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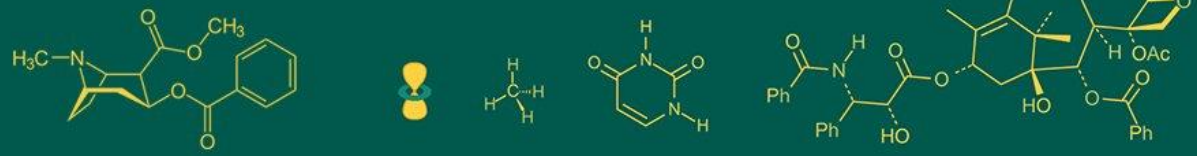

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Alok Singh Bargah
PhD Research Scholar, College of Forestry and Research Station, Mahatma Gandhi University of Horticulture and Forestry, Sankra, Patan, Durg, Chhattisgarh, India

Satya Prakash Vishwakarma
Assistant Professor (Guest), College of Forestry and Research Station, Mahatma Gandhi University of Horticulture and Forestry, Sankra, Patan, Durg, Chhattisgarh, India

Sadhna Yadav
PhD Research Scholar, College of Forestry and Research Station, Mahatma Gandhi University of Horticulture and Forestry, Sankra, Patan, Durg, Chhattisgarh, India

Sakshi Verma
PhD Research Scholar, College of Forestry and Research Station, Mahatma Gandhi University of Horticulture and Forestry, Sankra, Patan, Durg, Chhattisgarh, India

Pallavi Netam
PhD Research Scholar, College of Forestry and Research Station, Mahatma Gandhi University of Horticulture and Forestry, Sankra, Patan, Durg, Chhattisgarh, India

Manisha Tondan
PhD Research Scholar, Rani Lakshmi Bai Central Agricultural University, Near Pahuj Dam, Gwalior Road, Jhansi, Uttar Pradesh, India

Shiva Sahu
PhD Research Scholar, College of Forestry and Research Station, Mahatma Gandhi University of Horticulture and Forestry, Sankra, Patan, Durg, Chhattisgarh, India

Corresponding Author:
Alok Singh Bargah
PhD Research Scholar, College of Forestry and Research Station, Mahatma Gandhi University of Horticulture and Forestry, Sankra, Patan, Durg, Chhattisgarh, India

A comprehensive review on lac cultivation: Biology, management and future prospects

Alok Singh Bargah, Satya Prakash Vishwakarma, Sadhna Yadav, Sakshi Verma, Pallavi Netam, Manisha Tondan and Shiva Sahu

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Abstract
Lac cultivation is an important forest-based livelihood activity in Chhattisgarh, where host trees such as Kusum, Palash, and Ber occur abundantly. Under the Lac Development Scheme, 83 lac cultivation projects are operational, covering 66,934 Kusum, 4,73,768 Palash, and 5,442 Ber trees, benefiting 22,238 rural households. A dedicated Lac Training & Extension Centre at Kanker has trained over 231 master trainers, strengthening scientific cultivation practices in the state. Chhattisgarh contributes approximately 4,000 MT of lac annually, with major producing districts including Jagdalpur, Kanker, Mahasamund, Gariaband, Korea, Sarguja, and Kabeerdham. Lac, a natural resin secreted by Kerria lacca, is cultivated mainly on Kusum, Palash, and Ber trees. India accounts for 50-60% of global lac production, supporting 3-4 million tribal and forest-dependent families. Two principal strains—Rangeeni and Kusmi—yield crops twice a year and differ in host preference and resin quality. Lac processing generates high-demand products such as resin, dye, and wax, used in pharmaceuticals, cosmetics, food industries, paints, electronics, and eco-friendly coatings. Despite having 621.4 million potential host trees, India utilizes only 5-15%, indicating huge scope for expansion. Chhattisgarh has significantly enhanced lac productivity through initiatives of TRIFED, Lac Development Projects, European Commission-supported programmes, and micro-enterprises. The income per host tree varies considerably—Palash (₹900-1000), Ber (₹1200-1500), and Kusum (₹8000-10,000)—highlighting the economic potential of Kusmi lac. Villagers also undertake primary processing of stick lac/scrap lac into dana lac (seed lac) in local processing units. A standard unit processes 100 kg scrap lac per day, employing at least four workers. Through crushing, washing with caustic soda, drying, cleaning, and grading, 600-700 g of seed lac is obtained from 1 kg of scrap lac, providing additional income and rural employment. Strengthening scientific practices, improving processing efficiency, and utilizing untapped host tree resources can further enhance lac production, rural livelihoods, and sustainable forest-based economies in Chhattisgarh.

Keywords: Chhattisgarh (India), Host Trees (Kusum, Palash, Ber), *Kerria lacca*, Kusmi and Rangeeni Strains, Lac Cultivation, NTFP-based Livelihoods, Seed Lac Processing.

Introduction
The term *"lac"* originates from the Sanskrit word *"laksha,"* meaning "one hundred thousand," which refers to the large number of insect larvae that densely cover the branches of host plants during the brood development phase (Sharma *et al.*, 2020) [25]. In trade and industry, lac is a general term used for all types of natural resin secreted by tiny lac insects on specific host trees, predominantly found in India, Thailand, China, and Indonesia (Porte and Singh, 2022) [20]. In India, *Kerria lacca* (Kerr.) is the main species responsible for secreting natural resin. These insects flourish on the tender twigs of selected host plants such as Palash (*Butea monosperma*), Ber (*Ziziphus mauritiana*), Kusum (*Schleichera oleosa*), *Flemingia semialata*, *Ficus* spp., and others (Sharma *et al.*, 2010) [26].
The life cycle of the lac insect consists of three stages—egg, nymph, and adult—and it takes about six months for the eggs to develop into adults. In India, two major strains of lac—Rangeeni and Kusmi—are commonly cultivated, distinguished by their preferred host plants, life cycle duration, and quality of the resin they produce (Kapur, 1962; Shah *et al.*, 2015) [11, 23]. Kusmi lac is regarded as the highest-quality commercial lac, fetching premium prices both in domestic and international markets (Lalita, 2020) [17]. Processing of raw lac yields three important products: resin, dye, and wax. Lac resin has diverse industrial applications,

including its use in varnishes, paints, inks, adhesives, food industries, cosmetics, leather finishing, electrical components, and pharmaceuticals (Maibangsa *et al.*, 2023; Anjana *et al.*, 2023) [18]. Lac wax is widely used in shoe polish, bottle sealing, tailor's chalk, crayons, lipsticks, and edible fruit coatings (Sharma and Ramani, 2014; Sharma *et al.*, 2022) [24]. Owing to their natural and eco-friendly properties, these products have significant global demand. Agroforestry is a comprehensive term encompassing land-use systems where woody perennials like trees, shrubs, and bamboos are cultivated alongside herbaceous plants such as crops, pasture, and/or livestock.

India produced about 18,944 tonnes of lac during 2019-20, and exported 7,293.47 tonnes in various forms, earning foreign exchange worth ₹405.51 crores (Yogi *et al.*, 2021). Nearly 3-4 million tribal and forest-dependent people earn supplementary income from lac cultivation, making it an important livelihood activity for economically vulnerable communities (Kumar and Reddy, 2024; Ranjan *et al.*, 2018) [16, 21]. Besides supporting rural livelihoods, lac cultivation also contributes to the conservation of host trees, lac insects, and associated biodiversity. The establishment of plantations, recognizing the current need for sustainable alternatives for depleting natural forests, has gained significance for industrial and domestic wood production on both large and small scales (Bargah *et al.*, 2025) [4].

India is the world's largest supplier of non-wood forest product (NWFP)-based raw materials used in the food, cosmetic, pharmaceutical, paint, and varnish industries. The country possesses around 621.4 million potential lac host trees, yet only about 5% of this resource is currently exploited for lac production. Utilizing this vast potential through recommended technologies can reduce migration, generate local employment, and improve the socio-economic conditions of tribal farmers (Gupta *et al.*, 2018) [5]. Madhya Pradesh, India's second-largest state, has about 28.3% forest cover. Lac is one of the most commercially valuable forest products in the state, offering substantial income opportunities to people living in forest and semi-forest regions (Claude & Ou Bingrong, 1994; Jaiswal *et al.*, 2006; Singh *et al.*, 2018) [10, 27]. *Schleichera oleosa*, *Ziziphus mauritiana*, and *Butea monosperma* are the major lac host species (Kumar *et al.*, 2017) [13]. *S. oleosa* is most suitable for Kusmi lac, while *B. monosperma* supports high-quality Rangeeni lac production. *Z. mauritiana* is suitable for both strains, but only during specific seasons. These host plants are exploited for producing valuable industrial products such as resin, dye, and wax (Mohansundaram *et al.*, 2022).

Each lac strain produces two crops annually. For Rangeeni lac, the summer crop begins in October-November and matures by June-July, while the short rainy-season crop starts in June-July and matures by October-November; the commercial "ari" crop is harvested in May-June. For Kusmi lac, the summer crop starts in January-February and matures by June-July, while the winter crop begins in June-July and matures by January-February. Numerous studies in recent decades have examined lac production trends. Productivity estimations have also been conducted using correlation and regression analyses (Jaiswal & Saha, 1993) [22]. More recently, crop- and district-wise growth analyses of lac production were carried out for Jharkhand, West Bengal, Odisha, and Chhattisgarh during the XI and XII five-year plan periods. These evaluations are crucial for identifying high-performing districts and formulating strategies to enhance livelihood opportunities through increased lac production.

Almost all the scale insects are harmful as they suck the sap from the plants. Few of them are also beneficial and Lac-insect is one among them. Lac is a resinous protective secretion from of the lac insect. This secretion has great commercial value. So, lac insects are cultivated and lac is collected from the host plants. Hence, Lac culture is the commercial production of lac which includes regular pruning of the host plants, propagation of lac insects and the processing of the lac.

Lac is the gift of nature to mankind and is the only known commercial resin of animal origin. It is the hardened resin secreted by tiny lac insects belonging to a bug family. To produce 1 kg of Lac resin, around 300,000 insects lose their life. The lac insects yields resin, lac dye and lac wax.

Application of these products has been updating with time. Lac still finds extensive use in Ayurveda and Siddha systems of medicine. Lac has the unique properties of being eco-friendly, biodegradable and self-sustainable. Moreover it is a natural material and thus currently it has assumed special importance. Since lac insects are cultured on host trees which are growing primarily in wasteland areas, promotion of lac and its culture can help in eco-system development with reasonably high economic returns. It also acts as a source of livelihood for tribal and poor sub-forest areas.

History of lac

The use of lac in India dates back to the Vedic era, with its earliest mention appearing in the Atharva Veda. The term "lac" is believed to have originated from the Sanskrit word "laksha," meaning one hundred thousand, referring to the huge number of insects that cluster on the tender shoots of their host plants. The famous Indian epic Mahabharata also describes the "Laksha Griha," a highly inflammable palace made of lac, built by the Kauravas in an attempt to kill the Pandavas. Historical records suggest that ancient Greek and Roman civilizations were also aware of lac and its uses.

Other given names

The lac insect was first studied in 1709 by Father Tuchard. In 1782, Kerr named the species *Coccus lacca*. Later, Chatterjee referred to the lac insect as *Tachardia lacca* or *Kerria lacca*. Eventually, the name *Laccifera lacca* came into use.

Among the six known genera of lac insects, five are capable of secreting lac, but only one—Laccifer—produces lac in quantities sufficient for commercial recovery. The most common and widely distributed species in India is *Laccifer lacca* (Kerr), which contributes the majority of the commercial lac produced in the country.

Distribution in india and abroad

Until around 1950, India enjoyed a near-monopoly in the global lac market, producing nearly 85% of the world's sticklac. After 1950, Thailand emerged as a major competitor. Other countries that produce lac include regions in Africa, Australia, Brazil, Myanmar, Sri Lanka, China, France, Japan, and West Germany.

In India, the principal lac-producing regions include Assam, Bengal, Bihar, Delhi, Gujarat, Hyderabad, Kashmir, Madhya Pradesh, Chennai, Coimbatore, Mysore, Rajasthan,

and Uttar Pradesh. More than 90% of India's lac production comes from Bihar, Jharkhand, West Bengal, Madhya Pradesh, Chhattisgarh, eastern Maharashtra, and northern Odisha. Additionally, smaller pockets of lac cultivation can be found in Andhra Pradesh, Punjab, Rajasthan, Mysore, Gujarat, and in the Mirzapur and Sonebhadra districts of Uttar Pradesh.

Lac Culture in India

Lac resin is a natural, biodegradable, and non-toxic substance, making it suitable for use in food, textile, pharmaceutical and other industries. With the growing global preference for eco-friendly and safe materials for human use and consumption, the demand for lac has increased significantly. Lac cultivation also serves as an important source of income for tribal and economically weaker communities living in forest and sub-forest regions of India.

Until about 1950, India enjoyed an almost complete monopoly in global lac production, contributing nearly 85% of the world's sticklac. At present, India's share has declined to around 50-60%. After 1950, Thailand emerged as India's major competitor, and several other countries—including those in Africa, Australia, Brazil, Myanmar, Sri Lanka, China, France, Japan, and West Germany—also produce lac.

Despite this decline, India continues to have vast potential for lac culture. The regions suitable for lac cultivation can be divided into three categories:

1. **Regular lac cultivation zones:** Only 20-25% of available host trees are utilized.
2. **Moderate lac cultivation zones:** About 10-15% of host trees are used.
3. **Unutilized zones:** Host trees are present but remain unused due to lack of awareness and technical knowledge.

Overall, only about 15% of the lac host trees owned by farmers are currently tapped for production. A large number of ecologically suitable host trees remain unexplored. Scientific and systematic exploitation of these resources could substantially increase the country's lac production.

India produces approximately 20,000 metric tonnes of raw lac annually, and lac culture plays a significant role in earning foreign exchange. The leading lac-producing states are Jharkhand (57%), Chhattisgarh (23%), and West Bengal (12%). Other contributors include Odisha, Maharashtra, Assam, Andhra Pradesh, and Uttar Pradesh. States such as Odisha, Madhya Pradesh, Punjab, and Rajasthan have also shown rising lac production. Nearly three million tribal people in these regions depend on lac cultivation for livelihood. The Indian Lac Research Institute, now known as the Indian Institute of Natural Resins and Gums (IINRG), was established in 1925 at Namkum, Ranchi. The institute specializes in the production of high-quality white lac, which is preferred over red or colored lac because the latter may leave stains on surfaces. India earns nearly ₹120-130 crores in foreign exchange annually through lac exports. About 85-95% of the lac produced in the country is exported, mainly to the United Kingdom, the United States, Russia, and West Germany. Major export forms include shellac, button lac, seed lac, dewaxed lac, bleached lac, and aleuritic acid.

To meet domestic and international demands, it is essential to focus not only on increasing production but also on improving quality. Factors such as premature harvesting, improper storage, lack of immediate primary processing, and inadequate processing infrastructure often degrade lac quality. These issues require urgent attention and can be effectively addressed by following the scientific guidelines and technologies developed by the Indian Institute of Natural Resins and Gums.

Origin, distribution and taxonomy of lac insects

Taxonomy

- **Lac insect:** *Laccifera lacca*
- **Order:** *Hemiptera*
- **Sub order:** Homoptera
- **Super family:** Coccoidae
- **Family:** *Kerridae*
- **Genus:** *Laccifera*
- **Species:** *lacca*

Distribution

India is the predominant producer of lac, contributing over 50% of global production (Kumari *et al.*, 2024). All the primary lac host plants are found in natural woods, along roadsides, adjacent to agricultural land, and near to villages within the Chotanagpur plateau, that includes Jharkhand and its neighbouring states. The production primarily occurs in tribal, subforest, forest, and rainfed regions of Jharkhand, West Bengal, Chhattisgarh, Madhya Pradesh, Orissa, Maharashtra, as well as parts of Uttar Pradesh, Andhra Pradesh, Gujarat, and the northeastern region (Singh *et al.*, 2018) [27]. 54.60% of total production in the country comes from the state Jharkhand alone, which rightfully makes it the 'Lac state of India' (Government of Jharkhand, 2024; Kumar, 2018) [16]. This is followed by Chhattisgarh (17%), Madhya Pradesh (12%), Maharashtra (8%), and Odisha (3%), respectively. Ranchi, Palamau, Garhwa, Gumla, Simdega, Lohardaga, East and West Singhbhum are the main lac producing districts in Jharkhand (Kerketta, 2023) [12]. However, majority of these resources remain underutilised due to insufficient awareness, with just 5% of *S. oleosa* and *Z. mauritiana* and 1% of *B. monosperma* plants being employed for the production of lac.

Life cycle and biology of kerria spp. (lac insect)

Morphology

The lac insect is hemimetabolous, meaning it undergoes *gradual* metamorphosis. It has three life stages: egg, nymph (young one), and adult. Nymphs resemble adults in structure except for their smaller size and undeveloped reproductive organs. Adult males and females differ significantly; the female is almost three times larger than the male.

Male

Male lac insects are pinkish-red and may be winged or wingless. The winged type has one pair of thin, transparent forewings. They mostly appear during the dry season (Baisakhi and Jethwai) and survive only 3-4 days, dying soon after mating. Their main features include:

1. A large head with prominent but non-functional mouthparts.
2. Two pairs of ocelli and a seven-segmented, hairy antenna.
3. Three-segmented tarsi.

4. An eight-segmented abdomen, broad in front and narrow at the end.
5. The last abdominal segment carries a pointed penis.

Female

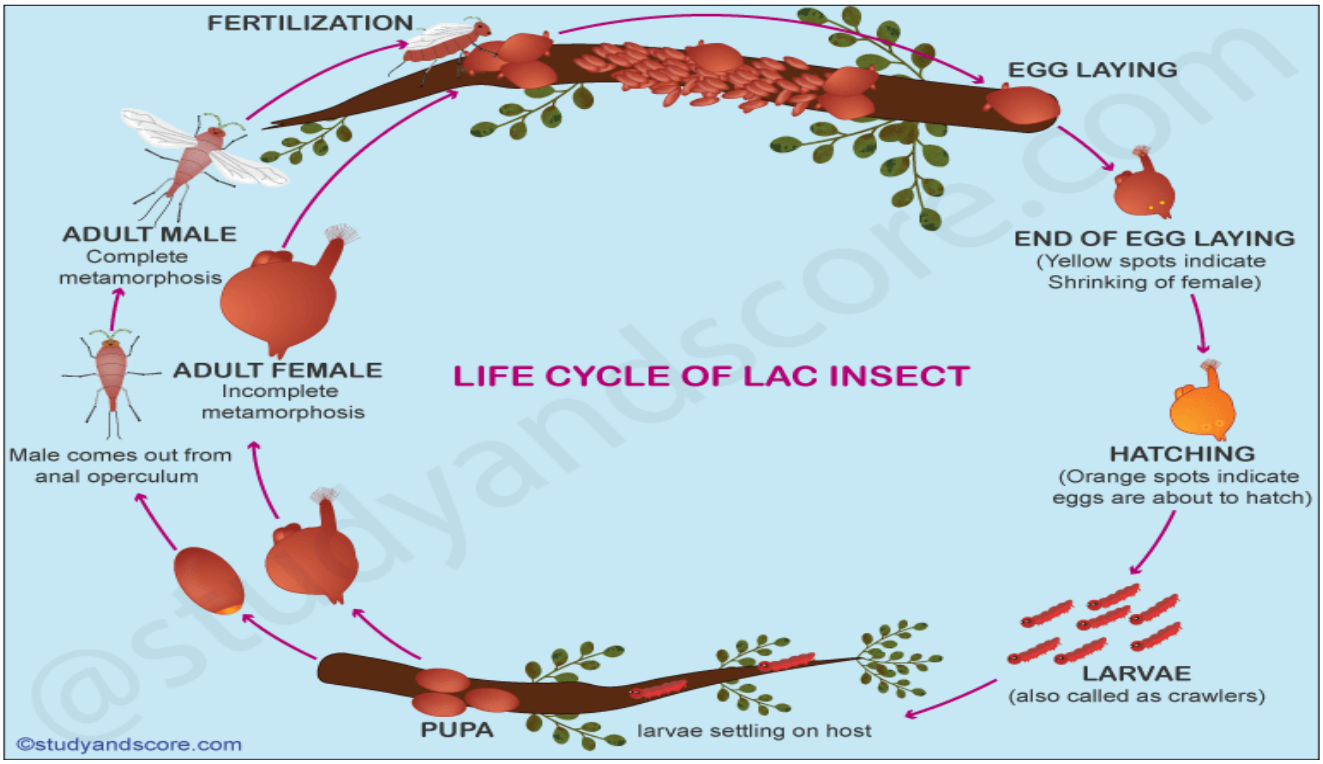
Female lac insects are pink with a flat ventral side and a convex dorsal side. Their distinctive features include:

1. Highly reduced eyes, wings, and legs.
2. Small, vestigial antennae with 3-4 segments.
3. Piercing-sucking mouthparts; the rostrum has two segments.
4. A mesothoracic appendage bearing spiracles.
5. A rounded abdomen with a dorsal spine.

Biology

Lac insects live inside small cavities formed by the resin (lac) they secrete on their host plants. A female lays 200-500 eggs, all of which contain fully developed embryos, meaning the insect is ovoviviparous. They lay three types of eggs:

1. mostly producing males,
2. mostly producing females,
3. producing males and females in equal numbers.



Source: https://www.studyandscore.com/studymaterial-detail/lac-culture-introduction-history-distribution-lac-culture-in-India-and-life-cycle-of-lac-insect

Fig 1: Life cycle of LAC Insect

Life cycle of lac insect

The life cycle of lac insect mainly depends on the ecological factors of the region like the temperature, humidity and the host plant species. It includes four stages namely, Egg, Nymph instars, Pupa and adult. The egg reached the adult stage within six months. The following are the stages involved in the reproduction of lac insects,

Fertilization

Lac insects are ovoviviparous types. The females get attached to the host plant inside the resinous mass. The male insect comes out of its resinous mass by pushing the operculum of the anal opening and then walks over the resinous covering of the female. This walking fertilizes the female within. One male lac insect is capable of fertilizing many females.

Egg-laying

After the fertilization, the female grows rapidly until it begins to lay eggs. By the time female starts to lay the eggs, its body contracts on the ventral side and gradually vacating the place for the eggs to be accommodated inside the resin cell. After laying the eggs the female secrets the lac resin at a faster rate. After about 14 weeks, female completes shrinks in size allowing the light to pass into the cell and onto the eggs.

At this stage, two yellow spots appear at the rear end of the resin cell. These spots gradually enlarge and turn orange in color. This indicates the completion of egg-laying by the female lac insect. After laying the eggs the female lac insect dies. Now the resin cell with eggs is called as ovisac. The ovisac appears orange in color due to the crimson fluid called the lac dye. This indicates that eggs are about to hatch in a week.

Egg hatching

After six weeks, the eggs are hatched into first instar larvae called crawlers. These larvae emerge our in very huge numbers and this emergence is termed as swarming. The first instar larva is broad, red-coloured and boat-shaped. It has paired antennae, ocelli and sucking type of mouth parts with proboscis. These larvae prefer succulent shoots as their host. The settled larvae suck the sap from the host and start to secrete resinous substance all over their body.

Pupa

As the resinous secretions come in contact with the air, it becomes hard and forms a coating over the body of the larva and now this covering is called cell. Within the cell various life processes like the growth of larva and morphological changes takes place.

Inside the cell, the larvae undergo three moults. After the first moult, both the female and male nymphs lose their appendages, eye and become degenerate. The female once inside the cell will never move on the other hand the male comes out through the operculum of the anal opening.

Adult

After about 6-8 weeks the stationary life of larva metamorphoses into adults having cast-off the second and the third moults. Only the male undergoes complete metamorphosis, it loses its proboscis, develops antennae, legs and a pair of wings. The females undergo incomplete metamorphosis. They retain her mouth parts but fail to develop any wings, eyes or appendages. Female becomes an immobile organism with little resemblance to an insect. They become little more than egg producing organisms.

The sex can be determined even during the early stages of development. As in case of males the growth is more on the longitudinal axis and in females the growth is more in vertical axis. The life span of the female is longer than that of the males. Most of the lac is secreted by the females. The life cycle occurs twice in one year on the same plant.

The eggs hatch within a few hours, releasing tiny crimson-red first-instar nymphs, called crawlers. These nymphs have two compound eyes, three pairs of legs, a pair of antennae, and six anal setae. Their mass emergence is known as swarming, which may continue for five weeks or more.

The crawlers move over branches until they find suitable twigs—neither too soft nor too hard—and settle in dense clusters of 200-300 insects per inch. They insert their needle-like proboscis into the bark to feed on sap. Within a day of settling, the nymphs start secreting semi-solid resin from glands beneath their cuticle (except near the mouth, breathing pores, and anus).

This resin hardens on exposure to air, forming the protective lac covering.

Inside their cells, nymphs undergo three moults, the duration of each depending on temperature, humidity, and host plant. After the first moult, both male and female

nymphs lose their legs, antennae, and eyes, which become reduced; however, the anal setae increase to ten. The male cell becomes slipper-shaped with a rear operculum, whereas the female cell becomes globular.

During the second moulting stage, male nymphs pass through prepupal and pupal phases and regenerate their appendages, while females remain degenerate but continue feeding, growing, and secreting resin. After the third moult, adult males emerge—winged or wingless. They reach maturity much faster than females and cannot feed because their mouthparts are atrophied. They mate with as many females as possible and die shortly afterward.

Females remain inside their cells, grow rapidly, and deposit most of the lac. As they mature, they become globular and fill the entire cell. Before laying eggs, they shrink to create space for the ovisac, where eggs are deposited. Two yellow spots appear at the cell's rear end, turning orange when the ovisac is full and the eggs are close to hatching (within a week). At this stage, the brood lac sticks are cut and used for inoculating new host trees.

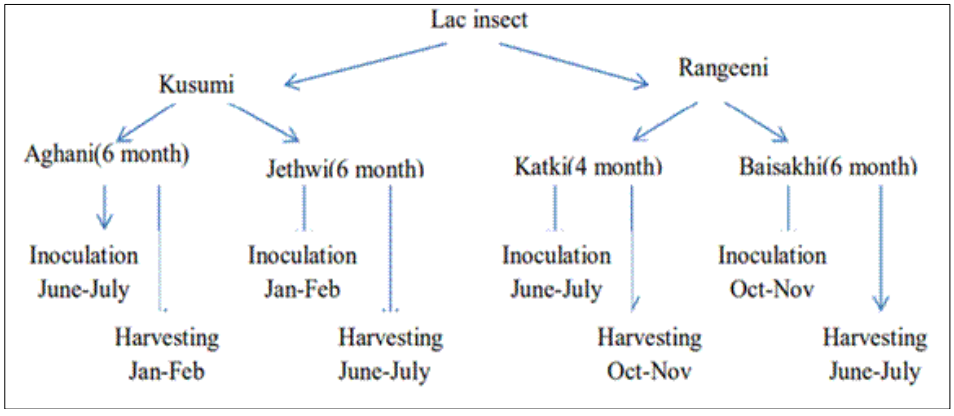
Host tree and strain

Host of major importance

1. **Palas:** Butea monosperma
2. **Ber:** Zizyphus mauritiana
3. **Kusum:** Shorea oleosa
4. **Kher:** Acacia catechu

Other host tree includes *Cajanus cajan* (Arhar), *Acacia auriculiformis* (Akashmani), *Zizyphusxylopyra* (Ghont), *Ficus* sp., *Grewea* sp., *Acacia Arabica* (Babul).

Strain of lac insect



The host tree can be divided into three categories based on the type of strain

- **Tree on which only kusumi strains can be developed:** *Shorea oleosa* (kusum)
- **Tree on which only rangeeni strains can be developed:** *Butea monosperma* (palas)
- **Tree on which both kusmi and rangeeni strain can be developed:** *Zizyphus mauritiana* (ber), *Acacia auriculiformis* (akashmani), *Acacia catechu* (khair), *Ficus* sp.
- Albizia lucida (Galwang) and Flemingia semialata are introduced species of plant on which lac cultivation can be taken up on plantation basis.

Lac Development: In Chhattisgarh Kusum, Palash & Ber trees are in abundance as a host plant, thus the cultivation of Lac is an important source of income of rural people. At present under Lac Development scheme 83 Lac cultivation

project are being run in the District Unions, treating 66,934 Kusum trees, 4,73,768 Palash trees & 5,442 Ber trees by 22,238 beneficiaries. A Lac training & Extension Centre has also been established in Kanker and till date 231 Master trainers / Lac cultivator farmers has been trained in the above centre. Chhattisgarh being one of the leading lac producing state in the country, annual production of lac is approx 4000 MT. Major lac producing districts in the state are Jagdalpur, Kanker, Mahasamund, Gariaband, Korea, Sarguja and Kabeerdham.

Table 1: lac cultivation calender timeline of crop cycle

Lac Cultivation - Calender				
Types of Lac Crop	**Host Tree**	**Pruning**	**Brood lac Inoculation**	**Crop Harvesting (After 6 months of Brood lac Inoculation)**
Kusumi Lac	Kusum	Jan-Feb. June-July	After 18 months of pruning Approx. 5 to 7 kg per tree	June -July Jan-Feb
Rangini Lac	Palash & Ber	April-Ma Oct-Nov.	After 6 months of pruning Approx. 0.50 to 1 kg per tree	Oct-Nov. April-May

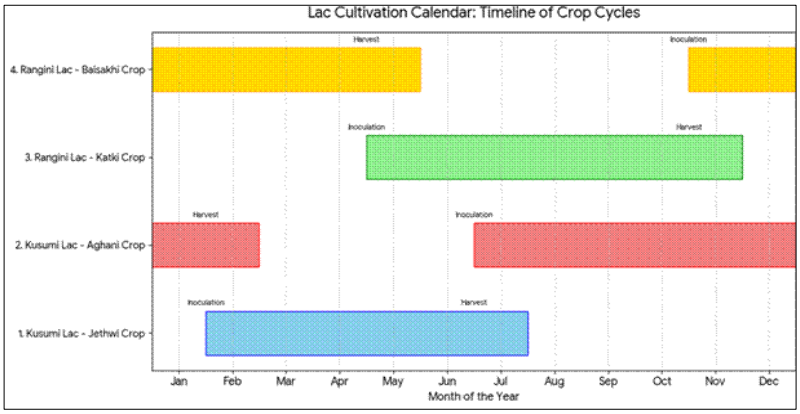


Fig 2: lac cultivation calender timeline of crop cycle

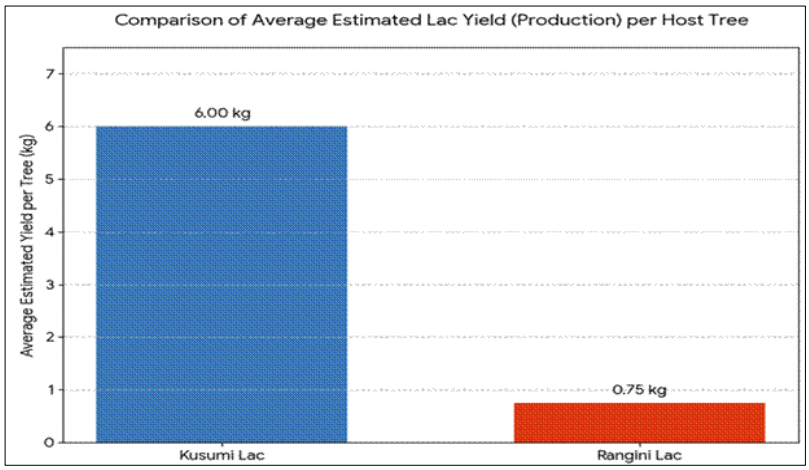


Fig 3: Comparision of average estimated lac yield production per host tree

The chart clearly shows that Kusumi Lac has the highest production per host tree.

- **Kusumi Lac (Kusum):** Average Estimated Yield is 6.00 kg per tree.
- **Rangini Lac (Palash & Ber):** Average Estimated Yield is 0.75 kg per tree.

Table 2: Average Annual Income per Host Tree from Lac Cultivation

Palash	**= Rs. 900/- to Rs. 1000/-**
Ber	= Rs. 1200/- to Rs. 1500/-
Kusum	= Rs. 8000/- to Rs. 10000/-

Source: Bargah *et al.*, (2024) [4], https://www.cgmfpfed.org/new/lac_cultivation.php

Swarn-Jayanti Gram Swarojgar Yojana (SGSY)

Under SGSY scheme for the beneficiaries living below poverty line 26 Lac cultivation & processing microenterprises have been established in various District unions / divisions. In above projects financial partnership of Central & State Government is in ratio of 75:25. In these projects Lac cultivation activities are being executed by treating 45,000 Kusum trees and 2,00,000 Palash trees by 13,214 beneficiaries. As a result of the implementation of the project 3810.26 quintal Brood Lac & 4597.93 quintal

Scrap Lac has been produced till December 2014 and approximate market value of the above produce is about Rs 27.13 Crore.

To promote and facilitate lac cultivation in the state Lac Facilitation Centres has also been established in forest circle headquarters at Jagdalpur (07782-222006), Kanker (07868-222014), Raipur (0771-2523769), Durg (0788-2210814), Bilaspur (07752-227624) & Sarguja (07774-240544). For more information people can also contact to respective Divisional forest offices. In season 2020 Kusumi and Rangini Lac is being procured at the rate of Rs. 300/- per kg & Rs 220/- per kg respectively in various collection centers of the District unions / Divisions under the Minimum Support Price Scheme of Government of India.

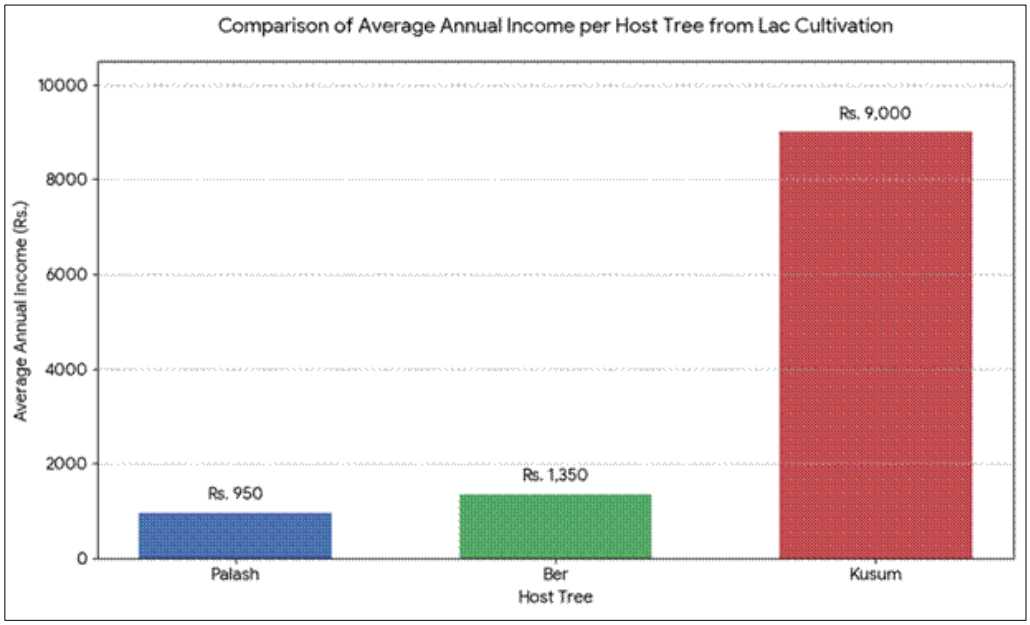


Fig 4: Comparision of average annual income per host tree from lac cultivation

Lac processing units

Along with lac cultivation villagers also do primary processing of the Stick lac/ Scraplac obtained from Kusum, Palash, Ber trees in the established processing centers of the States. This processed lac is durable. Stick Lac/Scrap lac cannot be stored for a long time so by lac processing scrap lac is processed as Dana Lac because it can be stored / kept by villagers for 3-4 years for a long time until their is an appropriate market value. One established Lac Processing unit has a capacity to process 100 kg of Scrap Lac in one day. At least four labours are required for Lac Processing work. Activities like crushing, grading and winnowing work is done due to which in each processing unit processing of 70 kg. of raw lac can be processed in 8 hours, during this activity first of all lac is crushed in the lac crushing machine approximately 8 to 10 hole in a inch. After crushing this lac is placed in washing machine in which 4.25 kg. of caustic soda mixed with per kilogram lac & washed with water. After washing one inch thick layer of lac is spread on solid floor for drying, the place should be shaded and full of air with less sunlight. Drying of lac can be done approximately in a day. When the lac is completely dried than this lac is placed in Osai machine in which the unwanted material is removed and then it is placed in lac grader in which three types of filters 8 mash, 10 mash and 12 mash is present through which lac grading can be done. After grading Seed Lac is received as final product. By this method 600 - 700 gm of seed lac can be received from one kilogram of scrap lac. Villager also gets employment by such kind of processing work.

Lac cultivation

Chhattisgarh State is very rich in biodiversity point of view. Various types of minor Forest Produce are available in abundant amount in the Forest area and its nearby places. Collection, Processing and Value addition activities are important parts of livelihood of villagers. Traditionally lac cultivation is done in the state. In the State lac cultivation work is done in the naturally growing tree i.e. on Kusum, Palash and Ber host trees with less effort and capital. Traditional method of lac cultivation is innovated by scientific method of lac cultivation. From initial stage of Project to year 2017 -18 different lac projects was going in the Federation under various scheme like Lac Development project, European Commission project, TRIFED project and by the 15 % fund recieved from the net profit of Tendu leaves 183 microenterprise was sanctioned in which 55616 beneficiaries are doing lac cultivation through 1254037 host trees of Kusum, Palash & Ber. Previously lac beneficiaries/ Master trainers are trained at Indian Institute of Natural Resins and Gums, Namkum, Ranchi by lac specialist for scientific cultivation of lac. By special effort of Chhattisgarh State Minor Forest Produce Federation has established State level Lac Training & Extension centre at Makri, Kanker. After above establishment year 2013 to till now 302 number of Master Trainers / lac cultivators are trained and beneficiaries are also trained at field level under sanctioned projects for their skill development.

Lac is used for making medicine, conservation of food products, electric nonconductor, varnish / polish, decorative and cosmetic products. Lac and its product is eco-friendly this is the reason it production is being promoted.

Future Suggestions

1 **Increase Use of Host Trees:** Utilize the vast unused lac host tree resources through plantation and community based agroforestry.

2 **Improve Productivity:** Standardize scientific pruning, adopt better brood management, and promote training for farmers.
3 **Develop Improved Lac Strains:** Focus on breeding high**:**yield, pest**:**resistant strains using modern genetic tools.
4 **Strengthen Pest Management:** Promote eco-friendly IPM methods, biopesticides, and biological control of major lac predators.
5 **Climate:Resilient Practices:** Study climate impacts and develop adaptive lac cultivation calendars and predictive models.
6 **Value Addition:** Encourage development of new lac**:**based products: natural coatings, cosmetics, edible films, and biodegradable materials.
7 **Enhance Tribal Livelihoods:** Organize SHGs/FPOs, establish training centres, and provide mobile processing units.
8 **Market Development:** Create lac market information systems, improve export standards, and strengthen supply chains.
9 **Sustainable Agroforestry:** Promote lac cultivation with fruit trees, medicinal plants, and beekeeping for ecological and economic benefits.
10 **Technology Adoption:** Use mobile apps, drones, and IoT tools for monitoring host trees and improving brood success.

Abbreviations

1. **CG:** Chhattisgarh
2. **NWFP / NTFP:** Non-Wood Forest Product / Non-Timber Forest Product
3. **IPM:** Integrated Pest Management
4. **SHG:** Self-Help Group
5. **FPO:** Farmer Producer Organization
6. **ICAR:** Indian Council of Agricultural Research
7. **IINRG:** Indian Institute of Natural Resins and Gums
8. **FAO:** Food and Agriculture Organization
9. **NABARD:** National Bank for Agriculture and Rural Development
10. **MP:** Madhya Pradesh
11. **GIS:** Geographic Information System
12. **kg:** Kilogram
13. **MT:** Metric Tonne
14. **Rs.:** Indian Rupees
15. **QPM:** Quality Planting Material
16. **R&D:** Research and Development
17. **PPP:** Public**:** Private Partnership

Conclusion

Lac cultivation in Chhattisgarh is a vital forest-based livelihood supporting thousands of rural households and contributing significantly to India's lac production. The state's abundant host trees—Kusum, Palash, and Ber—combined with scientific cultivation practices, training programs, and local processing units, have enhanced productivity and income generation. With India's lac industry still utilizing only a fraction of its potential host trees, there is substantial scope for expansion. Strengthening scientific methods, improving processing efficiency, and promoting sustainable management can further boost lac yields, provide additional rural employment, and enhance the economic and ecological value of forest resources in Chhattisgarh.

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