Notes

35

APICULTURE, LAC CULTURE AND SERICULTURE

Ever since the beginning of civilization, man has been trying to make use animals around him for various purposes and to rear them for increasing their number. In this context, you have learnt in the two previous lessons about animal husbandry and fisheries. In this lesson you will get acquainted with the major aspects of apiculture (Bee- keeping), lac culture (rearing lac insects) and sericulture (rearing silk moths).

OBJECTIVES

After completing this lesson, you will be able to :

- *define apiculture (bee-keeping), list the species of honey bee and emphasize their economic importance;*
- *describe the structure of the bee-hive and various castes in a normal bee colony;*
- *explain the different biological features of the castes of honey-bee, caste determination, development of the brood in comb (nest) and swarming;*
- *explain the methods of catching and hiving of swarms of honey bees and the common methods of bee keeping;*
- *describe the extraction of honey and beeswax and enumerate their uses;*
- *name the insect that produces lac and mention its uses;*
- *describe the main aspects in the life history of a lac producing insect;*
- *explain the terms stick lac, seed lac and shellac;*
- *define sericulture, name the insects (moths) that produce silk and their respective host plants;*
- *give a general account of the life history of the silk moth; and*
- *list the non-mulberry hosts for silk production, their sources and the parts of India where they are produced.*

35.1 APICULTURE

35.1.1 Bee-keeping – Its meaning and importance

Apiculture is also known as bee-keeping. Why this name?

'Apis' means bee. The scientific names of different species of honeybees begin with the generic name *Apis*. Apiculture or bee-keeping is the art of caring for, and manipulating colonies of honeybee in large quantity, over and above their own requirement.

35.1.2 Brief History

The first evidence of this association came to light from the rock paintings made by primitive human. Thousands of years ago, Egyptian were well acquainted with bee keeping before the Christian Era. In Rigveda, there are many references to bee and honey. Bee-keeping became a commercial proposition during the 19th century as a result of scientific research. Apiculture is a flourishing industry in many advanced countries like USA, Canada, Germany and Australia.

35.1.3 Importance of bee keeping

There are three main advantages of bee-keeping:

(i) Provides honey - a valuable nutritional food

(ii) Provides bees wax - which has many uses in industry

(iii) Honey bees are excellent pollinating agents, thus increasing agricultural yields. In terms of actual value this advantage exceeds the other two.

35.1.4 Species of honey bee

There are four common species of honey bee under a single genus *Apis* (apis = bee):

1. *Apis dorsata* (The rock- bee)

   This is the largest honeybee.

   Builds single large open comb on high branches of trees and rocks.

   Produces large quantity of honey, but this bee is difficult to domesticate.

   This bee is ferocious, stings severely causing fever and sometimes even death.

2. *Apis indica* (The Indian bee)

   Medium - sized

   Hive consists of several parallel combs in dark places such as cavities of tree trunks, mud walls, earthen posts, etc.

   This bee is not so ferocious and can be domesticated

3. *Apis florea* (The little bee)

   small - sized

   Builds single small combs in bushes, hedges, etc.

   Honey yield is poor.

4. *Apis mellifera* (The European bee)

   Somewhat like the Indian bee (*Apis indica*).

   This has been introducted in many parts of the world including India.

   It is easily domesticated.

INTEXT QUESTIONS 35.1

1. What does "Apis", a latin word mean literally?

   .....

2. Write three advantages of bee-keeping.

   .....

3. Name the two species of honeybee that can be domesticated.

   .....

35.1.5 The bee colony – various castes and their activities

A honey bee colony has three castes (Fig. 35.1a)

(i) Queen – only one; functional female

(ii) Workers – 20,000-30,000, sterile females

(iii) Drones – a few only, functional males available prior to swarming.

(i) Queen Bee

Queen bee is the only perfectly developed female, that is has well developed ovaries and other organs of female reproductive system.

She is largest in size.

Its wings are smaller and are shrivelled.

Mouth parts for sucking food is shorter than that of workers.

No wax glands.

Live for about 3 - 4 years.

May lay eggs at the rate of 800 - 1500 per day.

35.1.6 Events in the life of queen bee

Usually at the age of 7-10 days in her parent hive, after the old mother queen along with some workers had left for starting another hive, this new virgin queen goes out for marriage (nuptial) flights. The drones from the same hive chase her. This swarm may also be joined by drones (male bees) from other hives. Mating takes place, while flying, on an average, the queen mates with about six drones and then returns to the hive. The sperms she has received are enough for her whole life, and she never mates again.

The queen has a control mechanism on the release of the sperms from the spermatheca (sperm store). She can lay two types of eggs:

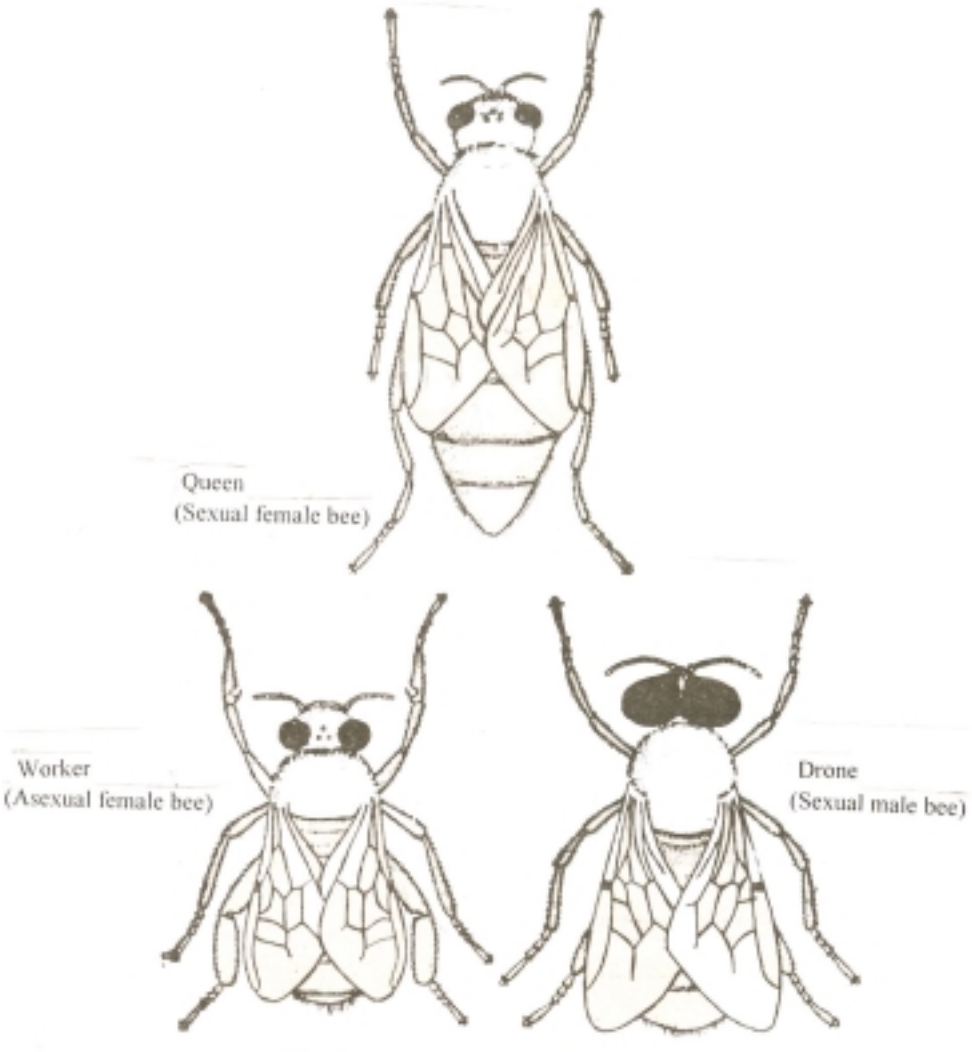

Fig. 35.1(a) Various castes of honey bee.

1. Fertilized – eggs that produce females (either sterile workers or fertile females (new queens).
2. Unfertilised – eggs which produce drones.

(ii) Worker bees

Worker bees are imperfectly developed females.

These are smaller than the queen.

These have strong wings to fly.

These have a large and efficient proboscis (mouth parts packed together like a thin tube) for sucking nectar.

A well-developed sting is present.

Hind legs have "pollen basket" for collecting pollen.

The workers have a life span of about 35 days. The different duties which they perform age-wise are as follows:

Day 1-14 Activity inside the hive such as cleaning the hive, feeding the larvae, etc.

Day 14-20 Guard duties at entrance to the hive

Day 21- 35 Foraging, i.e. collecting the food (nectar and pollen from the surroundings)

For foraging, some scout bees set out in the morning. On locating good sources of nectar (i.e. flowers) they return to their hive and perform characteristic movements (bee dances) at the comb. These dances communicate to the other worker bees the distance and the direction of the food source. This is how more and more worker bees are deployed in food gathering. The workers visit flower to flower, collect nectar and pollen and return to their own nest against taking clue from the position of Sun as well as by certain amount of memory and finally the smell of their own particular hive (Fig. 35.1b).

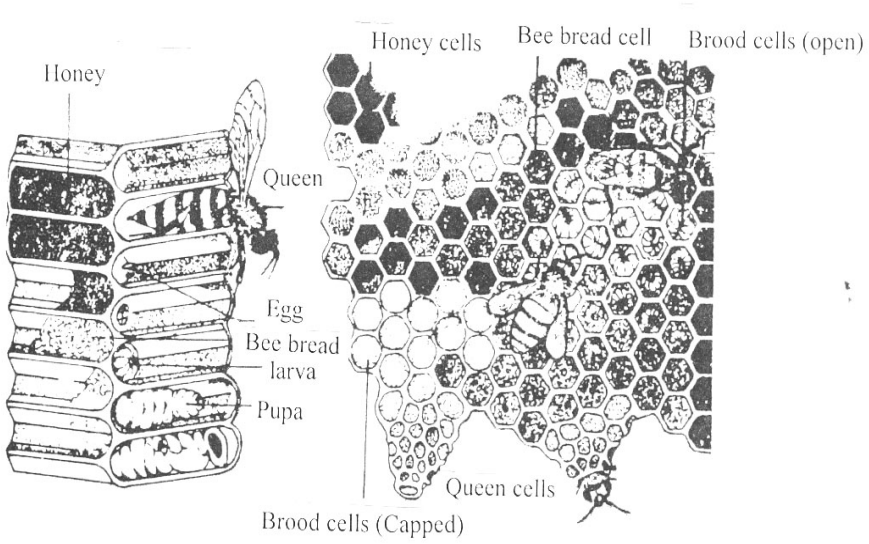

Fig. 35.1b A portion of the nest (hive) of the honey bee

The bee dance

In this dance the middle course of the dance communicates to the other bees the angle from the hive with reference to the sun. Taking a hint from this angle they have to fly to reach the food source (Fig. 35.1c).

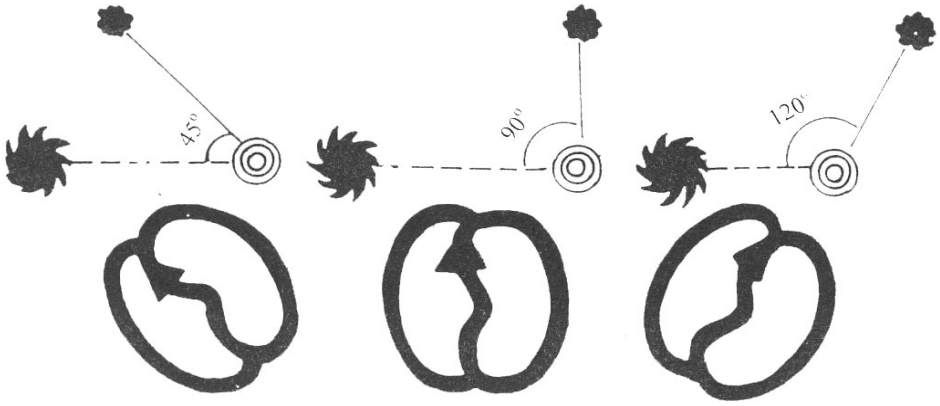

Fig. 35.1C The bee dance

(iii) Drones

Drones are the male bees produced from unfertilised eggs. Their production in the hive synchronises with the production of the new (virgin) queens. At the age of 14-18 days the drones perform mating flight chasing the virgin queen in the air. Drones can live up to about 60 days, although they are stung and killed after the mating.

The schematic representation of formation of different castes of bees is shown in Fig. 35.2.

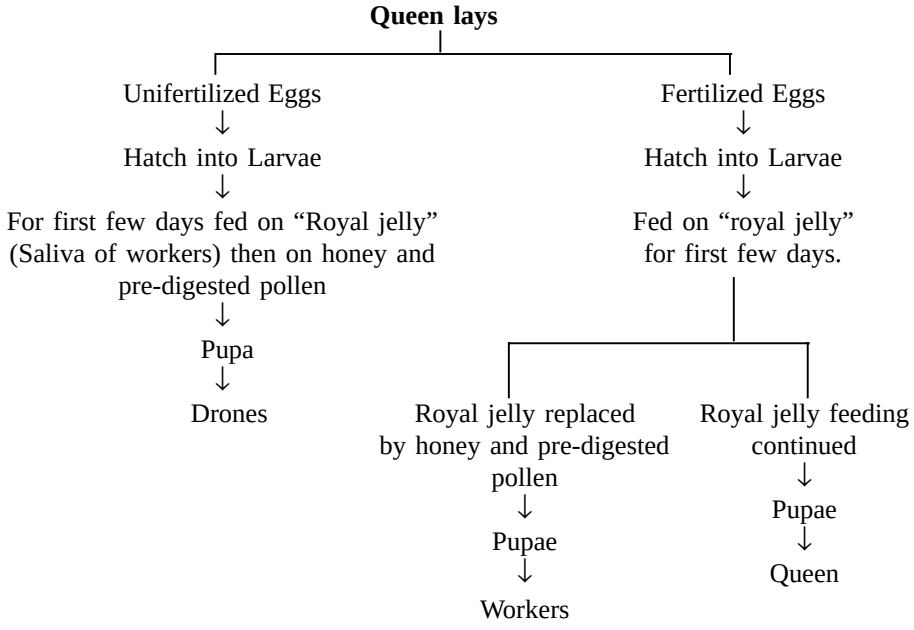

Fig. 35.2 Schematic representation of the formation of different castes in honeybee.

Notes

Emergence of new Queen, and Swarming of the old one

When the queen gets older (usually in the third year) her body gives out a chemical stimulus to the workers to construct a few rearing cells for queens. She places one fertilized egg in each of such brood cells. The larvae are fed on royal jelly (saliva of workers). They turn into pupae and then into queens. The first queen to emerge from the brood cells, kills the remaining ones.

Now the old queen takes to swarming along with a mixture of workers of all ages, leaves the old hive to develop a colony at some new site.

The new queen in the old hive takes to mating flight with the drones and returns to the same hive, as described earlier.

INTEXT QUESTIONS 35.2

1. Name the three castes in a honey bee colony

   .....

2. Name the following

   (i) The caste largest in size

   .....

   (ii) The kind of flight which the new virgin queen takes along with the drones out of the hive

   .....

   (iii) The caste produced from unfertilised eggs

   .....

3. What are the main duties of a worker bee in its following day wise age phases

   (i) Days 1-14 .....

   (ii) Days 14-20 .....

   (iii) Days 21-35 .....

4. What happens to the drones after mating flight?

   .....

35.1.7 Apiculture and commercial production of honey

Bees produce honey and wax both of which are valuable and marketable commodities.

(a) Indigenous methods of bee keeping

Many villagers make (i) wall or fixed types of hives in rectangular spaces in the walls with a small hole or (ii) movable types of hives in wooden boxes or earthen pitchers. The traditional beekeepers catch clustered swarms from trees, bushes, etc and transfer them to the above-mentioned spaces. After sometime when the honey

is ready, the bees are driven away from the comb usually by smoking the hive. Then the comb is cut away and the honey is squeezed out through a piece of large - meshed cloth.

(b) Modern hives

The modern beehive is made up of a series of square or oblong boxes without tops or bottoms, set one above the other. This hive has the floor at the bottom, and a crown board at the top, and a roof over all. Inside these boxes, wooden frames are vertically hung paralled to each other. The wooden frames are filled with sheets of wax foundation on which the combs are built by the bees. The only entrance to the hive is below the large bottom box (brood chamber). The queen is usually confined to the brood chamber. The boxes termed "supers" are used for storage of honey. The queen is prevented from going to the "supers" by the "queen excluder" that allows only the workers to move (Fig. 35.3).

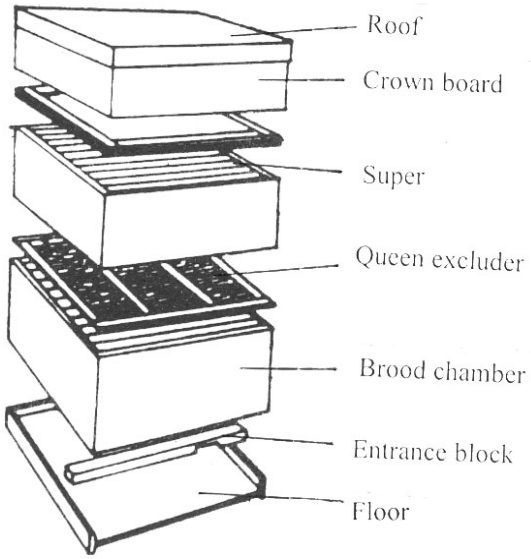

Fig. 35.3 A modern bed hive.

Catching a swarm

You have already read what a swarm is. It is an old queen accompanied by huge population of workers flying to start a new hive. Swarms are collected from where they are settled. Some kind of a container is needed to collect the bees. The container is usually a straw basket (skep) with a lid.

Hiving a Swarm

It is the process in which the collected swarm is transferred to the hive to build up the colony and produce honey. It is operated in two ways:

(i) Traditional method

The hive is set up with brood chamber filled with its full number of frames. Each frame has a full sheet of foundation and there is a crown board with roof at the top.

A sloping board with white sheet is set against the entrance of the hive.

Bees in the skep (basket) are knocked out of it on to the slope.

The instinct of the bees to move upwards onto the dark, drives them onto the hive through the entrance.

(ii) Quick method

In this method the crown board of the hive is taken off, frames are also taken off and the entrance is closed.

The skep is intimately united with the hive and the bees are poured into the brood chamber from the top.

The frames containing the wax foundation are placed in the hive.

The crown board is put back in its position and the entrance is opened.

It must be seen that the queen enters the hive. Now, sugar syrup must be fed to the swarm, as this feeding will help the bees to settle down to work in their new home.

Bee Pasturage

The plants that yield nectar and pollen are collectively termed "bee pasturage". The fruit trees, ornamental plants and forest trees comprise important bee pasturage.

Nectar is the sweet secretion of the flowers. It is raw material for honey.

Pollen provides the raw material necessary for the major food of the brood.

INTEXT QUESTIONS 35.3

1. Name the two types of indigenously made hives.

   .....

2. Rearrange the following parts of a modern hive for bee keeping, in their proper sequence from bottom to the top:

   Brood chambers, crown board, queen excluder, floor, super, roof.

   .....

3. Name the two methods for hiving a swarm.

   .....

4. What is the meaning of the term "bee pasturage" ?

   .....

35.1.8 Products from a bee hive

A. Honey

Honey is a food material for the bees and their larvae. Large quantities of honey are stored in the hive to meet the demands in scarcity. Chemically, honey is a viscous water solution of sugar. Its approximate composition in percentage is as follows:

Water	13-20
Fructose	40-50
Glucose	2-3
Minerals	Traces
Vitamins (B_1, B_2, C)	(minute quantities)

Composition of honey and its different flavours depend on the kinds of flowers from which the nectar is collected.

Nectar is sucked from flowers and mixed with saliva. It is swallowed into a special region of the gut called **honey stomach**. Nectar is a disaccharide (sucrose) it is hydrolysed by the salivary amylase to produce monosaccharides (fructose and glucose).

Inside the hive the workers regurgitate the processed nectar. The honey thus produced is still very dilute. After placing this honey onto the storage cells of the hive the bees "fan" with their wings to evaporate the excess water and bring the honey to its required concentration.

Extraction of honey from the combs is done by centrifugation.

Uses of Honey

Some uses of honey are as follows

- Food : Honey is a nutritious food, rich in energy and vitamins.
- Medicines: It is used as a carrier in ayurvedic and unani medicines. It acts as a laxative and prevents cold, cough and fever.
- It is used in religious ceremonies.
- It goes in the making of alcoholic drinks and beauty lotions.
- Another important use is in scientific research for making bacterial cultures.
- It is also utilised for making poison baits for certain insect pests.

Purity Standards

There is no ready method to test the purity of honey by the customers. Homogenous granulation is a probable sign of its purity. Otherwise there are laboratory methods for testing (test for monosaccharides).

Notes

B. Beeswax

Beeswax is secreted by the wax glands located on the underside of the last four abdominal segments (4^{th} to 7^{th}) of the worker bee. This wax is used in constructing bee combs in which the colony of the bees develops.

Uses of beeswax

Some uses are as follows:

– making of candles (the modern candles are made of paraffin wax, a petroleum product);
– making pharmaceutical preparations;
– preparation of varnishes and paints;
– Water proofing and waxing of threads; and
– formation of comb foundation (wax foundation in apiaries).

INTEXT QUESTIONS 35.4

1. Name the two major kinds of sugar found in honey

   .....

2. Mention any one non-food use of honey

   .....

3. How is honey chemically different from nectar?

   .....

4. Mention any two uses of beeswax.

   .....

35.2 LAC CULTURE

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

35.2.1 Lac or shellac is used in many ways

– 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
– As insulating material in electrical work

– In making phonograph records (now replaced by synthetic material)
– In shoe polishes
– In toys and jewellery

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.

35.2.2 Lac insect

The lac insect lives on native trees in India, Burma (now called Myanmar) and Malaysia. In India it is chiefly grown on trees like " Kusum", " Palas", and "Ber".

– The minute young lac insect (also called crawler) finds a suitable branch.
– The insect inserts its beak into the plant tissue to obtain nourishment.
– It grows in size and secretes a resinous material around itself.
– The resinous material hardens on exposure to air.
– Thousands of crawlers settle side by side and the resinous secretion builds up around them and completely encases the twig.
– Most crawlers develop in about 3 months into female which occupy small cavities in the resinous mass. The females can never come out of these masses.
– Eggs develop inside the body of the female and she assumes a sac like appearance.
– The female dies, the eggs hatch, the crawlers escape and move to a nearby-uninfected part of the twig, and the process is repeated. (Fig. 35.4).

Fig. 35.4 A piece of twig encrusted with lac.

35.2.3 Extraction of Lac

The encrusted twigs are known as **stick lac**. Such twigs are harvested.

– The stick lac is ground largely in crude mortars, and the resulting granular lac is called **seed lac**.
– The fine particles or the dust separated from the granular lac is used in making toys, bangles etc.
– The wood portion is used as fuel.
– The seed lac is washed, melted, spread out in a thin layer and dried. This is the shellac of commerce.

Notes

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.

INTEXT QUESTIONS 35.5

1. What is the scientific name of the lac insect?

   .....

2. List any three common uses of shellac.

   .....

3. Name any two trees on which lac insect grows.

   .....

4. What is seed lac?

   .....

35.3 SERICULTURE

Sericulture or silk production is the breeding and management of silk worms for the commercial production of silk.

Sericulture is an important industry in Japan, China, India , Italy, France and Spain.

35.3.1 Brief History

Sericulture or silk production from the moth, *Bombyx mori* has a long and colourful history unknown to most people. This insect is the only living species of family Bombycidae and has been domesticated for so long that it is possible that there are no survivors in the wild any longer.

According to the Chinese records, the discovery of silk production from *B. mori* occurred about 2700 BC. It is believed that empress Si-lung-Chi was asked by emperor Huang-ti to find the cause of damaged mulberry leaves on trees in their garden. The empress found white worms eating the leaves. She noticed that they were also shiny cocoons around themselves. A cocoon dropped in her cup of tea

and silky threads separated from the cocoon. Silk industry began in China where the source of silk was kept a secret for more than 2000 years. After some time, China lost their monopoly in silk production, sericulture reached Japan through Korea and then to other countries.

Sericulture has been growing in India as an agro-based industry playing a vital role in the improvement of rural economy.

35.3.2 Source of silk – The silkworm

The silkworm is the larva or the caterpillar of the moth *Bombyx mori* (popularly called the silk moth) the total life history of the moth (from egg to adult take 50 days. The different stages are as follows:

(i) Egg 10 days

(ii) Larva (4 Stages) 30 days

(iii) Pupa (Cocoon) 10 days

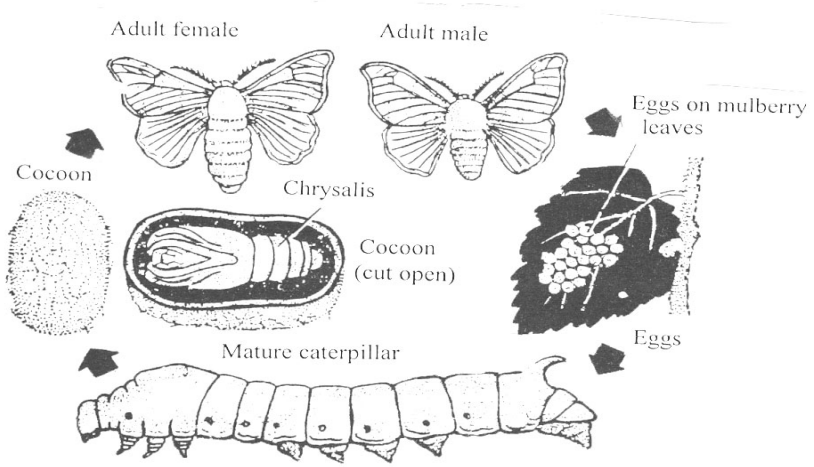

Fig. 35.4a Stages of life history of silk worm moth.

(i) Adult

The adult silk moth is a creamy white moth that has a flat body and a wing expanse of about 5 cms. It takes no food and seldom attempts to fly. It lives for only 2 to 3 days. After mating, the female moth lays 300-500 eggs on leaves of the mulberry tree.

(ii) Eggs

The eggs are round and yellowish-white, and they become grey as hatching time approaches.

Notes

(iii) Larvae

The newly hatched larva is about 3 mm long and somewhat black in colour.

The larvae grow in size and shed their skin (moult) four times. Each growing stage of the caterpillar consumes lot of mulberry leaves.

The last stage full grown larva is about 7 cm long. It has a hump behind the head and a spine-like horn at the tail end.

When full grown, the mature larva stops feeding, climbs on a twig and spins a cocoon.

(iv) Pupa

The full grown larva pupates inside the cocoon

– In about 10 days time it transforms into a winged adult. The adult moth makes an opening in the cocoon and escapes through it.

The cocoon

The cocoon is formed from a secretion from two large silk glands (actually the salivary glands), which extend along the inside of the body and open through a common duct on the lower lip of the mouthparts. The larva moves the head from side to side very rapidly (about 65 times per minute) throwing out the secretion of the silk glands in the form of a thread. The secretion is a clear viscous fluid, which on exposure to the air gets hardened into the fine silk fibre.

The filament forming a cocoon is continuos and ranges in length from 700-1100 metres.

The cocoons from which moths have emerged are called pierced cocoons. These are of low value because continuous thread cannot be obtained. Pieces are removed by instruments and spun into a thread.

35.3.3 Rearing of silkworms

Selected healthy silk moths are allowed to mate for 4 hours. Female moth is then kept in a dark plastic bed. She lays about 400 eggs in 24 hours, the female is taken out and is crushed and examined for any disease, only the certified disease- free eggs are reared for industrial purpose. The eggs are hatched in an incubator.

The hatched larvae are kept in trays inside a rearing house at a temperature of about 20°C-25°C . These are first fed on chopped mulberry leaves. After 4-5 days fresh leaves are provided. As the larvae grow, they are transferred to fresh leaves on clean trays, when fully grown they spin cocoons.

35.3.4 Reeling silk

The cocoons are cooked in hot water and the silk fibre is unwound from the cocoons. This process is called reeling. The silk consists of two proteins the inner core is fibroin and an outer cover of sericin. There are four following steps for the completion of the process of reeling:

For reeling silk the cocoons are gathered about 8 days after spinning had begun.

– The cocoons are first treated by steam or dry heat to kill the insect inside. This

is necessary to prevent the destruction of the continuous fibre by the emergence of the moth.

– Next, the cocoons are soaked in hot water (95° -97°C) for 10-15 minutes to soften the gum that binds the silk threads together. This process is called cooking.
– The "cooked" cocoons are kept in hot water and the loose ends of the thread are caught by hand.
– Threads from several cocoons are wound together on wheels ("charakhas") to form the reels of raw silk (Fig. 35.5).

Only about one-half of the silk of each cocoon is reelable, the remainder is used as a silk waste and formed into spun silk.

Raw silk thus obtained is processed through several treatments to give it the final shape.

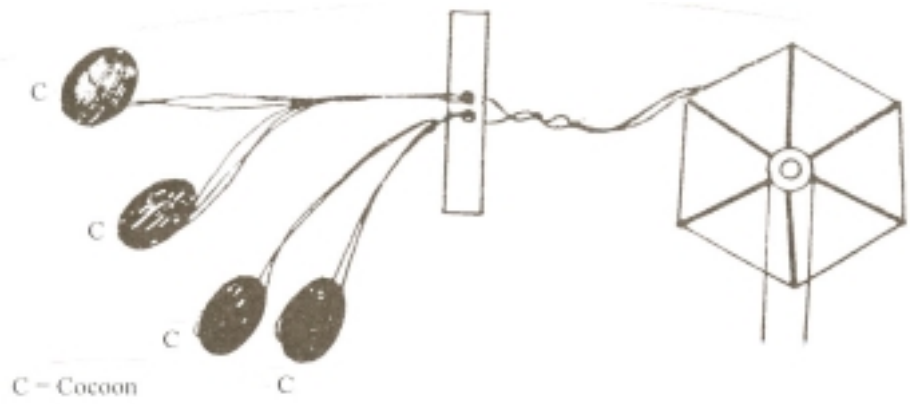

Fig. 35.5 Reeling of silk cocoons.

35.3.5 Main properties of silk

1. It is lustrous, soft and strong.
2. It is made of two proteins : the inner core is fibroin and an outer cover is sericin
3. It is hard wearing.
4. It can be dyed into several colours

Silk moth *Bombyx mori* is at present fully domesticated. It no longer exists in a wild state and it cannot survive without the human care.

35.3.6 Silk Producing States of India

Major Indian States producing mulberry silk are:

Karnataka

West Bengal

Jammu and Kashmir

35.3.7 Non-mulberry "silks"

1. Tasar silk is produced by certain species of another moth *Antherea royeli*. Their

larvae are reared on Arjun trees, chiefly in Bihar, Madhya Pradesh and West Bengal.

2. Muga silk is obtained from *Antherea assama* whose larvae are reared on " Som" trees in Brahmaputra Valley.

3. Eri silk is produced by the moth *Philosamia ricini* whose larvae feed on castor leaves. It is produced in Assam.

INTEXT QUESTIONS 35.6

1. Match the items of the columns A, B, and C

A	*B*	*C*
Kind of silk	*Insect source*	*Trees*
1. Mulberry silk	(i) *Antherea royeli*	(a) Arjun tree
2. Tasar silk	(ii) *Antherea assama*	(b) Mulberry tree
3. Muga silk	(iii) *Philosamia ricini*	(c) Som tree
4. Eri silk	(iv) *Bombyx mori*	(d) Castor

2. Where did the silk industry first start in the world?

.....

3. State the following :

(i) The number of days for which the adult silk moth survives.

.....

(ii) The number of times the silkworm sheds its skin before turning into a pupa.

.....

(iii) The temperature at which the silk worms are kept in the rearing house.

.....

(iv) The purpose of cooking the cocoons in hot water.

.....

4. Name the three largest silk growing states of India.

.....

5. Which body part of the silkworm produces the silk forming substance?

.....

WHAT YOU HAVE LEARNT

- Bee- keeping helps in three ways – provides honey, provides wax and bring about pollination of agricultural crops.
- There are four common species of honey bee - the wild *Apis dorsata* the two domestic ones *Apis indica* and *Apis mellifera* and the little bee *Apis florea.*
- A bee colony has three castes - a queen, large number of workers and the male drones (produced only for mating in the nuptial flight).
- Queen is the largest, has no wax glands, lives up to 3-4 years, and lays eggs at the rate of 800- 1500 per day.
- Queen lays two types of eggs - fertilized eggs produce females and unfertilised eggs produce male bees.
- Workers are sterile females and possess an efficient sucking proboscis, wax glands, and a sting.
- Workers live for about 35 days, and they perform different duties in different life periods.
- Workers communicate to the fellow workers of the hive about the direction and distance of the food source by means of "bee dances".
- When the hive is overpopulated the old queen with a large number of workers leaves the parent hive (swarming) and settles at some other site, and one new queen takes charge of the previous hive.
- Beekeeping is an ancient industry but the modern way is very technical. Modern hive consists of several boxes one above the other.
- A swarm is caught and is hived by either traditional method or the quicker methods.
- The plants visited by the bees are called " bee pasturage".
- Honey is a nutritious food rich in simple sugars and vitamins.
- Honey has numerous uses besides as a direct food. Beeswax is secreted by the wax glands of the workers. It has wide uses in cosmetics, varnishes, paints, candle-making.
- Lac is produced by a tiny insect *Laccifer lacca.*
- Lac has numerous uses in industry- largest being as a polishing material and in making phonograph records.
- Lac is the secretion of the lac insect, which hardens and covers the insect, making an encrustation on the twig.
- The lac on the twigs is called stick lac and after removal from the wood, and is ground into grains is called the seed lac.
- Lac is grown in the largest quantity in India in the state of Bihar.

- Silk is the product of silk glands of the silkworm or in the larva (caterpillar) of the moth *Bombyx mori*.
- Besides mulberry silk there are tasar silk, muga silk and eri silk produced by three other moths.
- For obtaining silk the cocoons are killed by steam, then they are kept hot water (cooking) and the silk is reeled.
- Silk is lustrous, and made of the proteins Fibroin and sericin.

TERMINAL QUESTIONS

1. Describe the composition of a flourishing bee colony.
2. Describe the composition of a modern hive used in beekeeping. How is a swarm hived in it?
3. What is lac? Differentiate between stick lac, seed lac and shellac.
4. What is silk? How does the silkworm produce it?
5. Describe the various steps in obtaining raw silk form the cocoons.

ANSWER TO INTEXT QUESTIONS

35.1 1. bee

2. Provide (i) honey, (ii) Wax and (3) bees are pollinating agents
3. *Apis indica*, *Apis florea*, *Apis mellifera*

35.2 1. Queen, worker, drone

2. (i) Queen, (ii) nuptial flight (iii) drones
3. day 1 to 14 – cleaning the hive, feeding larvae

   day 14 to 20 – guard entrance of the hive

   day 21 to 35 – foraging/collecting food/collecting nector
4. They get killed

35.3 1. Fixed on wall, movable type in wooden box or earthen pitchers

2. Floor, brood chamber, queen excluder, supers, crown board
3. Traditional method, quick method
4. A collective term for plants that yield nector and pollen

35.4 1. Glucose, fructose

2. Medicine/cosmetics/bacterial culture (any one)

3. Nector is sucrose a disaccharide and honey has monosaccharides fructose and glucose

4. Making candles or varnish, water proofing waxing threads (any two)

35.5 1. *Leccifer lacca*

2. Sealing, insulation, gramophone records, shoe polish, toys, jewellery (any three)

3. Kusum, palas, Ber (any two)

4. Granular lac

35.6 1. 1-iv-b; 2-(i)-a; 3-(ii)-c 4-(iii)-d

2. China

3. (i) 2 to 3 day
   (ii) 4 times
   (iii) 20°C to 25°C
   (iv) to soften the gum that binds the silk fibres.

4. Karnataka, West Bengal, Jammu Kashmir

5. Silk glands