	1	15000
	Total		29380
II	Recurring Expenditure		
1	Cost of 50 kg broodlac @ Rs. 450 Per kg		22500
2	Cost of plastic string/sutli (3 kg) @ Rs.100 per kg		300
3	Bamboo basket (8 Nos.) @ Rs.100		800
4	Insecticide (1.5 L) & fungicide Rs. 25 per tree		2500
	Total		26100
III	Expenditure per year		
1	Labour charges (125 man-days @ Rs.150 per day)		18750
2	Cost of input materials		26100
3	Depreciation on implements (5%)		1469
	Total		46319
IV	Income per year		
1	<i>Phunki</i> lac sticks (50% of broodlac input=25 kg @ Rs. 350 per kg)		8750
2	Sale of broodlac (5 kg/tree = 500 kg) @ Rs. 300/-per kg		150000
3	Sale of scraped lac from rejected broodlac 0.5 kg per tree @ Rs. 250 per kg for 50 kg		12500
	Gross income		171250
V	Net income per year		
			124931

7. Methodology:

Lac culture is completely new to the MAC area. Therefore, farmers will be organised in to SHGs with leaders who have undergone training either at IINRG, Ranchi or at Workshops conducted by MAC. They are to be sensitised about the new crop and they should be ready to invest for pruning of the trees and management of the lac culture. The initial non recurring expenditure is not must and total man days required for one crop with 100 trees are 125 days only which if divided among a group of 10 farmers, the individual man days investment is 12 days.

About 3000 trees have already been pruned in Jan/Feb, 2015 which are now (July, 2015) ready with tender shoots for inoculation.

Broodlac is not available in MAC area and it will have to be brought from either West Bengal or Jharkhand. Therefore, the project proposes procurement of 1300 Kgs of *Kusmi* Broodlac from

reputed Lac farmer certified by IINRG through NIT for distribution among approximately 300 farmers @ of 5 Kgs to one farmer.

7. Beneficiaries:

The list of beneficiary SHGs with names of President and Secretary, location of cultivation and other details are enclosed as annexure I.

8. Conclusion

Wild Indian plum tree has little economic value for farmers which is available in large number in *Char-Chapori* and forest areas. The fruit is either consumed locally or wasted due to poor market value. If these trees are utilized for cultivation of Lac, adequate employment and income can be generated at village level itself. Besides, there is no adverse effect on host tree, instead harvesting of Lac crop also serve the purpose of pruning and helps in maintaining the general health condition of tree in forest/rural areas. Lac culture holds big potentiality of providing an alternative means of livelihood to rural people in MAC area. Apart from the naturally grown ones, this tree species can also be raised on barren land and also on border of paddy fields without any adverse effect on rice production. The wood biomass obtained after scraping of lac is utilised as fuel by the rural people.

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