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Lac Insect : (Introduction, History, Species, Habit, Habitat and Biology)

Introduction:

Lac is a natural commercial resin of animal origin. It is the secretion from a scale insect belonging to the genus *laccifer* (Hemiptera: Coccoidea) as a hard-protective covering around its body. It has a reddish or dark brown colour with a disagreeable smell. The word "*lac*" is derived from a Sanskrit word which means "hundred thousand" indicating the gregarious habit of this insect. It is commonly called Shelllac and in Nepali, the laha. The insects are commercially exploited worldwide for the production of lac which has diverse industrial applications. *Laccifera lacca* is the common Indian lac insect. Lac is produced mainly in India, Bangladesh, Thailand, and China. India is still the largest producer of lac in the world. In Nepal also lac is produced.

History:

Lac has been used in India from time immemorial for several purposes, from the epic of Mahabharat it has been recorded that Kauravas built a palace of lac for the destruction of Pandavas. We come across references of lac in the Atharvaveda and Mahabharata, so it can be presumed that ancient Hindus were quite familiar with lac and its uses.

Scientific study of lac started much later. In 1709 Father Tachard discovered the insect that produced lac. First of all Kerr (1782) gave the name Coccus lacca which was also agreed by Ratzeburi (1833) and Carter (1861). Later Green (1922) and Chatterjee (1915) called the ac- insect as Tachardia lacca (kerr). Finally, the name was given as Laccifer lacca.

Distribution in India and abroad:

India held virtual monopoly of lac until 1950 and accounted for about 85% of the world's production of sticklac. After 1950, Thailand became the main competitor of India. Other countries like Africa, Australia, Brazil, Burma, Sri Lanka, China, France, Japan and West Germany also produce lac.

In India major lac producing regions are Assam, Bengal, Bihar, Delhi, Gujarat, Hyderabad, Kashmir, Madhya Pradesh, Chennai, Coimbatore,

Mysore, Rajasthan and Uttar Pradesh. Over 90% of Indian lac produced comes from the states of Bihar, Jharkhand, West Bengal, Madhya Pradesh, Chhattisgarh, Eastern Maharashtra and northern Orissa. Some pockets of lac cultivation also exist in Andhra Pradesh, Punjab, Rajasthan, Mysore, Gujarat, and Mirzapur and Sonebhdra districts of Uttar Pradesh.

Lac culture in India:

Lac resin is natural, biodegradable, nontoxic and hence finds application in food, textiles and pharmaceutical industries. As now-a-days, there is increased stress on the use of eco-friendly, safe material for human contact and consumption lac is high in demand. Lac production is a source of livelihood for tribal and poor people of forest and sub forest regions of India.

India held virtual monopoly of lac until 1950 and accounted for about 85% of the world's production of sticklac. Currently it has come down to 50-60%. After 1950, Thailand became the main competitor of India. Other countries like Africa, Australia, Brazil, Burma, Sri Lanka, China, France, Japan and West Germany also produce lac.

Still India has great potential for lac cultivation. The areas for lac cultivation can be classified into three categories which are as follows:

Regular lac cultivation areas: Only 20-25% of the total available host trees are being used

Moderate lac cultivation areas: Around 10-15% of available host trees are being used

Un-utilized areas: Though host trees are available, they are not utilized due to lack of knowledge and awareness

On the whole only 15% of the total available lac host trees owned by farmers are used for lac cultivation. There are vast untapped trees,, which are ecologically favorable for lac production in our country. If exploited properly in scientific manner these areas would enhance the lac production capacity of India.

The production of raw lac in India is approximately 20,000 metric tonnes per year. Lac culture has been a good source of foreign revenue. The major lac producing states in India are Jharkhand- 57%, Chhattisgarh- 23% and West Bengal- 12%. Other minor producers include Odisha, Maharashtra, Assam, Andhra Pradesh and Uttar Pradesh. Other states like Odisha, Madhya Pradesh, Punjab, Rajasthan etc. have shown increased production of lac. Approximately three million tribals inhabiting in these areas have taken up lac cultivation.

In 1925, Indian Lac Research Institute (currently named as Indian Institute of Natural resins and Gums) is been established at Namkurn, Ranchi. This institute produces good quality of white lac. Indian White lac is supposed to be better than red or other colored lac as the colored lac leaves stains at the places where they are kept.

India fetches about Rs. 120-130 crores of foreign currency through export of lac every year. Out of total lac produced in India 85-95% is exported especially to Britain, USA, Russia and West Germany. Export of Lac from India is mainly in the form of shellac, button lac, seed lac, dewaxed lac, bleached lac and Aleuritic lac.

While enhancing production quantity, quality also needs equal emphasis to meet the national and international demands. The lac suffers quality for the reasons like untimely harvesting, lack of appropriate storage, primary processing soon after harvesting and lack of appropriate processing machinery. These problems need urgent attention and can be addressed by adopting scientific recommendations developed by Indian Institute of Natural resins and Gums.

Systematic position:

Laccifera (=*Tachardia*) lacca is the most important lac producing insect of commercial importance. Its systematic position is given below:

Phylam — Arthropoda

Class — Insecta

Order — Hemiptera

Super-family — Coccoidae

Family — Lacciferidae

Genus — *Laccifer*

Species — *lacca*

Food Plants:

The insects live as a parasite, feeding on the sap of certain trees and shrubs. The important trees on which the lac insects breed and thrive well are –

Kusum (*Schleichera trijuga*)

Palas (*Butea frondosa*)

Ber (*Zizyphus jujuba*)

Babul (*Acacia arabica*)

Khair (*Acacia catcchu*)

Arhar (*Ca]anus indicus*)

Before coming to the actual mechanism of lac secretion and its processing, it is advisable for a lac-culturist to have detailed knowledge of lac insect and its life cycle.

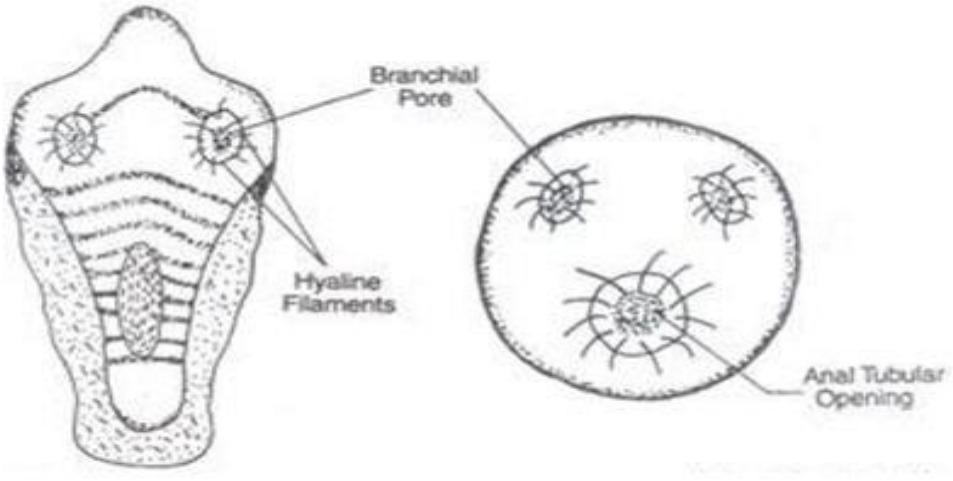
The adult lac insect

Shows a marked phenomenon of sexual dimorphism. The male and female insect varies in shape, size and also in presence or absence of certain body parts.

Morphology:

The lac insects are sluggish and have almost sedentary life. They live inside the chambers in the tree twigs. Therefore they are degenerated, without wings but with distinct legs.

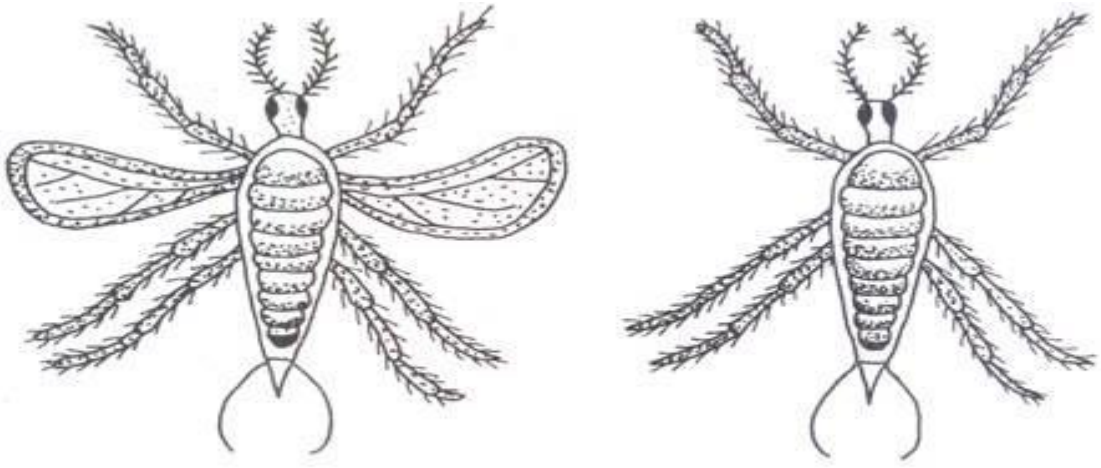
The female lac insect is larger in size and is more degenerated. It measures 4-5 mm in length. It has a bag-like body with indistinct head, thorax and abdomen. A small reduced antenna and a proboscis are present on the head. They lack eyes, legs and wings. The loss of eyes, wings, and legs are due to the fact that the female larvae after once settling down never move again. Abdomen bears a pair of caudal setae. It is the female lac insect which secretes the bulk of lac for commerce.



Fig; Male cell

Fig; Female cell

The male lac insect is smaller in size and red in colour. It measures 1.2-1.5 mm in length. The body is has typical three parts: head, thorax and abdomen. The head bears a pair of antennae and a pair of eyes. Mouth parts are absent so adult male insects do not take food. The thorax has three pairs of legs. Wings may or may not be found. The wing form has only one pair of wing. Abdomen is the largest part of the body bearing a pair of caudal setae and sheath containing penis at the posterior end.



(a) Male with wings (b) Male without wings

Fig. 33. Adult male lac-insect.

Life Cycle of Lac insect (Biology 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:

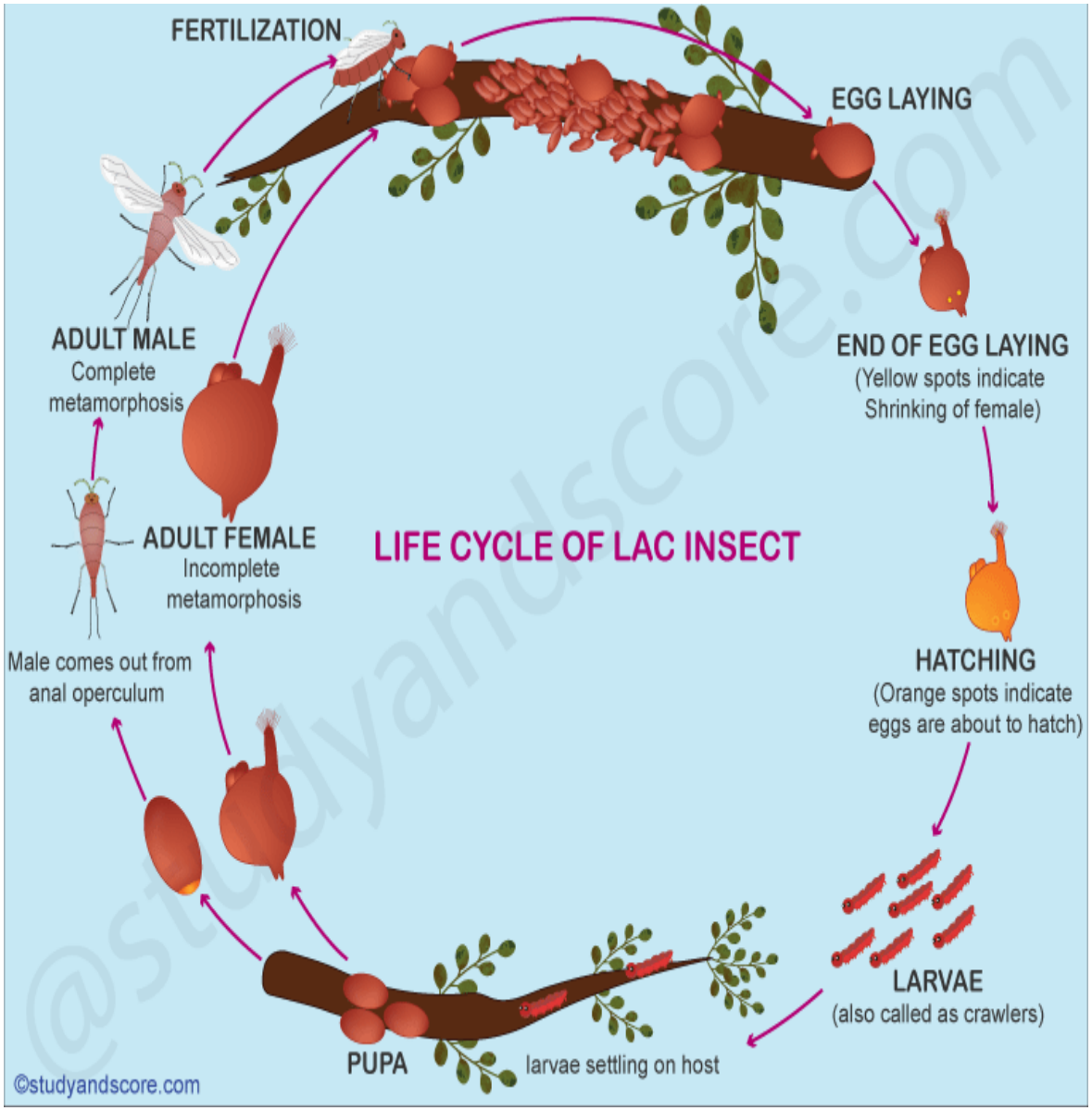
After six weeks, the eggs are hatched into first instar larvae called crawlers. These larvae emerge our in very huge numbers and this emergence is termed as swarming. The first instar larva is broad, red-coloured and boat-shaped. It has paired antennae, ocelli and sucking type of mouth parts with proboscis. 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.



Lac Secretion:

Lac is a resinous substance secreted by certain glands present in the abdomen of the lac insects. The secretion of lac begins immediately after the larval settlement on the new and tender shoots. This secretion appears first as a shining layer which soon gets hardened after coming in contact with air.

This makes a coating around the insect and the twig on which it is residing. As the secretion continues the coating around one insect meet and fuses completely with the coating of another insect. In this way a continuous or semi-contmuous incrustation of lac is formed on the tender shoots.

Fig. 36. Lac incrustation.

Lac Enemies and Their Control:

A lac enemy imposes a challenge to the lac culturist, as they not only decreases the population of lac insects, but also retard the production and quality of lac. Damage caused to lac insects may be grouped under two heads, (a) damage caused by insects (b) damage caused by animals other than insects. Insect enemies of lac crop may be predators and parasites.

The common parasites of lac insect are known as “Chalcid.” They are small, winged insects which lay their eggs inside the lac coat either on the body of the lac insect or inside the body of the lac insect. The larva which hatches from these eggs feed upon the lac insects, thereby causing mortality of their host. Damage done by this parasite constitute about 5-10% of the total destruction of the lac crop.

Damage done by the predators is of greater intensity (35% of the total destruction). The major predators of lac insects are Eublemma amabilis (the white moth) and Holococera pulverea (the blackish grey moth). They not only feed on lac insects but also destroy the lac produced by term. Squirrels, monkey, rat, bat, birds (wood peckers), man etc., are the enemies other than insects which destruct the lac crop in different ways. Damage is also done by climatic factors such as excess heat, excess cold, heavy rain, and storm and partly by the faulty cultivation methods.

Control:

Damage caused by the above mentioned animals can be reduced to certain extent by the use of the following methods.

Cultural Method:

The amount of damage by infection can be reduced to a greater extent by taking care during the culture of lac insects, especially at the time of inoculation. The brood lac showing the minimum enemy attack should be selected for inoculation and should be cut from the host plant very near to the time of emergence of larvae (about one week before the emergence). This will reduce the chances of parasite attack on the emerging larvae at new place (host).

The brood lac used for inoculation should be removed from the new host's branches as soon as the emergence of larvae stops (approx. 3 weeks after inoculation). It reduces the chance of transference of enemies to the new host plant from the brood lac. The infected brood lac not fit for inoculation or the used up brood lac should not be retained for long. The lac should be scrapped at once and t e rest may be crushed or dropped into fire in order to destroy the predators and parasites.

The delay m processing also gives chances to the enemy insects to escape into field. So the manufacturers should try to convert stick lac into seed lac as soon as possible. By these cultural methods the future production can be saved from infection to some extent.

Artificial Method:

During the crop reaping, it is not always possible for the manufacturers to convert the huge amount of stick lac to seed lac at a time. To avoid the spreading of enemies at this time from stocked stick lac simple artificial method can be used. Bundles of stick lac should be tied with stones and immersed in fenced water (river or ponds) for about a week. This kills all the parasitic and predator insects as they cannot survive in water.

Biological Method:

It is an indirect method for killing the parasitic and predator insects. For this purpose hyper-parasitic insects are used which attacks the parasitic insects of lac and kill them. These hyper-parasitic insects are however, not harmful for lac crop.

Use of Lac:

Lac has been used for the welfare of human beings from the great olden days No doubt the development of many synthetic products have made its importance to a little lesser degree, but still it can be included in the list of necessary articles. Lac is used in making toys, bracelets, sealing wax, gramophone records etc.

It is also used in making grinding stones, for filling ornaments, for manufacturing of varnishes and paints, for silvering the back of mirror, for encasing cable wires etc., Waste materials produced during the process of stick lac is used for dying purpose. Nail polish is a good example of the by-product of lac.

Composition of Lac:

Lac is a mixture of several substances, of which resin is the main constituent. The approximate percentage of different constituents of lac is given below:

Resin – 68 to 90%

Dye – 2 to 10%

Wax – 5 to 6%

Mineral matter – 3 to 7%

Albuminous matter – 5 to 10%

Water – 2 to 3%

Present Position of this Industry in India:

Lac is produced in a number of countries including India, Thailand, Mayanmar, China, Indonesia, Vietnam and Laos. India and Thailand are the major producers, producing on the average 1700 tonnes of lac annually, followed by China. India alone, accounts for about 70/o of global lac production.

Former Bihar is the most important lac producing state of India. The Indian council of Agriculture Research has established Indian Lac Research Institute at Namkum in Ranchi district of Jharkhand.

The average of different states in the total quantity of stic lac produced in this country is given below:

Bihar – 55.5%

Madhya Pradesh – 22%

West Bengal – 10%

Maharashtra – 7.1%

Gujrat – 2.7%

Uttar Pradesh – 1.8%

Assam – 0.6%

Orissa – 0.1%

Total annual global production of pure lac is estimated to be 20,000 tonnes. The average total production of stick lac in India is about 24,000 tonnes, while the annual average pure lac produced in the country is 11,890 tonnes. About 6000 tonnes of pure lac produced in India is exported to different countries of the world, with an average earning of Rs. 202.38 million in term of foreign exchange. It has been estimated that 3-4 million people mostly tribals are engaged in the cultivation and several thousands in addition are engaged in the trade and manufacture of lac.

Two main competitors of Indian lac are (i) Thailac, which accounts 50% of the total lac exported, and (ii) Synthetic resion, which have replaced lac in certain field. Shellac being a versatile resion, there is immense scope of increasing its utilisation in various fields and there is also scope to modify it to meet particular need.

Shellac:

Shellac**,** commercial resin marketed in the form of amber flakes, made from the secretions of the lac insect, a tiny scale insect, *Laccifer lacca* (*see* lac). Shellac is a natural thermoplastic; that is, a material that is soft and flows under pressure when heated but becomes rigid at room temperature. This property makes it useful either by itself or in combination with such fillers as flaked mica and asbestos in manufactured molding compositions, used for producing molded articles such as buttons.

shellacBlond shellac.*Ivory*

Shellac is an ingredient in many products, including abrasives, sealing wax, hair sprays, and cake glazes. It was formerly used, along with fine clay or other filler, to mold phonograph records, but, after the early 1930s, synthetic thermoplastics, particularly vinyl resins, gradually replaced it.

Alcohol solutions of shellac, also called simply shellac, are used as varnishes for priming and finishing furniture, floors, and various wood articles and as an intermediate in nitrocellulose lacquers. Alkali emulsions of shellac are used to make self-polishing waxes, stiffeners for felt hats, cements, and sealers.