



Arthropods and Biological Control of Pests



B10CH4



Learning Objectives

Upon completion of this topic, learners will:

- describe and classify arthropods according to their morphology;
- explain the process of metamorphosis (complete & incomplete) and Ecdysis (molting) in arthropods;
- discuss the role of vectors (cockroach, mosquito, house-fly, and tsetse fly);
- explain the general characteristics of butterfly;
- elaborate on the economics importance of the honey bees and termites;
- discuss pests, their economic importance and control measures;
- describe the features and economic importance of grasshoppers.

4.1. ARTHROPODS: GENERAL CHARACTERISTICS AND CLASSIFICATION

4.1.1. General Characteristics

- Arthropods represent the largest phylum of kingdom Animalia comprising more than 70% of the animal species.
- The animals of this phylum have jointed appendages/legs (*arthos* = jointed; *poda* = leg/feet) hence the name.
- They are bilaterally symmetrical and have organ system level of organisation.
- The body of these animals is segmented and divisible into **head**, **thorax** and **abdomen**. In a few head and thorax are fused to form cephalothorax.
- Each segment may bear a pair of lateral jointed appendages adapted for food ingestion, locomotion, respiration, copulation etc.

- They have an **exoskeleton** made up of hard impermeable **chitin**, in the form of hard plates called **sclerites**.
- The hard exoskeleton limits the growth of the body, hence the dead exoskeleton is periodically shed to allow growth. This process is called **moulting** or **ecdysis**.
- Arthropods respire through gills or book gills, (aquatic forms) book lungs, or tracheal system (terrestrial forms).
- Their digestive system is complete. Most head appendages form mouth parts for cutting, chewing or sucking food. Anus is terminal.
- Arthropods have four types of mouthparts. (i) **Biting and chewing type** – to bite and chew the food (e.g. cockroach), (ii) **Sponging type** – adapted for sucking liquid or semi-liquid (e.g. housefly), (iii) **Sucking type**- to suck nectar of flowers (e.g. male mosquitoes, butterflies, etc.) and (iv) **Piercing and sucking type** – to pierce the skin of the host and suck its blood for feeding (e.g. female mosquitoes).
- Arthropods are unisexual (with **sexual dimorphism**). They are **oviparous** (lay eggs). Life cycle may includes one or more larval stages, that undergoes **metamorphosis** to develop into an adult.

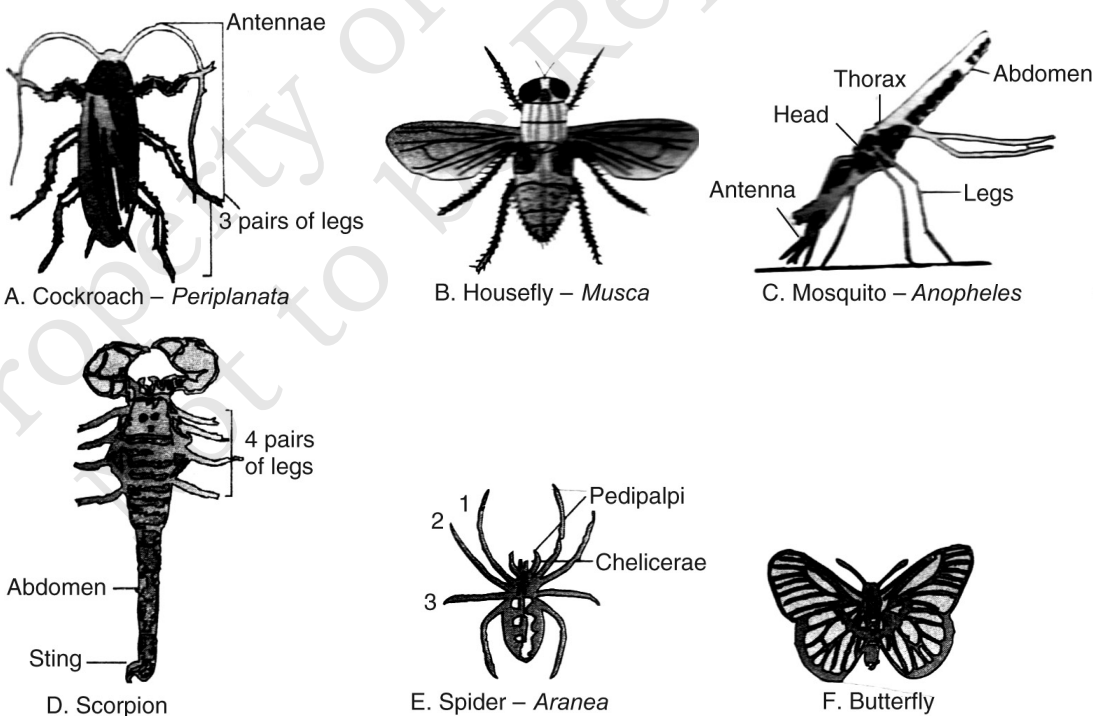


Fig. 4.1. Some common arthropods

4.1.2. Metamorphosis

Metamorphosis is the process by which a larva develops into an adult animal. It may be of complete or incomplete type.

- (i) **Complete metamorphosis:** Consists of four stages; egg, larva, pupa and adult. e.g. Housefly, mosquito.

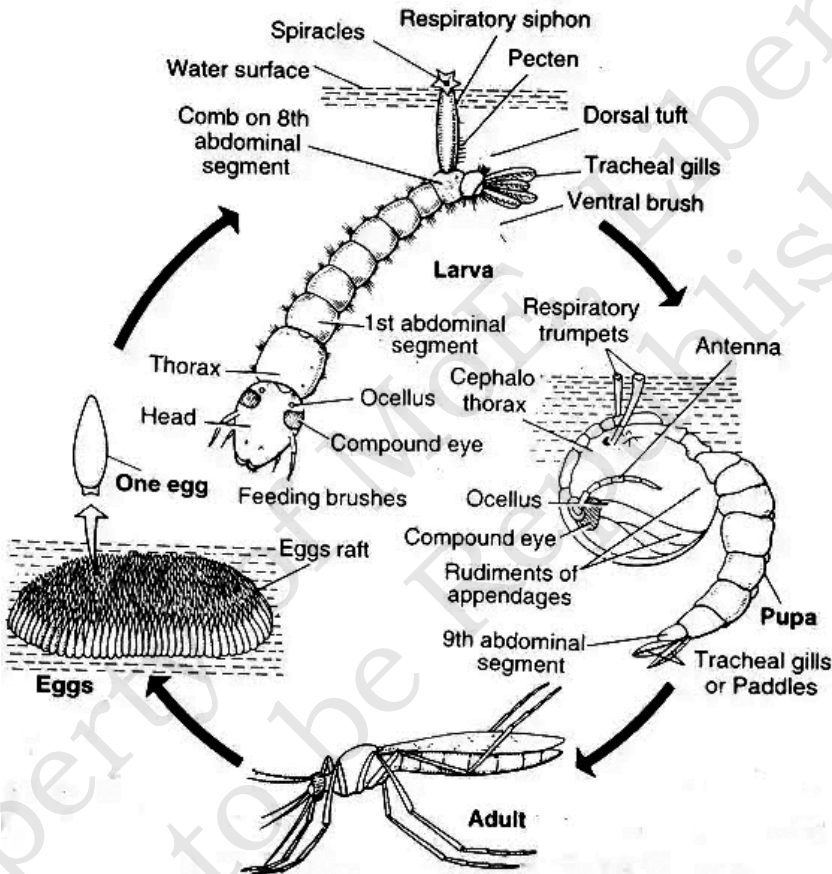


Fig. 4.2. Life cycle of mosquito

- (ii) **Incomplete metamorphosis:** Consists of three stages: egg, nymph and adult. During metamorphosis the nymphs shed their exoskeleton many times to grow. It is called **moulting**. e.g. cockroach.

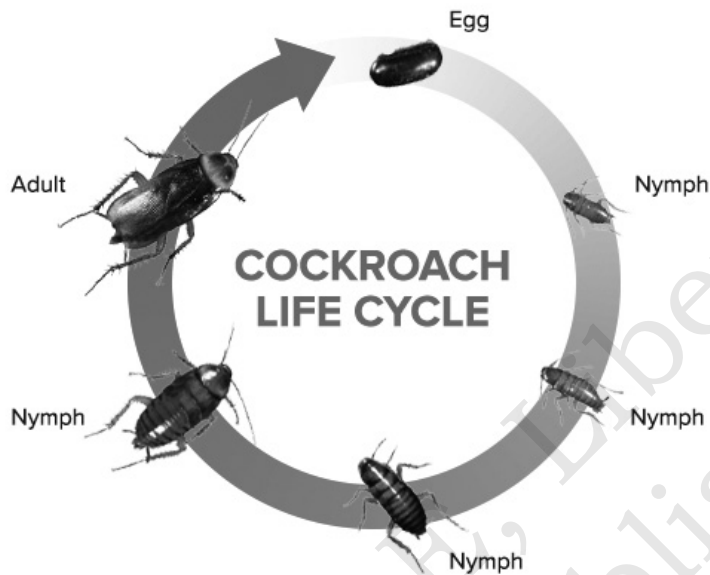
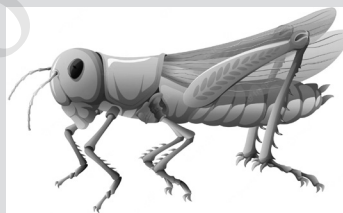
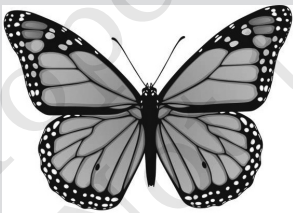


Fig. 4.3. Life cycle of cockroach

ACTIVITY 4.1

Make a field trip to study insects outdoor

Visit a garden/agricultural field and locate a butterfly harbouring on flowers, cotton stainer on cotton plants and grasshopper sitting on same leaves. Observe their external features and their mode of feeding. Draw their diagrams on your notebook.



4.1.3. Classification of Arthropoda

Phylum Arthropoda is divided into six classes as follows:

Class 1. Onychophora: They occur in most habitats and have worm like segmented body. The body segments bear unjointed legs with claws e.g. *Peripatus* (walking worm).

Peripatus shows characters of annelids, as well as arthropods. Therefore, it is considered as a **connecting link** between annelids and arthropods.

- Class 2. Crustacea:** They are aquatic arthropods with body divisible into **cephalothorax** (head + thorax) and **abdomen**. Head bears two pairs of antennae and a pair of stalked compound eyes. Thorax and abdomen have a pair of forked appendages in each segment. Cephalothorax is covered by a shield shaped **carapace** e.g. *Palaemon* (prawn), *Carcinus* (crab).
- Class 3. Chilopoda:** Their body is flattened and is divisible into **head** and **trunk**. The head bears one pair of antennae and one pair of eyes. Each segment of trunk bears a pair of legs. The first pair of legs are modified into poison claws e.g. *Scolopendra* (centipede).
- Class 4. Diplopoda:** Their body is long cylindrical and divisible into three regions—**head, thorax** and **abdomen**. There is single pair of antennae on the head. Each thoracic segment except the first bears a pair of legs, while each abdominal segment has two pairs of legs e.g. *Julus* (millipede).
- Class 5. Insecta:** It is the largest class of phylum Arthropoda. They live on land and air. Their body is divisible into three regions—**head, thorax** and **abdomen**. Head bears a pair of antennae, a pair of compound eyes and mouthparts adapted for different modes of feeding. Thorax consists of 3 segment each with one pair of legs, the second and third segments may have wings e.g. *Lepisma* (silverfish) *Periplaneta* (cockroach), *Apis* (honeybee) *Microtrema* (termite), *Anopheles/culex* (mosquitoes).
- Class 6. Arachnida:** The body is divisible into two regions—**cephalothorax** and **abdomen**. These are no antennae. Cephalothorax bears two pairs of mouthparts called **chelicereae**, one pair of **padipalpi** (for feeding) and four pairs of legs (for walking) e.g. *Palamneus* (scorpion), *Aranea* (spider).

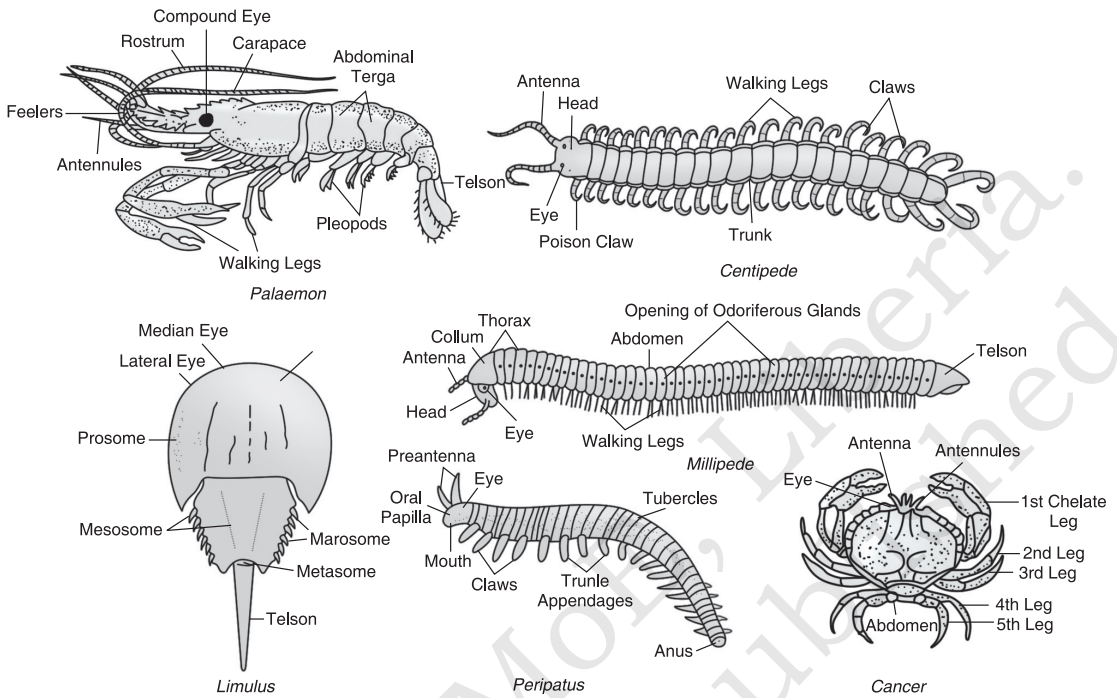
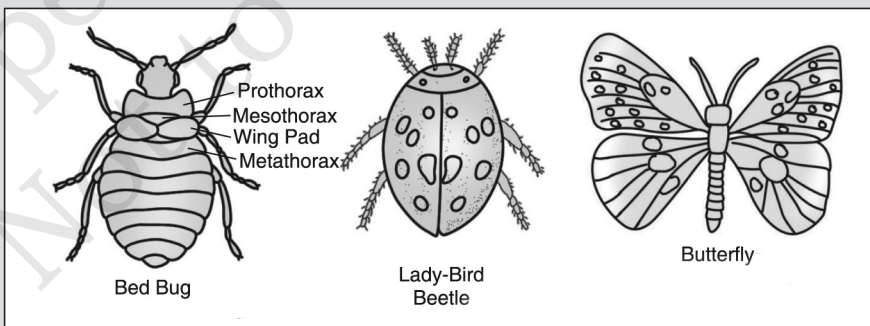


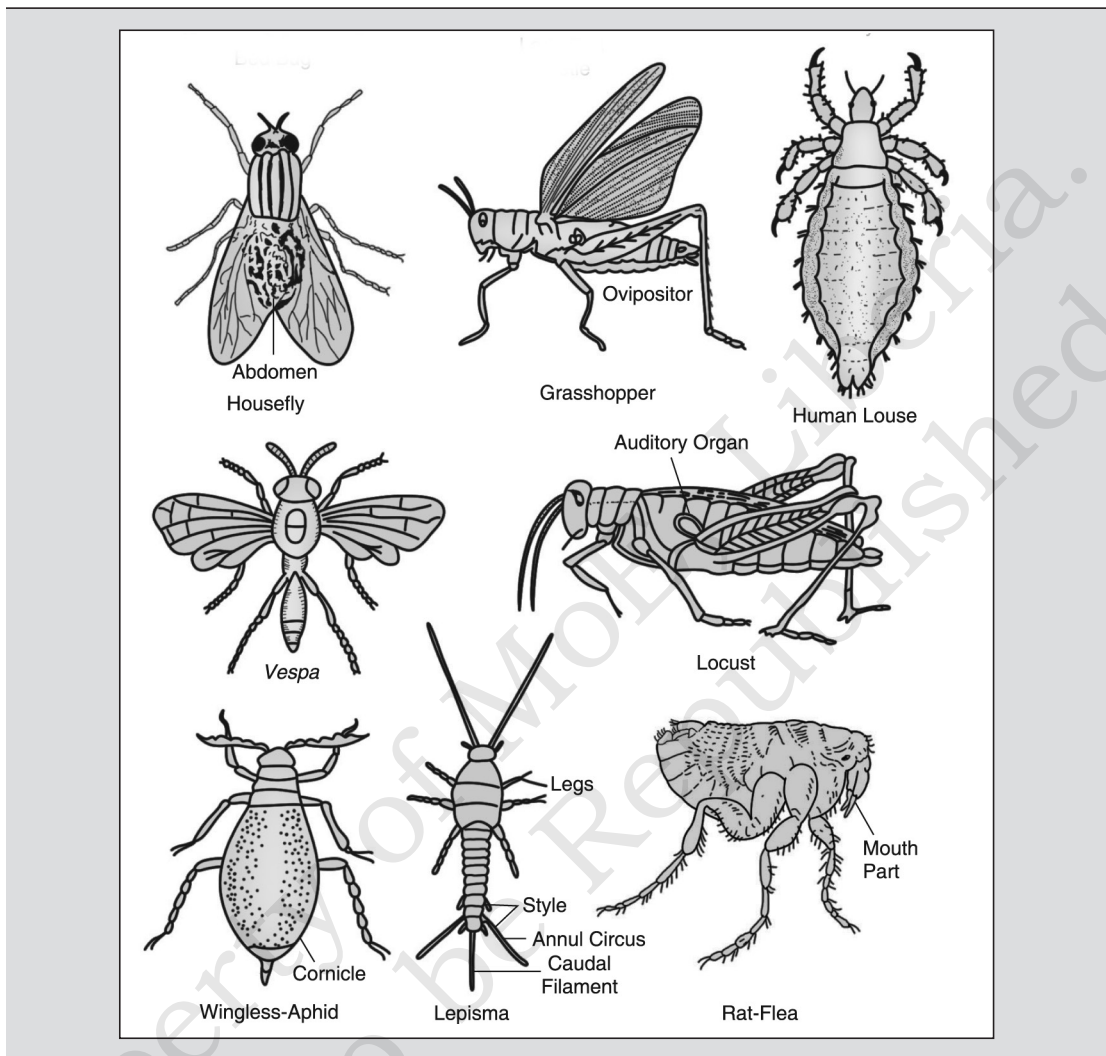
Fig. 4.4. Some arthropods

ACTIVITY 4.2

Make a visit to a food grain godown to study some insect pests.

Visit a food grain godown, and locate there, insects pests like housefly, cockroach, weevils etc. Study their morphological features and mode of feeding. Make their diagrams on your notebook.





4.2. VECTORS

A vector is an insect or animal that transmits a disease to other animals or humans. In other words, a vector is a carrier of a disease. The most common insect vectors include mosquitoes, tsetse fly, housefly and cockroach.

4.2.1. Mosquitoes

Mosquitoes are common in the tropical countries and found in abundance in damp and marshy places. The male mosquitoes subsist on plant juices, while the females feed on blood of man and other vertebrates. Its saliva contains an anticoagulant which prevents clotting of blood during

blood sucking. Mosquitoes have piercing and sucking type of mouthparts to pierce the skin of host and suck their blood. The mouthparts of female mosquitoes include labium, labrum, epipharynx, hypopharynx, mandibles and maxillae. The mandibles that pierce the skin of host are absent in male mosquitoes.

Life Cycle of Mosquitoes

Mosquitoes copulate while flying during the night. After copulation the female mosquitoes lays eggs in standing water of ponds, ditches, lake, water storage tanks and other open water containers in our houses. A blood meal by the female is necessary before laying eggs. The embryonic development is completed in an egg in 2-3 days and a larva, called **wriggler** hatches out from an egg. The larva actively swims about in water by wriggling, feeds on aquatic microorganisms and grows by undergoing **four moults**. After active growth and four moults the larva becomes inactive, sinks down to the bottom and undergo metamorphosis to develop into a comma shaped stage called **pupa**. The pupa has no mouth or anus, as it does not feed and depends only on stored food. In 2-7 days pupa metamorphoses into a young mosquito called **imago**, and hatches out from pupa. The life cycle of mosquito from egg to imago is completed in about a month. The metamorphosis in mosquito is **complete** or **holometabolic**.

Mosquitoes are vector (carriers) of several human diseases.

The bite of mosquito causes a mild inflammation with itching and burning and spread following human diseases.

- Malarial parasite (*Plasmodium*) which causes malarial fever is transmitted by the female *Anopheles*.
- Filarial worm (*Wuchereria*), which causes *filariasis* or **elephantiasis** is transmitted by *Culex*.
- *Encephalitis* is caused by a virus (which results in high fever, headache, drowsiness and inflammation of the brain) is also transmitted by some species of *Culex*.
- *Aedes* mosquitoes transmit viruses of **dengue**, **chikungunya** and **yellow fever**.

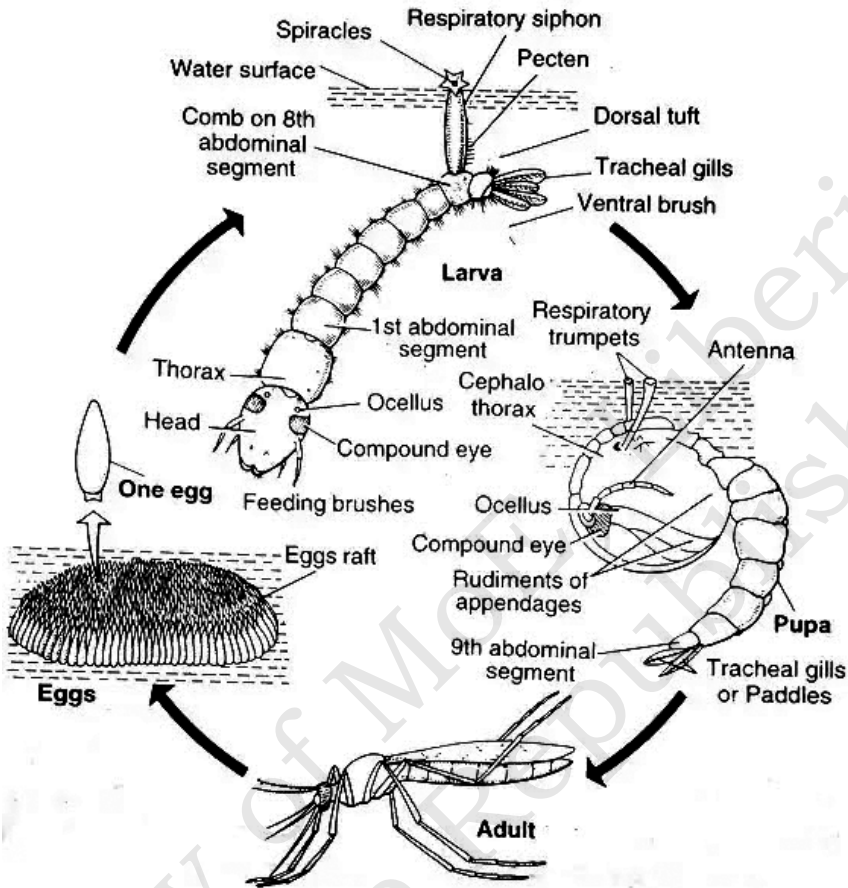


Fig. 4.5. Life cycle of mosquito

Prevention of Mosquito Borne Diseases

The mosquito borne diseases can be prevented by eradicating mosquitoes and their breeding places (by avoiding stagnation of water in around residential areas, regular cleaning of coolers, spraying insecticides in ditches, drainage, swamps etc, and introducing larvicidal fishes like **Gambusia** in pods that feed on mosquito larvae) and avoiding mosquito bites by using mosquito repellents etc.

4.2.2. Tsetse Fly (*Glossina*)

Tsetse fly is found only sub-saharan region of Africa. It is a vector for spreading a disease called **African Trypanosomiasis** also known as '**sleeping sickness**'. This disease is caused by a microscopic parasite (protozoan parasite) called *Trypanosoma brucei* which is transmitted by

the bite of tsetse fly. Trypanosomiasis is characterised by fever, headache, joint pain and itching. Later stages may include behavioural changes, confusion and poor coordination, which may be life threatening.

Life Cycle of Tsetse Fly

Female tsetse fly mate just once. After 7–9 days she produces a single egg which develops into a larva within her uterus. The mother continue to produce larva about every 9 days. Each larva burrows into the ground, where it metamorphosis into a pupa. A adult fly emerges from the pupa in the ground after about 30 days. Over a period of 12-14 days it matures, mates and if it is a female deposit its first larva. Thus, after about 50 days, a new fly is able to deposit its first larva.

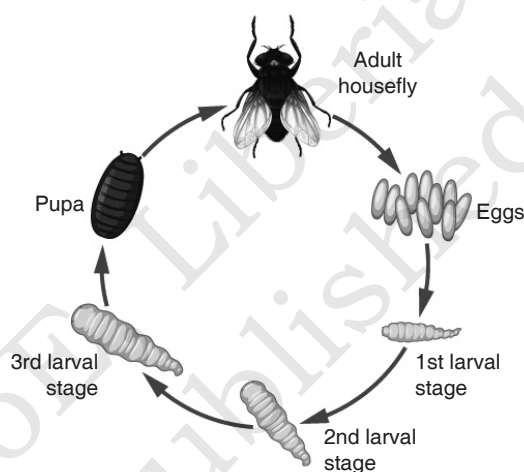


Fig. 4.6. Life cycle of tsetse fly

The disease, trypanosomiasis can be prevented by eradicating its vector i.e. tsetse fly. Since the fly has a slow rate of reproduction, can be eradicated by killing just 2-3% of the female population per day.

4.2.3. Housefly (*Musca Vicinia*)

Housefly is intimately associated with human life. Hence it is found in all places of human dwelling. It neither bites nor stings, yet we hate it for **insanitary habit** of once sitting upon dirty and decaying matters and other times sitting upon and contaminating our food staffs and other articles with all sorts of pathogens and its faecal matter.

As in other insects the body of housefly in distinguished into **head**, **thorax** and **abdomen**. It have two large blackish compound eyes in the head and a pairs of antennae. It has **sponging type** of mouthparts, which are adapted for sucking liquid or semi-liquid food like a songe. It bears 3 pairs of jointed legs and a pair of wings in thorax region. The abdomen is formed of 10 segments. The posterior segments (6-10 segments) bear genital organs.

Life Cycle of Houseflies

Houseflies are **unisexual**. Females are somewhat larger. Houseflies

copulate in summer and rainy season. Four to five days after copulation the female fly starts laying fertilised ova (eggs). About 500 to 800 eggs are laid by a single female in 4-6 instalments during its life span of about a month. The eggs are laid in small clusters inside semi-solid decaying matter such as dung, human excreta, decaying fruits and vegetables etc. In 8 to 24 hours a **larva** develops in each egg and released out from the egg case after hatching. The larva is called **grub** or **maggot**. After next 3-4 days the larva metamorphosis into a different type of young from called **pupa**. Externally the pupa appears lifeless, but significant changes occur inside its body. In about four to five days, pupa gives rise to a young fly. Since the maggot and pupa are very different from the adult fly, the metamorphosis involves drastic changes. Hence it is called **complete** or **holometabolic metamorphosis**.

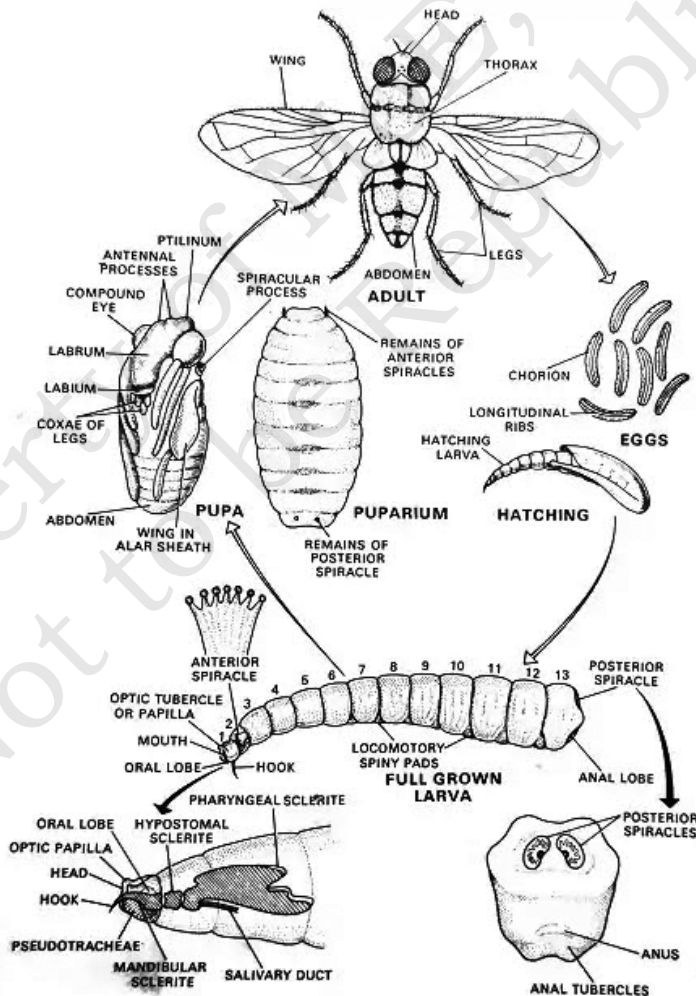


Fig. 4.7. Life cycle of housefly

Housefly is neither poisonous nor pathogenic yet it is responsible for spreading a number of fatal infectious diseases of man as follows.

- By sitting upon all sorts of dead and decaying matter for feeding houseflies collect a hoard of pathogenic microorganisms like bacteria, protozoans and their spores and transfer the same to our food stuffs and house hold articles. Thus spreads a number of infectious diseases like **dysentery, diarrhoea, typhoid, leprosy, tuberculosis, cholera, anthrax, trachoma** etc.
- Houseflies also collect the eggs of parasitic worms like **ascaris, tapeworm, hookworm**, etc., and transfer these to our food stuffs.
- They may lay eggs upon our open wounds or upon dirty and wounded mucous membrane of nose, mouth, anus, vagina etc. This cause great discomfort and delays healing of wounds.

Prevention of Flies from Spreading Diseases

This can be done by—

- Keeping the food stuff always covered.
- Keeping sputum, cough, vomit and stools of infected patients always covered and disposing these at the earliest time.
- Keeping the houseflies out of our dwellings by covering our doors and windows with thin wire nets.
- Effectively treating patients of all such diseases that are spread by the houseflies.

4.2.4. Cockroach (*Periplaneta americana*)

Cockroach is a nocturnal omnivorous insect, which live in damp places and have become resident of human homes and thus is a serious pest and vector for several human diseases. The body of cockroach is dorsiventrally flattened, segmented and divisible into three distinct regions—**head, thorax** and **abdomen**. The head bears (a) a pair of **compound eyes**, (b) a pair of thread like **antennae** laying in front of eyes for sensing and monitoring the environment and (c) Biting and chewing type of mouthparts, which consists of a **labrum** (upper lip), a pair of **mandibles**, a pair of **maxillae** a labium (lower lip) and a median **hypopharynx** (acting as tongue). The

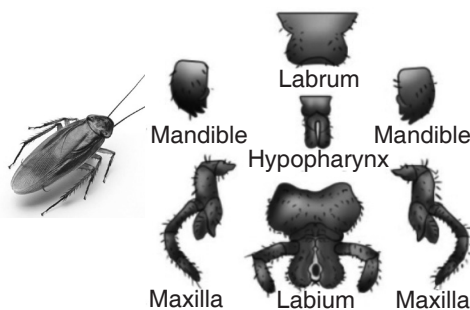


Fig. 4.8. Cockroach and its mouth parts

thorax bear 3 pairs of **jointed legs** and 2 pairs of **wings**. The abdomen consists of 10 segments. The abdomen has anus and genital aperture at the hind end. The genital aperture is surrounded by external genitalia called **gonopophysis** or **phallomeres**.

Life Cycle of Cockroach

Cockroaches are unisexual. March to September in their active breeding season. Mating or copulation occurs during nights. Fertilization is internal and occurs in the genital pouch of female cockroach. The fertilised eggs are encased in capsule called **ootheca**. On an average a female produces 9-10 ootheca, each containing 14-16 eggs. The development of eggs is completed inside the ootheca in about 5 to 13 weeks. On completion of embryonic development, the ootheca ruptures and the young ones hatch out.

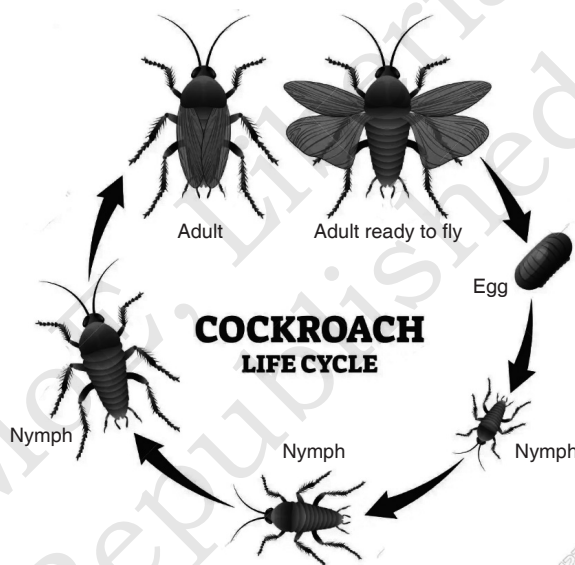


Fig. 4.9. Life cycle of cockroach

The young ones are structurally like the adults, but very small, light coloured and wingless. These are called **nymphs**. The nymph moults 13 times to become an adult. The next to last nymphal stage has wing pads which develop into wings in the last moult, and the nymph become an adult. The metamorphosis in cockroach involves only growth of nymph into adult. Such a metamorphosis is called **incomplete** or **paurometabolic**.

- Cockroaches are one of the most common household insect pests, as it destroy and contaminate with its smelly excreta.
- Cockroaches usually live in dark and damp places like gutters and reach our kitchens, and can transmit a variety of bacterial diseases by contaminating food stuff.

Control of Cockroaches

- A food mixed with an insecticide, baits are among the most effective insecticides for controlling cockroaches in homes.

- To prevent the spreading of cockroach borne diseases, the food stuff should always kept covered.
- Always keep the kitchen clean after cooking and clean all the utensils especially after the night meals.

ACTIVITY 4.3

Study of life cycle of mosquito (*Anopheles*) from a chart.

Draw a neat and well labelled diagram of the life cycle from a chart. Observe the role of mosquito in the life cycle of **Plasmodium** (malarial parasite), and in transmission of malaria in human population.

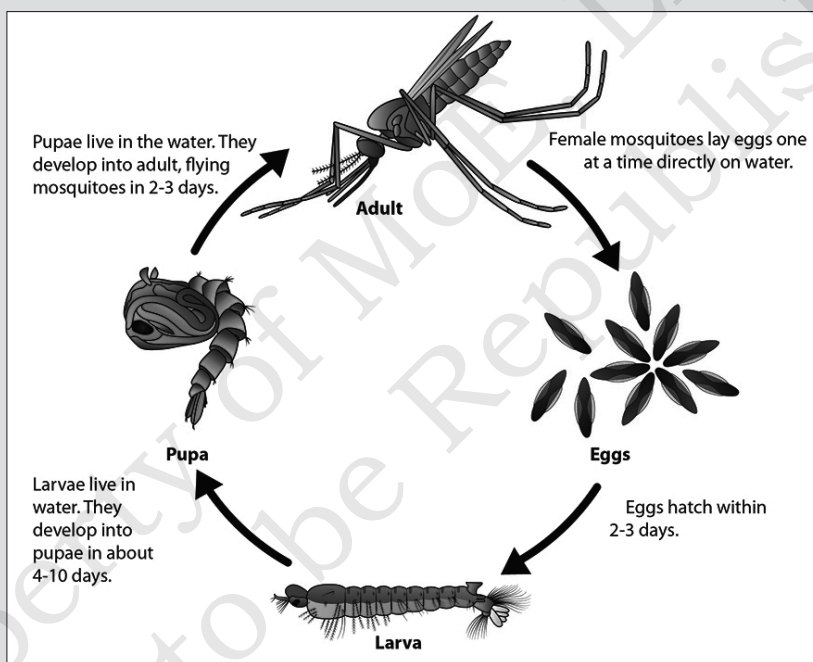


Fig. 4.10. Life cycle of *anopheles*

ACTIVITY 4.4

Study of mosquito larvae/wigglers

Visit a pond/ditch where mosquito are breeding. Collect some water containing mosquito larvae in a beaker from the pond and bring it in the laboratory. Place a larva on a slide with the help of dropper/forcep in a drop of water. Study the structure of the larva using hand lens, and draw its diagram.

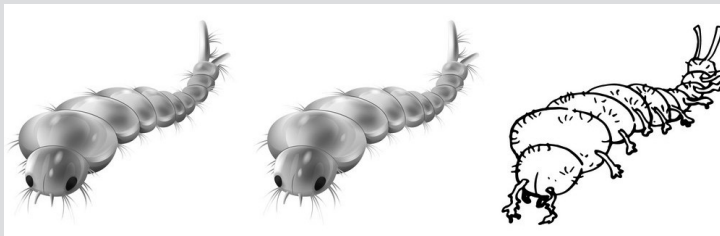


Fig. 4.11. Larva of mosquito

4.3. CAST SYSTEM IN SOCIAL INSECTS

Social insects such as ants, bees, termites and wasps are some insects known to have developed cast systems. Typical castes in insect societies include the **queen** (the sexual female, responsible for reproduction) the **workers** (the usually sterile caretakers of the queen and her eggs and larvae), and the **soldiers** (defenders of the colony). In many insect species differentiation of insect larvae into various castes is determined by diet, although hormones and environmental factors also affect their development. Some insects (such as some ant species) also produce sub-castes of workers or soldiers, which are morphologically and functionally distinct. They produce minor and major sub-castes. The minors perform foraging duties, while majors having large bodies and heads are involved primarily in defense. A reduction in the population of minor, causes majors to take over their duties, thereby promoting colony survival.

4.4. ECONOMIC IMPORTANCE OF SOCIAL INSECTS

Today, the life of every human being is affected by insects one way or the other. Insects which produce honey, wax, lac dyes and silk are commercially beneficial to man. Quite a number of insect species are closely related to agriculture, human health and natural resources having both beneficial and harmful effects. Some common economically insects are described below.

4.4.1. Honey bee (*Apis*)

Honey bees are social insects known for producing honey and beeswax. These live in highly organised colonies. They feed upon nectar and pollen of flowers. Each colony has its own nest called **honeycomb** or **beehive**. A beehive comprises thousands of small, symmetrical and hexagonal chambers called '**cells**' made of beeswax. The cells are used for storing

honey and pollens as well as for rearing the brood.

Honey bees make beehives upon tree branches, ceilings of old abandoned houses or inside caves and hollow stems of old trees.

Each beehive harbours a colony of thousands of polymorphic bees belonging to single family. The polymorphic individuals are of three main types— (i) a single **queen** (fertile female) (ii) one to a few hundred **drones** (fertile males) and (iii) thousands of **worker bees** (sterile females).

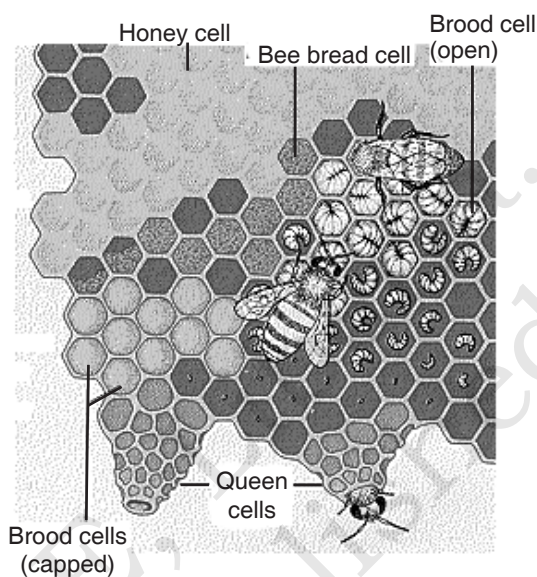


Fig. 4.12. Honeycomb

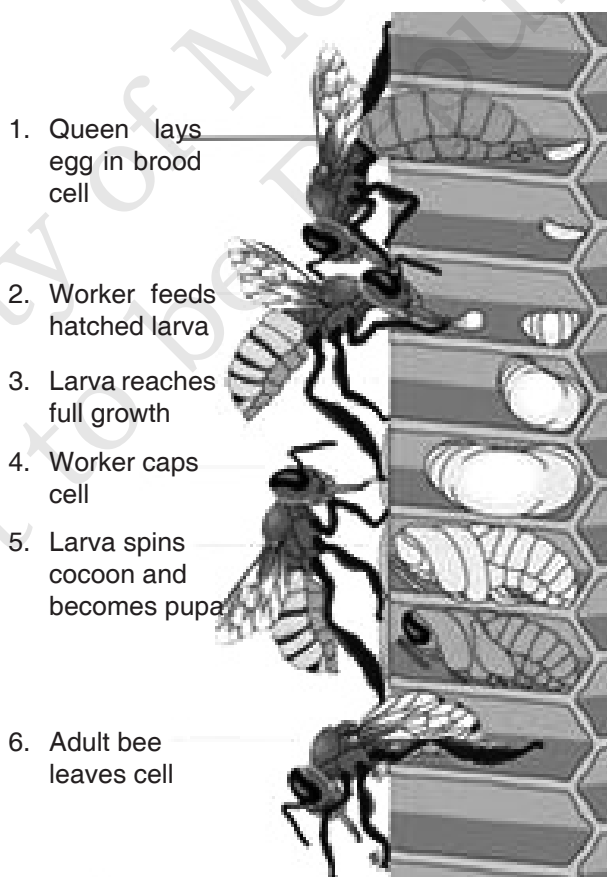


Fig. 4.13. Polymorphic individuals of honey bees

- The queen is the supreme being in a colony because all the main activities in the hive revolve around her. She normally lives for about five years and does nothing except laying eggs. Her body is nearly five times larger than that of a worker bees. She lays about one to three thousand eggs per day during the favourable season and about fifteen lacs of eggs during her life time.
- The drones are smaller but stouter than the queen. Their sole function is to fertilise the queen. Hence, during breeding season, these are well-fed by the workers, and can be often seen flying and mating with young queens in flight. After breeding season, they are neglected and driven out of the hives to die of hunger and heat.
- The workers are considerably darker and smaller with strongest mouthparts and well developed wings. Their body is covered with hair like bristle. They possess '**chewing and lapping** type' of mouthparts and four pairs of **wax secreting glands** on ventral surface of abdomen. The legs of worker bees are modified to collect pollen and thus help in pollination of plants. Due to their heavy duty life, the worker bees live only two to four months. The functions of worker bees change with age. Accordingly, they fall under three age-groups or casts.
 - (i) **Scavenger or sanitary bees:** For the first three days each worker bee acts as scavenger cleaning the empty cells of the colony for reuse.
 - (ii) **House or Nurse bees:** For the fourth day onwards each worker bee feeds the earlier brood like a foster mother. From the seventh day, these start secreting **royal jelly** (a special feed) with which, these start feeding young larvae, the queen and the older larvae which are destined to develop into future queens.
 - (iii) **Foraging and Field bees:** When the bee is about 15 days old, it takes up the most strenuous job of foraging and exploring new sources of nectar and pollen. The field bees may forage several kilometres from the hive.

Life Cycle

The queen bee is the mother of the whole colony of a beehive. She is looked after by a group of about fifty worker bees and periodically fed with highly nutritious royal jelly. The queen lays two types of eggs. (i) **fertilised eggs**, which develop into **queens** or **workers** and (ii) **unfertilised egg**, which develop into **drones** (male bees) from respective eggs, the development of queens, drones and workers respectively takes about 16, 14 and 21

days. A small worm like larva called **grub** hatches out from each egg in about 3 days. Each larva undergoes rapid growth accompanied with five moults. Then the nurse bee close its cell with wax within its closed cell, each larva, spins a silken **cocoon** and changes into **pupa**. The pupa metamorphoses into the adult and imerges out of its cell as a young bee called **imago**.

During spring when there is over crowding the old queen flies away with thousands of worker bees in swarm. These select a new suitable place to build a new hive. In the old hive new queens and drones develop from fresh brood. The earliest one of the new queens stings all other developing queens to death, and then make a **mating (nuptial) flight** with swarms of drones.

During this flight, the new queen is fertilised by one of the drones which dies after copulation. The queen returns to the hive and starts laying eggs to increase the population.

Honey and Bees Wax

Honey bees supply us honey and bees wax. The bees wax is used in making candles, cream, polish carbon ribbons and papers, cosmetics, certain ointments etc.

The honey is a natural antiseptic and valuable tonic for human body. It contains several substances of high medicinal value. It prevents infections if applied on wounds. It is also used to cure ulcers.

ACTIVITY 4.5

- Arrange a seminar to discuss economic importance of arthropods.
- Discuss about the arthropods that give us useful products and food (like prawns and crabs).
- Discuss about the arthropods that are harmful or dangerous for us.

4.4.2. Termites (white ants)

Termites are the harmful insect to household articles. These are common pest in houses and crop fields. Termites are very fond of cellulose. Hence attack and eat up paper and wood excavating extensive tunnels in cup boards and books, furniture, timber and stems of trees. Termites are social and polymorphic insects, living in large and well organised colonies. Each colony includes a **queen**, a **king** and thousands of **soldiers** and **workers**.

- The **workers** are small wingless and sightless sterile individuals. These construct the nest and tunnels of the colony, collect the food, feed the queen and look after the queen eggs and young ones.
- The **soldiers** are like the workers but are slightly larger and have stronger mouthparts. These protect the colony from enemies and keep a control over the workers.
- There is single royal pair of **queen** and **king** which are wingless but fertile. The queen is very large, thick, cylindrical and remains almost motionless. The king always remains with the queen and copulates with it from time to time.

Life Cycle

The eggs produce nymphs. Most of the nymph that hatch out from eggs develop into wingless workers and soldiers but at certain time of the year, some develop into fertile and winged (alate) male and female individuals. These abandon the colony and fly away in large swarms. These separate pairs of male and female individuals settle down in other locations to establish new colonies. After setting in a new locations the male and female individuals drop their wings (dealation) and copulate to raise their own colonies.

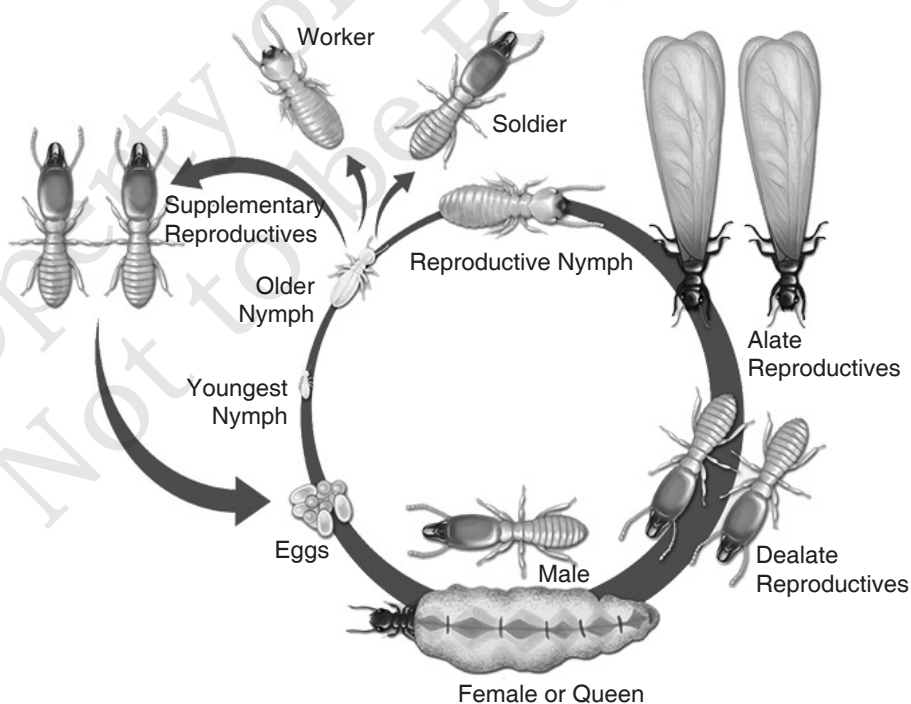


Fig. 4.14. Life cycle of termites

4.5. PESTS

Pests are the harmful organisms that cause damage to crop plants. Of all the pests, insects are the most common and they causes the maximum damage.

4.5.1. Economic Importance

Many of the pests transmit several viral, bacterial and fungal diseases of plants. Some insects like locust descend on crops in huge swarms and eat away the leaves and soft parts. The damage can be devastating over a wide area. Aphids and leafhoppers suck plant juices and make plants weak and susceptible to diseases. Some bore and drill holes in plants, while some others chew away plants parts. Certain insects like weevils, damage stored grains and bring about extensive losses. Termites and white ants attack the roots of crop and then damage their aerial parts. Many other pests like spider attack several fruit crops. Therefore, to minimise crop losses it is necessary to enforce control measures.

4.5.2. Control of Pests

Pest control uses various techniques to eliminate populations of specific pests to increase productivity of crops. The two most common methods are the use of chemicals (pesticides) and biological pest control.

(i) Chemical control: Pests can be kept under control in many ways. The main way to kill off pests by using chemicals called pesticide. Pests can be insects, rodents (such as rats, rabbits), weeds, fungi, bacteria and viruses. The pesticides are the substances used to control any type of the pest.

The pesticides are used in the form of powder, solutions, emulsions or fumes. Being poisonous (toxic), these effectively destroy harmful insects and other pests. These pesticides can be put into three categories.

- (a) **Stomach poison**—These are sprayed upon the food of pests, when ingested, the poisoned food kills the pest. Lead arsenate, sodium arsenate, sodium fluoride, bordeaux mixture are commonly used for this purpose.
- (b) **Contact poisons**—Some of the most popular contact insecticides are DDT, flit, pyrethrum, gammexane, aldrin, toxophene etc.

- (c) **Fumigants**—These are poisonous smokes for killing the insects common among these are sulphur, cyanide, ethylene dichloride, methyl bromide etc.
- (ii) **Biological control:** This is a self-perpetuating control mechanism which can be used in the following ways.
- (a) **Predation**—By increasing/releasing the predators of the specific pest (like lizards, non-poisonous snakes, spiders, birds etc.), which keep the pest population under control.
- (b) **Parasitism**—In this method, specific pathogens of pests (such as viruses, bacteria, fungi) that cause diseases in pests can be introduced to keep their population under control.

ACTIVITY 4.6

- **Lab Activity: Draw and label the parts of each class of arthropods**

Draw labelled diagrams of following animals from chart or model on your notebook.

- | | | |
|-----------------|----------------|---------------|
| 1. Grasshopper, | 2. Mosquitoes, | 3. Millipede, |
| 4. Crab, | 5. Crayfish, | 6. Spider |

ACTIVITY 4.7

- Arrange a seminar in the class and discuss the economic importance of honey bees and termites.
- Make two groups of students of your class and discuss honey bees and termites as polymorphic and social insects.

SUMMARY

- Arthropods represent the largest phylum of kingdom Animalia comprising more than 70% of the animal species.
- They have an **exoskeleton** made up of hard impermeable **chitin**, in the form of hard plates called **sclerites**.
- Their digestive system is complete. Most head appendages form mouth parts for cutting, chewing or sucking food. Anus is terminal.
- Malarial parasite (**Plasmodium**) which causes malarial fever is transmitted by the female **Anopheles**.

- **Encephalitis** is caused by a virus (which results in high fever, headache, drowsiness and inflammation of the brain) is also transmitted by some species of **culex**.
- **Ades** mosquitoes transmits viruses of dengue, chikun gunya and **yellow** fever.
- Cockroaches are one of the most common household insect pests, as it destroy and contaminate with its smelly excreta.
- A food mixed with an insecticide, baits are among the most effective insecticides for controlling cockroaches in homes.



GLOSSARY

1. **Ecdysis (Moulting):** The process of shedding exoskeleton for growth.
2. **Metamorphosis:** The process of development of a larva into an adult.
3. **Copulation:** Act of mating and male animal deposits its sperm into the genital tract of female animal.
4. **Compound eye:** An eye consisting of several units called ommatidia.
5. **Honeycomb:** Beehive of honey bee.
6. **Brood:** A family/group young animals produced at one hatching or birth.
7. **Homometabolic:** Complete metamorphosis involving larva and pupa stages to become egg to an adult.
8. **Paurometabolic:** Incomplete metamorphosis involving only growth of nymph to develop into an adult.
9. **Connecting link:** An animal showing characters of two related groups of animals.



EXERCISES

I. Multiple choice questions.

1. The exoskeleton of arthropods is made up of a hard impermeable material known as
 - (a) Cellulose
 - (b) Chitin
 - (c) Protein
 - (d) Amino acids

2. The process of shedding of exoskeleton periodically by arthropods for growth is called
 - (a) Metamorphosis
 - (b) Ecdysis
 - (c) Oviposition
 - (d) Copulation
3. A connecting link between phylum Annelida and Arthropoda is
 - (a) *Peripatus*
 - (b) *Pheretima*
 - (c) *Periplaneta*
 - (d) *Palamnaeus*
4. Vector of human disease sleeping sickness is
 - (a) *Anopheles* mosquito
 - (b) Housefly
 - (c) Tsetse fly
 - (d) *Aedes* mosquito
5. Human disease elephantiasis is transmitted by
 - (a) *Anopheles* mosquito
 - (b) *Culex* mosquito
 - (c) *Aedes* mosquito
 - (d) Tsetse fly
6. Which of the following feature is possessed by arthropods?
 - (a) cellular level of organisation
 - (b) Non-segmented body
 - (c) Jointed appendages/legs
 - (d) Chitinous exoskeleton.
7. Which of the following insect is useful to us?
 - (a) *Musca*
 - (b) Cockroach
 - (c) Mosquito
 - (d) *Apis*
8. Which one of the following having highest number of species in nature?
 - (a) Arthropods
 - (b) Flat worms
 - (c) Round worms
 - (d) Birds.
9. Metamorphosis in cockroach is
 - (a) Ametabolic
 - (b) Holometabolic
 - (c) Paurometabolic
 - (d) None of these

II. Mention true (T) or False (F) for the following statements.

1. Mouthparts of female *Anopheles* mosquito are biting and chewing type.
2. Housefly have sponging type of mouthparts.
3. Arthropods are oviparous.
4. Female *Culex* mosquito has piercing and sucking type of mouthparts.
5. Metamorphosis in honey bee is paurometabolic.

III. Fill in the blanks from the words given in the bracket after each statement.

1. All arthropods are (unisexual/bisexual)
2. Housefly belongs to class (Diplopoda/Insecta)
3. lays its eggs in water. (Mosquito/Cockroach)
4. which causes malaria is transmitted by female Anopheles mosquito. (*Plasmodium/Wuchereria*)
5. The larva of housefly are called (nymph/maggot)

IV. Match the items of column A with those of column B.

Column A

Column B

- | | |
|----------------|---|
| (a) Cockroach | (i) Mating flight |
| (b) Termite | (ii) Ootheca |
| (c) Housefly | (iii) Queen and king |
| (d) Honey bees | (iv) Eggs laid in semi-solid decaying matter. |

V. Answer the questions briefly.

1. Name the different types of mouthparts found in Arthropods.
2. Why do most arthropods undergo moulting?
3. Describe two types of metamorphosis in Arthropods.
4. Name any two types of mosquito and mention the human diseases each of which transmit in human population.
5. How can mosquito borne diseases be prevented?
6. Name the main types of human diseases spread by mosquitoes.
7. Housefly neither bites nor sting yet we hate it? Explain.
8. How are termites harmful to mankind?
9. Write a brief note on cast system in social insects.
10. Write the advantages of honey bees.
11. Explain how can pest be controlled?