

Honey Bee

Observe the picture given below and discuss:



Figure 3.1 Bee hive

- i. What type of hive is shown in the picture?
- ii. Should humans make hives for bees?
- iii. What type of animal is a bee?

Let's study the event

Sanumaya was watering the flowers in her garden. At that time, her attention was drawn to the buzzing sound of some insects. She began to look carefully to see why those insects had been buzzing. Then, she noticed that those insects were honey bees. They were flying and sucking nectar from flowers. Sanumaya looked the bees attentively for some time. She saw that the bees were sitting on flowers for a while before flying away. She tried to find out where they were going, and after following, She saw the bees were sitting in a hive made in a nearby tree. Although from a little distance, she also observed the hive and saw various types of bees there.

Have you ever seen a beehive in your home or locality? Based

on your experience or the aforementioned event, discuss the following questions:

- i. What do honeybees feed on to survive?
- ii. Are all the bees of same type in a beehive?
- iii. What lessons can be learned from bees?
- iv. Do bees help humans only by producing honey, or do they help in other ways too?

A bee is an insect that lives freely in a special type of hive that has made for itself. It belongs to the phylum Arthropoda. While farming honeybees, farmers construct artificial hives for them. Honey bees are social insects living in large colony. There are three types of honey bees called queen, worker, and drone, living in a hive. There is a high level of understanding and discipline among the members of the bee colony. A high degree of division of labour is also found among them. Every member of the bee colony is very disciplined and hardworking, and they keep themselves busy all the time. Honeybees collect pollen and nectar to make honey.

Human beings have been adopting traditional methods of farming bees since ancient times. Since the 20th century, beekeeping has been done not only for the production of honey but also for pollination and for producing wax. Nowadays, modern hives are used for beekeeping as an agricultural business, from which more honey can be produced. Commercial rearing of bees is called apiculture. A separate study of bees is done for farming bees from a business point of view. The science that studies bees is called melittology or apicology which is a branch of entomology (the science of insects).

Activity 3.1 Observation and study of the bee

Objective: Study the physical structure of the bee

Material required: If possible, all types of bees, if not, a video or picture showing the external structure of all bees.

Method

- i. Make three groups of students in the classroom.
- ii. Take a picture of a bee or watch a video and study its body structure.
- iii. Now draw a neat diagram of the bee you observed and note its characteristics.
- iv. Present and discuss the findings of each group turn by turn.

Conclusion: Conclude the structure of honey bee based on discussion.



Queen bee



Drone bee



Worker bee

Figure3.2 Types of bee

Generally, the size of a bee ranges from 9 mm to 20 mm in length. Like other insects, their body is divided into head, thorax, and abdomen. They have paired compound eyes, paired antennae and mouth parts in their head. They detect surroundings stimuli by the help of antennae. Compound eyes can see without rotating the head. Thorax consists of three segments. From each segment arise a pair of legs. Legs are jointed, so they are kept in the phylum Arthropoda. The first two segments of the thorax give rise to a pair of wings which help them to fly a far distance. The abdomen consists of 9 segments, but 6 segments are prominent in adult females and 7 segments in adult males.

In a hive, three types of bees are present: queen bee, drone bee

and worker bee. Each member has their own characteristics, which is studied here:

Queen bee

The queen bee is the largest sized and elongated bee in the beehive. Its head is smaller and rounded than others. Its proboscis is short and covered with hairs. Sting is present at the end of abdomen. Generally, there is only one queen in the hive. Its main function is to lay eggs. It controls activities of all bees in the hive according to the situation. Its body produces a special scented substance called pheromone. With the help of this, it attracts males for mating. Similarly, pheromones are also used for the communication and to find out the location of hive. A queen bee lives the longest in the hive, about 2-5 years. Worker bees form a new queen by feeding royal jelly to the larva.



Drone bee

The drone bee is smaller than the queen but larger, blackish and hairy than the worker bee. It does not have sting, pollen basket, and wax-producing glands. It is the laziest bee in the hive. It is even fed by worker bees. Its function is to fertilize the queen bee. Drones are haploid. They have only 16 chromosomes, but the queen and worker are diploid, having 32 chromosomes. Drones are developed from unfertilized eggs. This process is called parthenogenesis. They only survive for about two months.



Worker bee

They are the smallest size bee in the hive. They have a special body structure. Mouthparts are chewing and lapping type.



Worker bees are extremely hardworking. Their legs are densely covered with hair. Legs also possess pollen baskets. They collect pollen in the pollen basket and transport to the hive. The function of worker bees includes collecting nectar, constructing the hive, nursing young ones, protecting the hive, etc. About 20,000-80,000 worker bees can be found in a hive. Life span of worker bees is about 6 weeks to 6 months.

Question to think: Why do bee stings cause swelling?

Life cycle of honey bee

Activity 3.2 Observation and study of the life cycle of the honey bee

Materials required: Video or picture showing life cycle of the honey bee, clay, metacard, etc.

Method

- i. Divide the class into four groups.
- ii. Watch the video of honey bee.
- iii. Study thoroughly and each group discuss one of the stages (egg, larva, pupa and adult) of life cycle of bee. Draw a picture on the metacard and note the characteristics. Also prepare a model of the life cycle of the honey bee using clay.
- iv. Paste the metacard and model prepared by each group on the board in sequential order. Present and discuss each stage in turn.

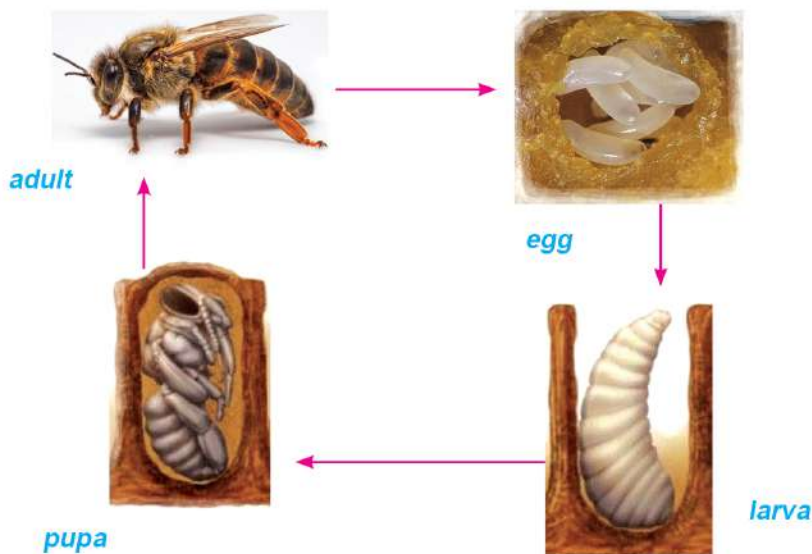
Conclusion: Conclude the discussion on life cycle of the honey bee based on the presentation.

All bees complete their life cycle in four stages- egg, larva, pupa, and adult. The duration of these stages varies according to the types of bees. To complete the life cycle, there occur two events- histolysis (degeneration of old tissues) and histogenesis

(the formation of new tissues) in the larva and pupa. Because of these events, there is transformation of egg into larva, larva into pupa, and pupa into adult. This process is called complete metamorphosis.

When there is an excess number of worker bees in a hive, the queen bee forms a new colony with a number of worker bees and eventually leaves the hive. Worker bees construct new hive. The worker bees in the old hive prepare a new queen by feeding a larva developed from a fertilized egg only with royal jelly. When the queen bee becomes adult, she leaves for the nuptial flight or mating flight. Usually, the queen bee leaves for the mating flight in the evening. When the queen bee leaves hive then she is followed by a group of drones. Queen bee mates with many drones. After mating, drones die. Queen bees receive sperms from drones which are used to fertilize millions of eggs. The structures used to store sperm in the body of the queen are called spermathecae. Drones die after mating because their genital organs are forcibly pulled during mating. After 2-3 days of mating, the queen bee starts laying eggs in the brood cell.

Figure 3.3 Life cycle of honey bee



Egg

The eggs of honey bee are white and elongated. Each egg lies erect within the brood cell on the first day, slanted on the second day, and horizontal on the third day. The queen bee lays eggs in drone cells to make drones, queen cells to make queens and worker cells to make workers. She can lay eggs up to 3,000 per day under favourable conditions. The number of eggs varies with the types of bees. The duration of an egg for all bees is three days. The size of an egg ranges from 1 mm to 1.5 mm. There are two types of eggs: fertilized and unfertilized. From fertilized eggs develop queen and worker bees. Drones develop from unfertilized eggs.



Larva

After three days of laying eggs, the eggs hatch into larvae. The larval stage lasts for about 5.5 days for queens, about 6 days for workers, and about 7 days for drones. The larva actively feeds in this stage. The larvae of future queens and drones are larger than the larvae of future workers. Queen and worker bees are both females developed from fertilized eggs. Whether a larva will be developed into a queen bee or a worker bee depends upon the type of food fed to the larvae. All larvae are fed royal jelly for three days. After that, the food type is changed according to the types of bee. The larvae that will become queen bees in the future continuously feed on nutritious royal jelly, but the larvae of future workers and drones feed on bee bread after three days. Honey bread or bee bread is the mixture of honey and pollen. The larva moults for five times. As the food fed to the larvae is different, the duration of their developmental stage is also different.



Pupa

The pupa is an inactive phase in the life cycle of the bee in which it does not feed or move, but its structural changes are going on. In this phase, three pairs of legs, wings, and mouthparts are developed. The pupal stage lasts for 8 days, 12 days, and 14 days for the queen, the worker, and the drone respectively.



Adult

After many changes, the pupa is transformed into an adult. The mandibles in the mouth of the newly formed adult bee chew the layer of wax sealed to the brood cell and emerge out. After they emerge, worker bees start helping others immediately. They have important tasks in the hive, such as caring for brood cell, feeding larvae, and protecting the hive.

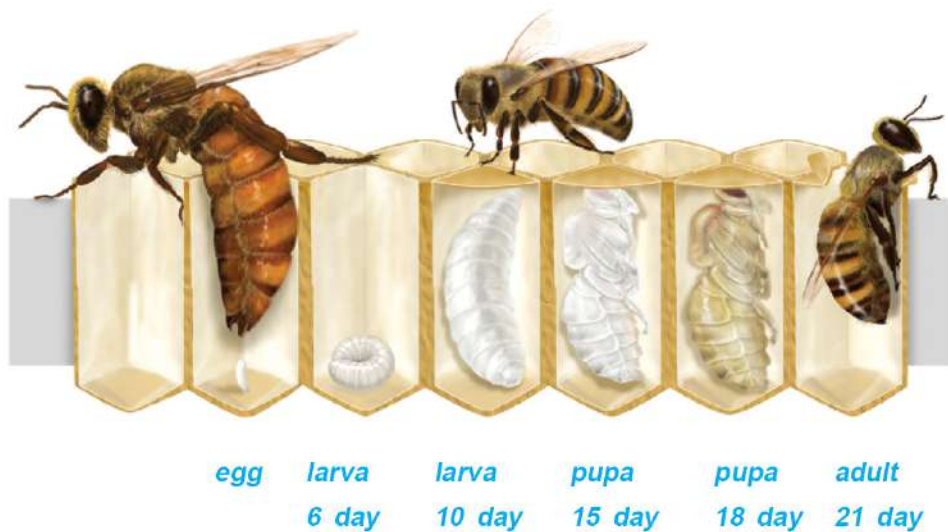


Figure 3.4 Various stages of bees

Generally, it takes different time period to reach adulthood from an egg. This is given in the following table.

Bee	Egg	Larva	Pupa	Total
Queen bee	3	5.5	7.5	16 day
Worker bee	3	6	12	21 day
drone	3	7	14	24 day

Newly born worker bees work within the hive for about three weeks. Then, the workers are assigned to work outside the hive. Work division of the bee according to their types and age:

S.N.	Type	Age	function
1.	Drone	Throughout the life	Fertilize queen bee and make hive warm.
2.	Queen bee	Throughout the life	Lays eggs and regulates the activities of hive by secreting pheromones.
3.	Worker	1-3 day	Clean the hive and cling to the honey comb to provide warmth to egg larva and pupa
		4-6 days	Feed honey bread to larvae.
		7-11 days	Royal gland is developed in their head to produce royal jelly which is fed to larva and queen.
		12-17 days	Four pair of wax glands are developed in their body, used for making honey comb and to seal larval cell and honey cell.
		18-20 days	Sting glands are developed to protect hive.
		After 21 days	Collect nectar, pollen, water, etc.

Let us know

Honey production

Like royal jelly, honey is not produced from a particular gland in the body of a bee. Honey is a combination of monosaccharide sugars, especially fructose and glucose, which is prepared by evaporating as much water as possible from a mixture of different types of flower juice or nectar with the help of natural wind and the wind that blows when the worker bees flap their wings. It is composed of 80-85% carbohydrates, 15-17% water, 0.3% protein, 0.2% amino acids, vitamins, and other constituents. The colour, smell, and effectiveness of honey depend on the type of flowers from which the nectar is collected.

Use of honey bee

Honey bees are beneficial insects for the ecosystem, including human beings. Their benefits can be mentioned in the following points:

- Human beings are encouraged in various social behaviours by the hardworking nature, division of work, and high level of discipline among honey bees.
- Highly nutritious honey is produced by bees, which is used in Ayurvedic medicine, candy, cake, bread, etc.
- While sucking nectar from flowers, pollination is carried out in plants. So honey bees have a role in the production of more crops in agriculture.
- Beeswax is widely used in cosmetics; for the manufacture of cream, lipstick, candles, etc.
- Beekeepers can earn a large sum of money if they get knowledge on extraction of royal jelly from the bees.
- Farmers can earn a lot of money from apiculture which can promote the economy of a nation.

Project work: Visit the beekeeping area

Visit the bee keeping area near the school, observe, and inquire about the structure of bees, the life cycle of bees, bee farming, and its importance. Based on this, prepare a short report and discuss it in the class.

Exercise

1. Choose the correct options for the questions below.

- a. Which bee contains only 16 chromosomes?
 - i. Queen bee
 - ii. Worker bee
 - iii. Drone bee
 - iv. Queen and worker bee
- b. From where is royal jelly produced?
 - i. from the gland at the head of queen bee
 - ii. from the gland at the head of drone
 - iii. from the gland at the head of worker bee
 - iv. from the salivary gland of worker
- c. Which bee is formed when the larva is fed royal jelly continuously?
 - i. queen
 - ii. drone
 - iii. workers
 - iv. queen and worker bee
- d. Which stage of the bee is shown in the given diagram?
 - i. egg
 - ii. larva
 - iii. pupa
 - iv. adult
- e. Why is honey bee called a social insect?
 - i. It produces honey.
 - ii. It helps in pollination in plants.
 - iii. It lives in colony
 - iv. It is domesticated insect.
- f. When the pollen baskets in the legs of worker bees are broken by certain means, which of the following functions cannot be performed by them?



- i. collecting nectar
 - ii. constructing brood cell
 - iii. feeding royal jelly to larva
 - iv. collecting pollen from flower
- g. Which of the following is the characteristic of the drone bee?
- i. haploid, sterile, medium sized, hairy
 - ii. haploid, fertile, medium sized, hairy
 - iii. diploid, sterile, medium sized, smooth
 - iv. diploid, fertile, medium sized, hairy
- h. Where does the queen bee store the sperms received from the drone bee after the nuptial flight?
- i. pollen sac
 - ii. ovary
 - iii. sperm sac
 - iv. egg sac

2. Differentiate:

- a. Drone and worker bee
- b. Queen bee and worker bee
- c. Queen bee and drone

3. Give reason:

- a. Honey bee is called social insect.
- b. Pasture land is required for bee farming.
- c. Drone dies after mating.
- d. Bees are multipurpose insects.

4. Answer the following questions:

- a. Write the various types of bee found in the hive.
- b. What is the function of the drone bee?

- c. If the queen bee dies for some reason, who will control the hive?
- d. How does the queen bee control other members of the hive?
- e. Write the uses of honey.
- f. Describe the structure of the queen bee.
- g. Mention the functions of the worker bee.
- h. Explain how the division of labour occurs in bees.
- i. Explain the life cycle of honey bee with diagram.
- j. What is the process called in which a drone is developed from an unfertilized egg?
- k. When a farmer practises bee farming, then income of other farmers in that locality also increases. Justify your reason.
- l. Due to the problem of pasture land in the beekeeping area, beekeepers shifted the bees from there. After that, there was a reduction in the yield of mustard crops of nearby farmers. Based on this, explain the relationship between beekeeping and agricultural production.
- m. Look at the concept map and complete it.

