Lac Production in India: An Overview

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In an agricultural country like India, alongside crop cultivation, insects are also raised. Beekeeping, silkworm rearing, and lac insect cultivation are among these practices. With a minimal requirement for technical knowledge and time, lac insect cultivation can be easily undertaken. Large scale cultivation of lac pests is termed lac cultivation.

The term "lac" is believed to have originated from the Sanskrit word "Laksha," meaning a hundred thousand (Ogle, 2006), indicating the abundance of insects involved in its production. References to the lac insect and its host plant, *Butea monosperma* (Lakshataru), are found in the Atharva Veda. Additionally, the Mahabharata mentions the construction of the highly flammable "lakhshagriha" or "Jadugriha" (Lac house) by the Kauravas, with the intention of physically eliminating the Pandavas by setting the Lac palace on fire (Chattopadhyay, 2011).

Status of raw lac production

India leads the world in lac production, producing over 20,000 tons of raw lac annually (Ogle, 2006). Approximately 80% of the global lac production originates from India, with 75% of it being exported to more than a hundred countries, primarily in processed and semi processed forms. Following India, Thailand is the second largest producer of lac. Additionally, lac is cultivated in Indonesia, parts of China, Myanmar, the Philippines, Vietnam, and Cambodia. In India, lac production is primarily concentrated in the Chhota Nagpur region of Jharkhand state, as well as in Chhattisgarh, Madhya Pradesh, West Bengal, Orissa, Uttar Pradesh, and Maharashtra. Among these lac-producing states, Jharkhand ranks first, followed by Chhattisgarh, Madhya Pradesh, Maharashtra, and Odisha. The combined contribution of these five states to national lac production is approximately 93% (Yogi, 2015).

Biology of lac insect

Lac is a natural resin produced by the female Indian lac insect, *Kerria lacca* (Kerr). Belonging to the Kerriidae family, it comprises nine genera, with reported species ranging from 87 to 100 (Sharma and Ramani, 2011). Two genera are found in India, with the genus *Kerria* being the most significant and widely utilized insect for lac cultivation. The lac insect undergoes four stages in its life cycle: egg, larva, pupa, and adult, completing it within six months on host plants. Adult male lac insects have a brief lifespan of 3-4 days, whereas females live longer. Throughout its life cycle, the insect feeds on the sap juices of tree branches and secretes lac around the branches of host plants, leading to the formation of sticklac, thereby playing a crucial role in lac production (Ogle, 2006).

Types of raw lac

There are two strains of lac, namely the Rangeeni strain and the Kusmi strain. The Rangeeni strain thrives on hosts other than Kusum, while the Kusmi strain is cultivated on Kusum trees (Sharma, 2006; Mohanta, 2012). For the Rangeeni strain, two crops, namely Katki and Baishakhi, are harvested, whereas for the Kusmi strain, the crops harvested are Jethwi and Aghani (Chattopadhyay, 2011).

Scientific method of lac cultivation

Initiating lac cultivation requires consideration of two main factors such as the selection of a suitable host plant on which the lac insect can thrive and the availability of healthy brood lac in a timely manner. Major lac cultivation practices involve six stages:

- Selection of suitable host plants,
- Inoculation of brood lac,
- Removal of brood lac sticks,
- Management of natural enemies of the lac insect,
- Harvesting of lac sticks, and
- Scraping of raw lac from twigs.

Suitable host site selection for lac cultivation

Sites selected for lac host plantation should ideally be open areas with good air circulation and minimal fire susceptibility. Before initiating

cultivation in new areas, it's advisable to prune the selected host trees to ensure optimal lac production. The selected lac hosts should exhibit certain characteristics such as fast growth, lower sap density, and adaptability to pollarding. Currently, worldwide, 113 varieties of host plants and 87 species of lac insect have been described, with India alone hosting two genera and 23 species (Sharma and Ramani, 2011). Commonly used host plants globally include Dhak (*Butea monosperma*), Ber (*Ziziphus mauritiana*), and Kusum (*Schleichera oleosa*) in India; Rain tree (*Albizia saman*) and Pigeon pea (*Cajanus cajan*) in Thailand; Pigeon pea (C. cajan) and *Hibiscus* species in some parts of China; and *Nepalenesis* species in Myanmar.

Pruning of host plants

To ensure the availability of soft and juicy twigs on nutritious trees, light pruning and trimming of trees are necessary at specific times to facilitate the rearing of lac insects. For instance, pruning and trimming of safflower trees are typically done in January-February and June-July, while for Palash trees, it's advisable to prune them before the new coplanes arrive in the fall.

Inoculation of brood lac

Brood lac refers to mature lac from which young insects are ready to emerge within a specified timeframe. To ensure optimal results from lac cultivation, the work should be systematically planned. To transfer the lacquer insect to nutritious trees, bundles of 6 to 9 inches long, containing 3 to 4 stalks (equivalent to a thick ring) of lacquer, are placed at various locations on the lacquer tree. This process involves allowing young lac larvae (crawlers) to emerge from their mother cells and settle on the host plant, typically completing within two to three weeks.

Removal of brood lac sticks

Once the young lac larvae have emerged from the brood lac, the remaining stalks, known as "Phunki," are considered spent. Typically, the emergence of lac larvae from the brood lac stops after three weeks. Removing these spent brood lac sticks is essential to prevent access by predators and parasitoids of the lac insect to new lac crops, avoid wastage of lac after the Phunki dries up, and prevent it from falling to the ground. To minimize losses, bundles are pulled down from the trees either by climbing or using pole-mounted Phunki hooks.

Natural enemies of lac

The lac insect faces attacks primarily from two types of natural enemies: parasites and predators. Parasites are living organisms that nest in other living bodies, relying on their hosts for nutrition, growth, and development. In the case of the lac insect, small winged parasites like *Tachardiaephagus tachardiae* and *Tetrastichus purpureus* are the most common lac-associated parasites. These parasites lay their eggs in lac cells, and the hatched larvae feed on the lac insect within its cells. Predators, on the other hand, directly consume their host, causing more serious damage of up to 30-35% to the cells in a crop. *Eublemma amabilis* and *Pseudohypatopa pulvera* are among the most destructive key pests of the lac insect.

Harvesting of lac

Harvesting of the lac crop involves collecting lac from host trees using two primary methods: Ari lac harvesting and mature harvesting. Ari lac harvesting involves collecting immature lac before swarming, while mature harvesting involves collecting lac after swarming, known as mature Lac. Ari lac harvesting is recommended for Rangeeni lac only, as it yields better production. Different lac crops have varying harvesting periods. For example, the summer (Baisakhi) and rain carpet (Katki) crop of Rangini lac mature after 8 and 4 months of transmission, respectively. Similarly, the summer (Jethvi) and winter (Aghani) crops of Kusmi are ready in June-July and January-February, respectively. Estimated yields per tree in India are approximately 6-10 kg for kusum, 1.5-6 kg for ber, and 1-4 kg for dhak. Lac insect life cycles can produce two stick lac yields per year, although it may be beneficial to allow the host tree to rest for six months to recover.

Scrapping of raw lac from twigs

Scraping involves the removal of incrustation lac resin from lac host sticks. After harvesting matured lac, and sometimes immature lac, scraping is necessary as the primary processing step for long-term storage. This practice is carried out using a scraping

knife or crusher for various applications in the processing area.

Composition and properties of lac

The estimated levels of various constituents of lac are as follows: resin 68 to 90%, dye 2 to 10%, wax 5 to 6%, mineral substances 3 to 7%, albuminous substances 5 to 10%, and water 2 to 3%. Lac is often referred to as a multipurpose resin due to its many desirable properties. These properties include: i) solubility in alcohol, ii) adhesive nature, iii) resistance to water, iv) high scratch hardness, v) capacity to form a uniform and durable film, and vi) ability to be rubbed quickly with sandpaper without gumming or slicking.

Forms of lac

Lac can be obtained in various forms including Stick lac, Seed lac, Shellac, Button lac, Garnet lac, and Bleached lac, each of which is described below along with accompanying photographs.

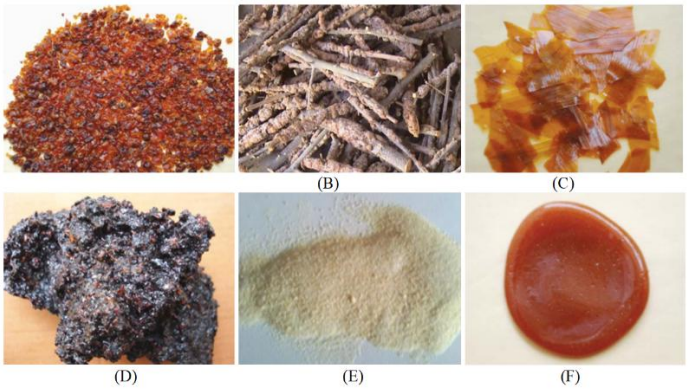

Fig. 1: Types of Lac: (A) Seed lac, (B) Stick lac, (C) Shellac, (D) Garnet lac, (E) Bleached lac, (F) Button lac.

Uses of lac

Lac, with its unique combination of properties, is widely utilized in various industries. It is used in the manufacturing of lac bangles, glazed paper, printing and waterproofing inks, dental plates, and optical frames. Additionally, lac is employed in finishing different commercial products such as playing cards and oilcloth. It is also utilized for preserving archaeological and zoological specimens. In the electrical industry, lac serves as a coating for insulators, spark plugs, and sockets of electrical lamps, providing anti tracking insulation. In the pharmaceutical sector, it is used for coating tablets, micro-encapsulation of vitamins, and coating medicines. Lac finds applications in automobile paint, cosmetic, and leather industries as well.

Previously, approximately half of the total lac output was consumed in the gramophone industry. Lac has long been utilized for decorative and insulating varnishes, typically applied as a first coating on wood to fill the pores. Bleached lac is widely used in the coating of confectioneries and medicinal tablets. Lac dye is extensively used in India for dyeing woof and silk, as well as in skin cosmetics. Lac wax is a key ingredient in the manufacturing of lipstick and shoe polishes.

Conclusion

The purpose of this text is to emphasize the importance of skill and necessity in lac cultivation, aiming to provide a basic understanding of lac culture. The outcomes of this study will not only contribute to comprehending the life stages of the lac insect during cultivation but also offer an opportunity to bolster lac cultivation and productivity in the country by increasing the population of suitable lac host plants in the region. Lac cultivation is essential in today's context for preserving environmental biodiversity.

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