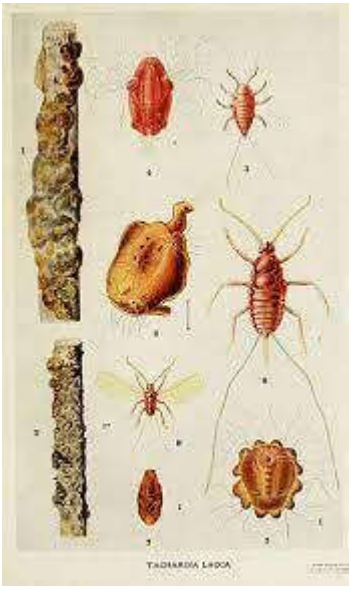
UNIT 4- BSc Semester 6

Lac culture, Enemies of Lac and Uses of Lac.



LAC and SHELLAC

Lac is a resinous substance secreted by a tiny insect called *Laccifer lacca* (popular name “lac insect”) .Shellac is the purified lac usually prepared in the orange or yellow flakes

Lac culture is the scientific management of lac insects to obtain a high amount of quality lac. This involves selection and maintenance of host plants, inoculation of host plants with healthy lac insects, collection and processing of lac and protection against enemies.

Lac is the resinous secretion of lac insects. Two species of lac insects Tachardia lacca and T. chinensis are common, of which the former one is predominant in India. India is the highest lac-producing country. Thailand is next in order.

Phylam — Arthropoda

Class — Insecta

Order — Hemiptera

Super family-Coccidae

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

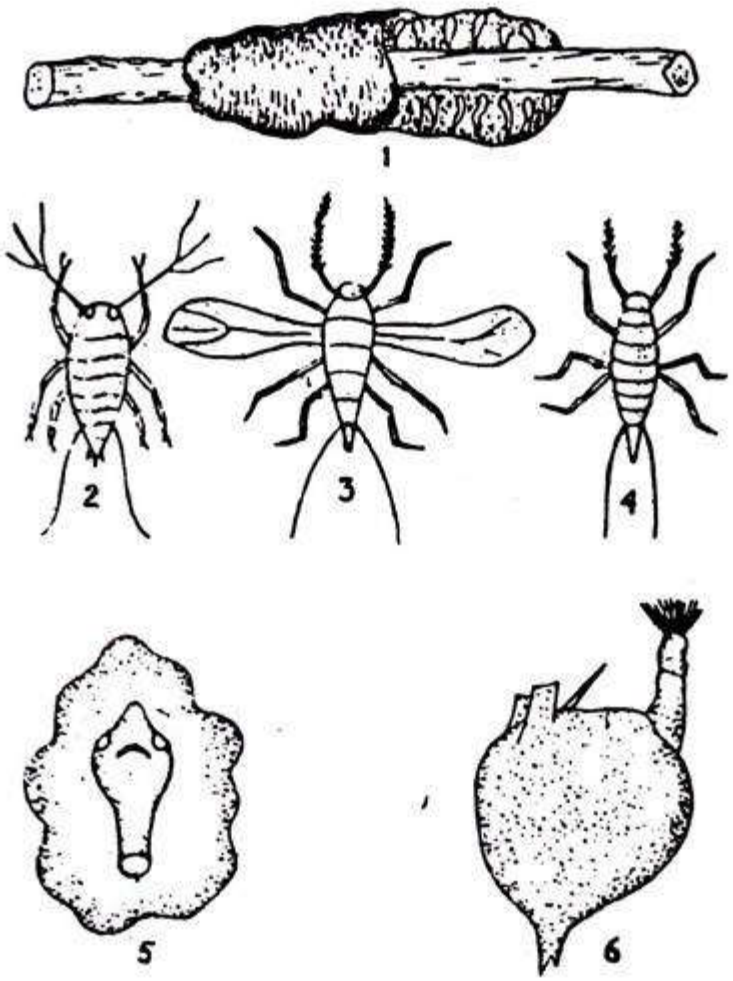


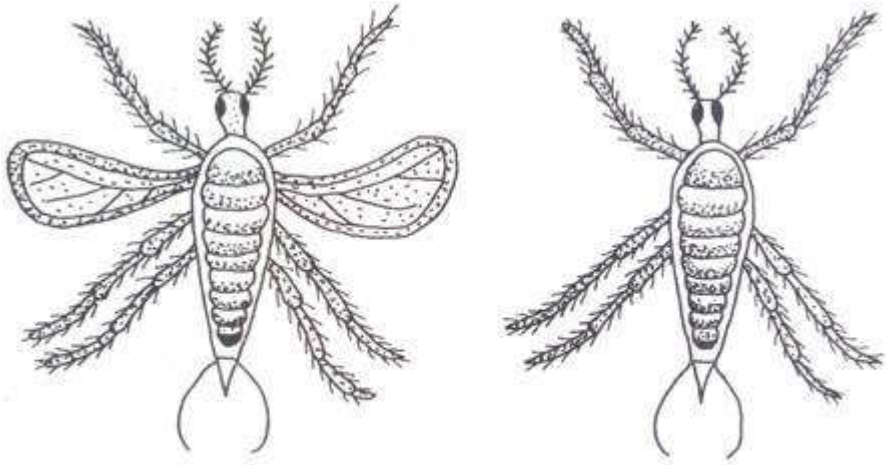
Fig. 47.6. Tachardia sp. Life cycle. 1. Lac incrustation around host plant (a part removed) 2. Nymph, 3. Male (winged), 4. Male (wingless), 5. Female in incrustation, 6. Female (exposed)

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.

Structure of Male Lac-insect:

It is larger in size and red in colour. The body is typically divided into head, thorax and abdomen. The head bears a pair of antennae and a pair of eyes. Mouth parts are absent so a male adult insect is unable to

feed. Thorax bears three pairs of legs. Wings may or may not be found. (Fig. 33 a, b).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

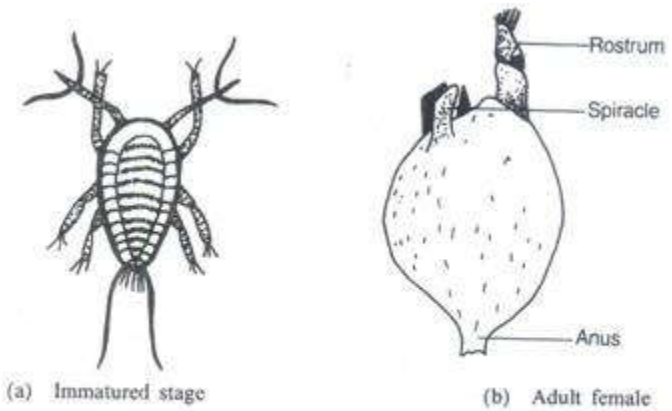
Fig. 33. Adult male lac-insect.

Structure of Female lac-insect:

It is smaller in size. Head bears a pair of antennae and a single proboscis. Eyes are absent. Thorax is devoid of wings and legs. (Fig. 34. b) The loss of eyes, wings, and legs are due to the fact that the female larvae after settling down once never move again and thus these parts become useless and ultimately atrophy. Abdomen bears a pair of caudal setae. It is female lac insect which secretes the bulk of lac for commerce.

Fertilization:

After attaining the maturity, males emerge out from their cells and walk over the lac incrustations. The male enters the female cell through anal tubular opening and inside female cell it fertilizes the female.

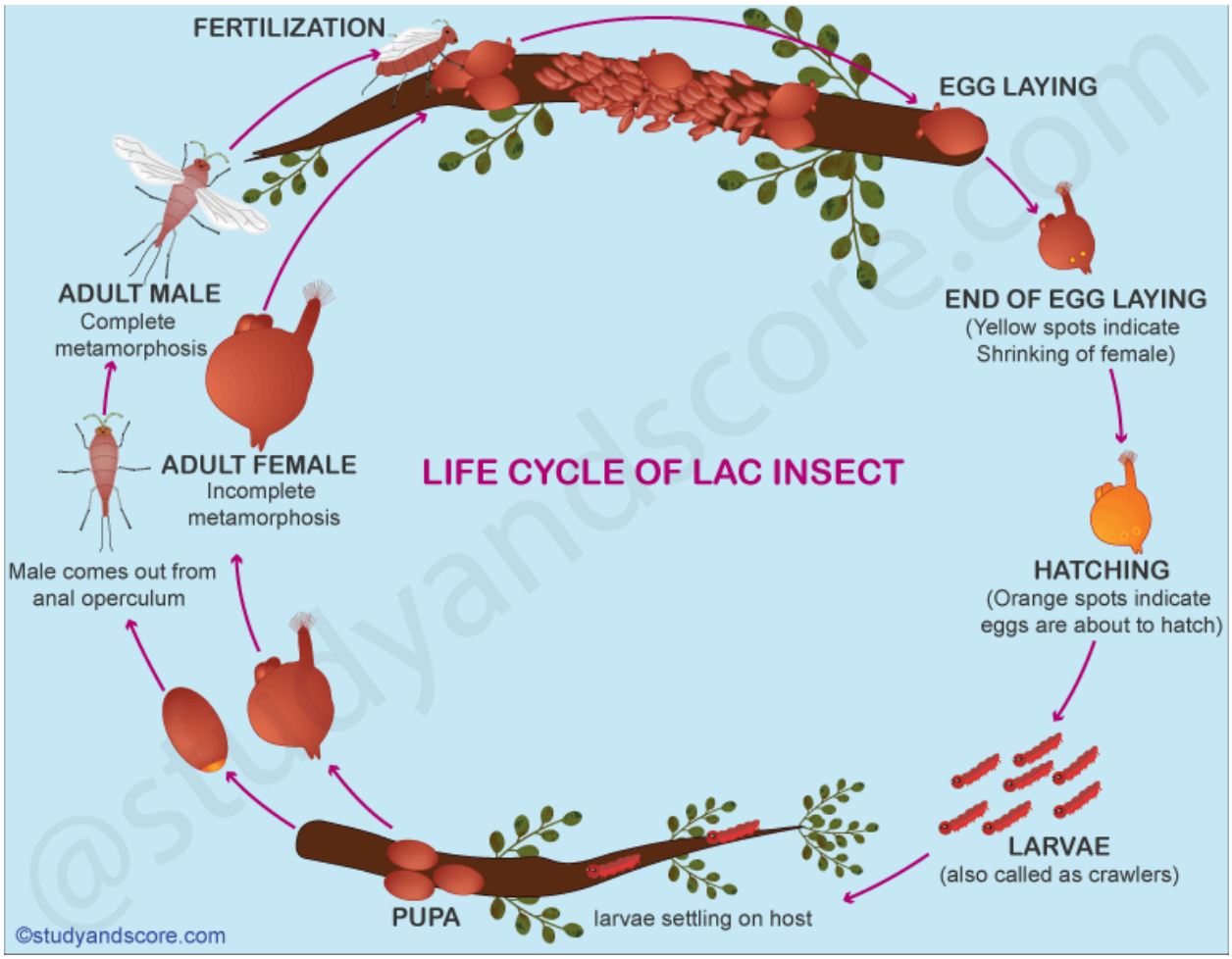


(a) Immatured stage (b) Adult female

Fig. 34. Showing loss of some vegetative parts in an adult female lac-insect.

After copulation, the male dies. One male is capable of fertilizing several females. Females develop very rapidly after fertilization. They take more sap from plants and exude more resin and wax.

Life Cycle:


FERTILIZATION
EGG LAYING
ADULT MALE
Complete metamorphosis
END OF EGG LAYING
(Yellow spots indicate Shrinking of female)
ADULT FEMALE
Incomplete metamorphosis
LIFE CYCLE OF LAC INSECT
HATCHING
(Orange spots indicate eggs are about to hatch)
Male comes out from anal operculum
LARVAE
(also called as crawlers)
PUPA
larvae settling on host
©studyandscore.com

The females after fertilization are capable of producing eggs. But it has been noticed in case of lac insects that the post fertilization developments start when the eggs are still inside the ovary. These developing eggs are oviposited into the incubating chambers (formed inside the female cell by the body contraction of females). A female is capable of producing about one thousand eggs (average 200-500). Inside incubating chamber, the eggs hatch into larvae.

The larvae are minute, boat shaped, red coloured and measure little over half millimeter in length. Larva consists of head, thorax and abdomen. Head bears a pair of antennae, a pair of simple eyes and a single proboscis. All three thoracic segments are provided with a pair of walking legs. Thorax also bears two pairs of spiracles for respiration. Abdomen is provided with a pair of caudal setae.

These larvae begin to wander in search of suitable centre to fix them. This mass movement of larvae from female cell to the new off-shoots of host plant, is termed as “swarming”.

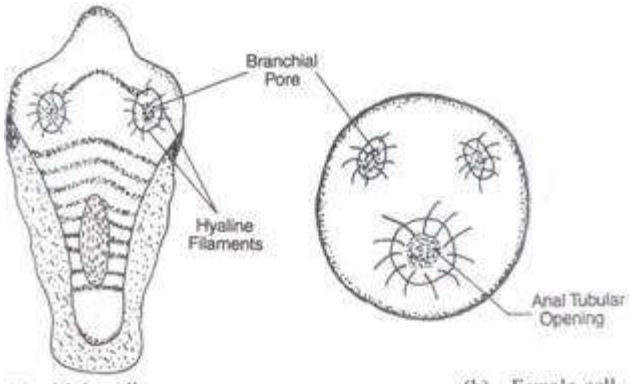


Fig. 35. Different forms of lac cell.

The emergence of larvae from female cell occurs through anal tubular opening of the cell and this emergence may continue for three weeks. The larvae of lac are very sluggish and feed continuously when once they get fixed with the twig. In the meantime the larvae start secreting resinous substance around their body through certain glands present in the body. After some-time the larvae gets fully covered by the lac encasement, also known as lac cell. Once they are fully covered, they moult and begin to feed actively.

> The cell produced by male and female differ in shape, and can be easily distinguished sometimes later. Male cells are elongated and cigar shaped. There is a pair of branchial pores in the anterior side and a single large circular opening covered by the flap in the posterior side. (fig. 26, a). It is through the posterior circular opening that the matured male lac insect emerges out of its cell.

Female cell is oval, having a pair of small branchial pores in anterior side and a single round anal tubular opening in posterior side. Through the anal tubular opening are protruding waxy white filaments, secreted by the glands in the insects body, which is an indication that the insect inside the cell is alive and is in healthy condition. These filaments also prevent the blocking of the pore during excess secretion of lac.

Larvae moult in their respective cells. It is the second stage larva which undergoes pseudopupation for a brief time, whereby it changes into adult stage. Now the male emerges out from its cell, moves on lac incrustation and enters the female cell for fertilization. In this way the life cycle is completed.

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.

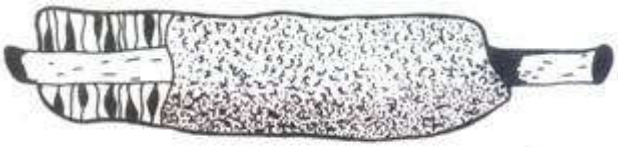


Fig. 36. Lac incrustation.

Cultivation of Lac:

Cultivation of lac involves proper care of host plants, regular pruning of host plant, infection or inoculation, crop-reaping, control of insect pests, and forecast of swarming, collection and processing of lac.

The first and perhaps the most important prerequisite for cultivation of lac is the proper care of the host plant. It is the host plants on which lac insects depend for their food, shelter and for completion of their life cycle. There are two ways for the cultivation of host plants. One is that plants should be allowed to grow in their natural way and the function of lac-culturist is only to protect and care for the proper growth of plants.

Another way is that a particular piece of land is taken for the purpose and systematic plantation of host plant is made there. Regular watch is necessary in this case by providing artificial manures, irrigation facilities, ploughing and protecting the plants from cattle and human beings for which the land should be fenced. The larvae of lac insects are inoculated on host plants only after the host plants have reached a proper height.

The lac larvae feed on the cell sap by inserting their proboscis in the tender twigs. The proboscis can only be inserted in the tender young off-shoots. For this before inoculation, prunning of lac host plants is necessary. The branches less than an inch in diametre are selected for pruning. Branches half inch of less in diametre should be cut from the very base of their origin. But the branches more than half inch diametre should be cut at a distance of 1 ½ inch from the base.

Inoculation:

The method by which the lac insects are introduced to the new lac host plant is known as inoculation. This may be of two types, namely "Natural infection" and "Artificial infection". When infection from one plant to other occurs by natural movements of insect, it is called natural infection. This may be due to overcrowding of insect population and nonavailability of tender shoots on a particular tree.
Artificial infection takes places through the agencies other than those of nature. Prior to about two weeks of hatching, lac bearing sticks are cut to the size of six inches. They are called"Brood lac". Brood lacs are then kept for about two weeks in some cool place.

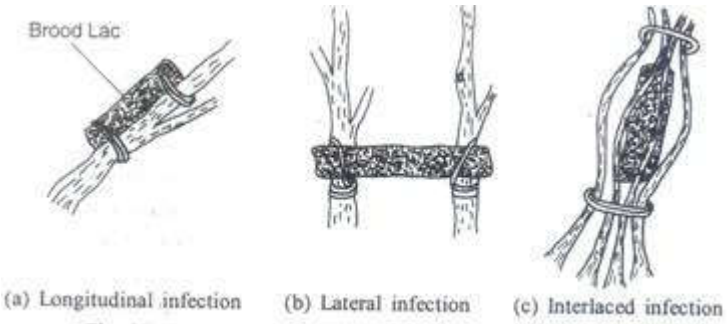


Fig. 37. Three different ways of artificial inoculation of lac.

When the larvae start emerging from this brood lac, they are supposed to be ready for inoculation. Strings co be used for tieding the brood lac with the host plant may be of different types in longitud infection the brood lac is tied in close contact with host branches. In lateral infection the brood lac is tied across the gaps between two branches. In interlaced method, brood lac is tied among the branches of several new shoots.

Lac Crop:

The lac insects repeat its life cycle twice in a year. There are actually four lac crops since the lac insects behave in two ways either they develop on Kusum plants or devlop on plants other than Kusum. The lac which grows on Non-Kusum plants is called as "Ranjeem lac," and which grows on Kusum plant is called as "Kusumi lac. Four lac crops have been named after four Hindi months in which they are cut from the tree. They are as follows:

Ranjeeni Crop:

(i) Katki:

Lac larvae are inoculated in June-July. Male insect emerges m August-September. Female give rise to swarming larvae in October-November and the crop is reaped in Kartik (October and November).

(ii) Baisakhi:

Larvae produced by Katki crop are inoculated in October-November, male insects emerges in February-March, females give rise to swarming larvae m June-July, the crop is reaped in Baisakh (April-May).

Kusumi Crop:

(i) Aghani:

Lac larvae are inoculated in June-July, male insect emerges m September, female give rise to swarming larvae in January-February and crop is reaped in Aghan (December-January).

(ii) Jethoi:

The larvae produced by Aghani crop is inoculated in the month of January- February, male emerges in March-April, female give rise to swarming larvae in June- July and the crop is reaped in the month of Jeath (June-July).

The time of infection with swarming larvae, the time of emergence of male insects, the time of reaping the crop, and the time of producing swarming larvae by female etc., are shown m tabular form below

Infection with swarming larvae	*Emergence of male insect*	*Crop reaped*	*Female give rise to swarming larvae*
Ranjeeni or Nankusumi Crop			
Katki (June-July)	August	Oct.-Nov.	Oct.-Nov.
Baisakhi (Oct.-Nov.)	Feb.-March	April-May	June-July
Kusumi Crop			
Aghani (June-July)	September	Dec.-Jan.	Jan.-Feb.
Jethoi (January)	March-April	June-July	June-July

Scraping and Processing of lac:

Lac cut from the host plant is called as "stick lac". Lac can be scraped from the twigs before or after the emergence of larvae. If it is used for manufacturing before the emergence of larvae, the type of lac produced is called as "Ari lac" and if it is used for manufacturing purpose after swarming of larvae has occurred, the lac is said to be Phunki lac".

The scraping of lac from twig is done by knife, after which they should not be exposed to sun. The scraped lac is grinded in hard stone mills. The unnecessary materials are sorted out In order to remove the finer particles of dirt and colour, this lac is washed repeatedly with cold water.

Now at this stage it is called as "Seed lac" and is exposed to sun for drying. Seed lac is now subjected to the melting process. The melted lac is sieved through cloth and is given the final

shape by molding. The final form of lac is called “Shellac”. Colour or different chemicals may be mixed during melting process for particular need.

NATURAL ENEMIES OF LAC

Some chalcedonic and lepidopteran insects lay eggs inside the mists. The nymphs of lac insects are eaten up by their larvae. Proper selection of seed lac, killing of predator eggs in harvested lac, and use of insecticides greatly minimise damage to the crop.

Predators:

Two moth predators cause a lot of damage to lac.

1. ***Eublemma amabilis (***the white moth***)*** The larva is dirty white in colour and tunnels through the lac encrustation and feeds on larvae and adults. It pupates within the tunnel and adults after emerging lay their eggs near the lac encrustation.
2. ***Holcocera pulverea.(*** the blackish grey moth).The damage by the brownish larva is similar to the above species. Pupa is slightly bigger and yellowish-brown. They not only feed on **lac insects** but also destroy the **lac** produced by term.

Parasites:

The following insects are parasitic on lac insect. 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.

Paraecthrodryinus clavicornis; Erencyrtus dewitzi; Tachardiaephagus tachardiae; Eupelmus tachardiae; Tetrasticus purpurens.

The above natural enemies can be controlled by maintaining healthy cultures and by enclosing the brood lac sticks in wire mesh before inoculation so that natural enemies are not able to emerge and cause re-infestation

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

USES OF LAC

The various applications of lac can be summarized as follows:

Commonest use is in polishing wooden furniture. The granules are dissolved in spirit and then are applied in very thin layers on the wooden surfaces
– In sealing parcels, packets and envelopes

Lac resin is used in food processing industry; cosmetics and toiletries industry; varnish and printing industry; coating of fruits and vegetables; electrical industry; leather industry; adhesive industry; pharmaceutical industry; perfumery industry; miscellaneous applications.

Lac dye (erythrolaccin) has been used in India as a skin cosmetic and dye for wool and silk. In China it is a traditional dye for leather goods. The use of lac for dye has been supplanted by synthetic dyes. It is used in medicine to protect liver and to fight obesity.

Lac is used in food, confectionery and beverages industry and textile industry.

Lac is used in the manufacture of toys, ornaments, electrical insulating materials, varnishes, polishes, lithographic inks, shoe polishes, sealing wax, etc. It is used in electric insulations, lamination of papers, hat proofing and coating of pictures and fossils.

Lac is used for manufacture of tailors chalks, crayons, bottle sealers, lipsticks, enamels, printing inks, gramophone records and in fireworks.

Utilization of lac for various purposes has been very ancient in India. A "lac palace" is described in Mahabharata, which was intended to be used for burning the Pandavas alive. The Hindi name "Lakh" or "Laksha" in Sanskrit
It requires about 4,00,000 (4 lacs) insects to yield one kilogram of lac.The Hindi word "Lakh" for shellac possibly derives from such large number of insects required to produce lac.

In India the lac insect is found in great abundance and millions of people directly or indirectly find livelihood in this industry.
Lac Research Institute in Ranchi (Now in Jharkhand) conducts research on the various aspects of the lac insect, its life history, protection against enemies, etc. Synthetic lacquers have been produced by the modern industry, which is replacing true shellac for many purposes.