

DEPARTMENT OF ZOOLOGY

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B.Sc. Zoology Part I

ECONOMIC ZOOLOGY: LAC CULTURE

SYSTEMATIC POSITION

Phylum: Arthropoda
Class: Insecta
Order: Hemiptera
Superfamily: Coccidae
Family: Lacciferidae
Genus: *Laccifer*
Species: *lacca*

INTRODUCTION

- ✓ Lac is a **natural resin** of animal origin. It is secreted by an insect, known as **lac-insect**. In order to obtain lac, these insects are cultured and the technique is called **lac-culture**.
- ✓ It involves proper care of host plants, regular pruning of host plants, propagation, collection and processing of lac.
- ✓ Members of two families of Hemiptera, namely, Lacciferidae and Tachardinidae secrete lac over their bodies for protection.
- ✓ **Lac insect** belongs *Laccifer* of superfamily Coccoidea of order Hemiptera.
- ✓ In all 22 species have been recorded under the genus *Laccifer* in Indian subcontinent.
- ✓ India is still being regarded as the principal lac producing country of the world. Burma went into lac trading since sixteenth century.
- ✓ Lac culture in China probably dates back to 4000 years and they use lac for dyeing silk and leather goods. India produces about 65% of the world's total output.
- ✓ Bihar and Jharkhand account for 40% of India's total production lac.

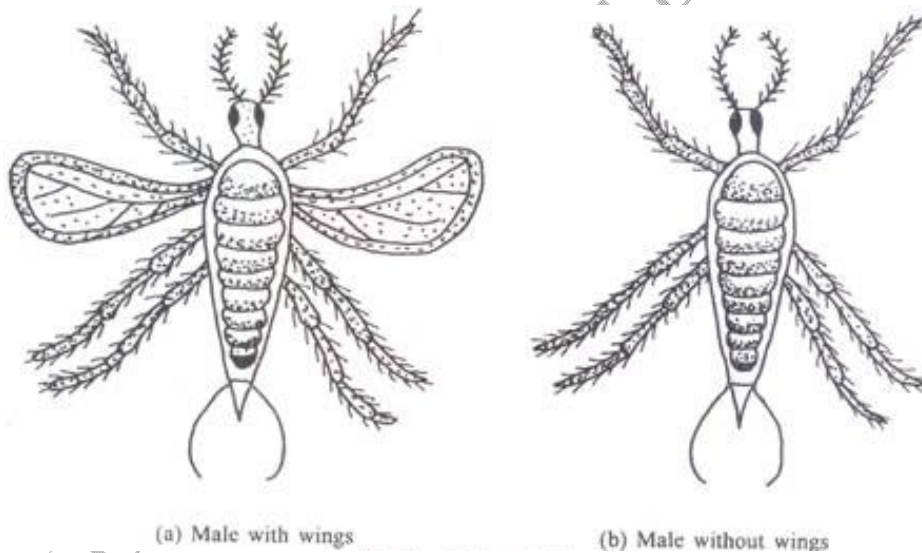
HOSTS

Plants such as:

Kusum	(<i>Schleichera trijuga</i>)
Palas	(<i>Butea frondosa</i>)
Ber	(<i>Zizyphus jujube</i>)
Babul	(<i>Acacia arabica</i>)
Khair	(<i>Acacia catcchu</i>)
Arhar	(<i>Cajanus indicus</i>)

- ✓ *Zizyphus mauritiana*, *Butea monosperma*, *Butea monosperma*, *Schleichera oleosa*, *Acacia Arabica*, *A. catechu*, *Cajanus cajan*, *Ficus benghalensis*, *F. cunia*, and *F. religiosa* are common hosts of the lac insect *Laccifer* (= *Tachardia*) *lacca*.

BIOLOGY OF LAC INSECT



Fig; Adult lac insect

- ✓ *Laccifer lacca*, (*Tachardia lacca*) is the commercially cultured **lac insect**.
- ✓ It is mainly cultured in India and Bangladesh on the host plants such as ber (*Zizyphus mauritiana*), palas (*Butea monosperma*) and kusum (*Schleichera oleosa*).

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.

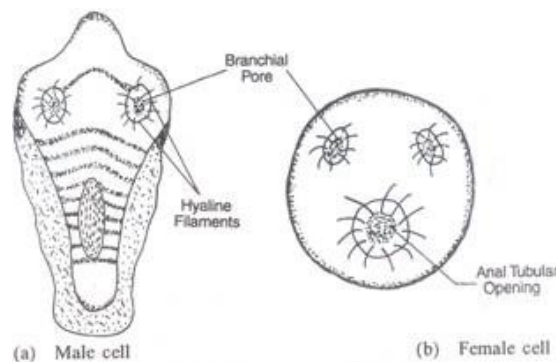
- ✓ Thorax bears three pairs of legs. Wings may or may not be found.
- ✓ Abdomen is the largest part of the body bearing a pair of caudal setae and sheath containing penis at the posterior end.

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.
- ✓ 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.

LIFE CYCLE

- ✓ Female insect is viviparous, producing about 1000 nymphs, deep red in colour with black eyes.
- ✓ The larvae settle down on a suitable place of the host plant gregariously.
- ✓ A day or two after settlement, the larvae start secreting lac all around the body except on the rostrum, spiracles and on the tip of abdomen.
- ✓ Thus it gets encased in a cell of lac which gradually increases in size along with the increase in size of the insect.
- ✓ The insect moults twice before reaching maturity.
- ✓ The male larvae produce elongated lac cells while the females produce oval cells.
- ✓ After the first moult larvae lose their legs, antennae and eyes and become bag like.
- ✓ After the 3rd moult the larvae pass on to a pseudo-pupal stage. Males emerge and copulate with the females and die.
- ✓ The female larvae never regain appendages and continue to remain under the lac cell, become adults and reproduce.
- ✓ As the lac insects remain close together, lac secretion from adjacent cells coalesces with each other and forms a continuous encrustation on the tree branch.



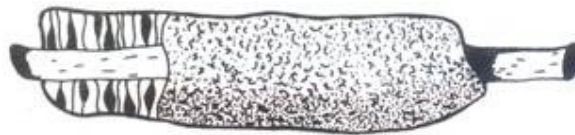
Fig; Different forms of lac cell

LAC CULTIVATION

- ✓ Lac culture involves two important steps:
 - (1) Inoculation and
 - (2) Cropping
- ✓ **Inoculation** can be carried out through artificial infection of tender branches by brood lac stick obtained from mature lac trees immediately after harvesting.
- ✓ In this process, the brood lac sticks are tied in bundles of 2 or 3 sticks on the branches of the host tree, allowing maximum contact with the branches.
- ✓ There are four seasons of lac cultivation and according to the Hindi calendar, they have been named as **Kartiki**, **Aghani**, **Baisakhi**, and **Jethwi**.
- ✓ The crop period, from inoculation to harvesting, for **Kartiki**, ranges from July to November, for **Aghani**, from July to February, **Baisakhi**, from November to July, and **Jethwi**, from February to July.
- ✓ When young shoots come up on branches, the brood sticks are tied adjacent to the growing tender branches in a way so that maximum contact between shoots takes place.
- ✓ Within a week or two the larvae emerge and settle down on tender shoots.

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-continuous incrustation of lac is formed on the tender shoots.



Fig; Lac incrustation

PROCESSING OF LAC

- ✓ Lac encrustations are removed from the twigs of host plants by scraping.
- ✓ The raw lac thus obtained is known as **scraped lac** or **stick lac**.
- ✓ **Stick lac** is crushed into small grains, sieved, washed with mild alkaline water and dried.

- ✓ This semi-refined product, called **seed lac** or **grain lac** or **Chowrie**, which is further refined by a system of hot melting, filtration and stretching into thin sheet which are subsequently broken into brittle flakes called **shellac**.
- ✓ Alternatively the purified lac resin can be in the form of circular discs called button lac.
- ✓ If a solvent process is used to purify the raw lac, de-waxed, decolorized lac can be obtained as the end product.
- ✓ The normally amber coloured resin can also be bleached with sodium hypochlorite to obtain bleached lac, which is white in colour.
- ✓ Bleached lac has specialized demand for coating medicinal tablets, confectioneries etc.
- ✓ India is the principal lac producing country of the world, producing approximately 18000 metric tons of raw lac annually. About 85% of the country's production is exported to various countries.
- ✓ The USA, Germany and Egypt are some of the major lac importing countries of the world.

USES OF LAC

The various applications of lac can be summarized as follows:

- 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 wax is used in polishes for shoe, floor, car polishes 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.

NATURAL ENEMIES OF LAC INSECTS

Predators:

Two moth predators cause a lot of damage to lac.

1. *Eublemma amabilis*:

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 damage by the brownish larva is similar to the above species. Pupa is lightly bigger and yellowish-brown.

Parasites:

The following insects are parasitic on lac insect.

1. *Paraecthrodryinus clavicornis*;
2. *Erencyrtus dewitzi*;
3. *Tachardiaephagus tachardiae*;
4. *Eupelmus tachardiae*;
5. *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.

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