

CHAPTER – 08

APPLIED ZOOLOGY

INTRODUCTION:

The science of utilization of animals for the welfare of human beings is called **applied zoology**.

General zoology deals with the study of the morphology, structure, organisation and functions of animals. But, the applied zoology deals with the utility of animals.

Applied zoology involves the farming of animals. If the animals can not be able to farm, their benefits are harvested from the wild.

Thus applied zoology is broadly classified into two categories; the **animal farming** and the **wild harvesting**.

Animal farming is the culture and rearing of animals to exploit their benefits. The animal farming includes **sericulture, vermiculture, apiculture, pearl culture, poultry, diary**, etc.

CULTURE OF ANIMALS FOR COMMERCIAL PURPOSES:

Various animals are cultured under the supervision of human in order to obtain products and these products are processed and marketed for the profit.

1. **Honey** is one of the products of **apiculture**, which is used in **pharmaceutical and food industries** in the manufacture of **cosmetics, capsules, syrups, cream, tincture, chewing gums**, etc.
2. **Bee wax** is the another product comes from **apiculture**, which is used in the manufacture of **cosmetics, face creams, ointments, paints, polishes, candles, carbon paper** and many other **lubricants**.
3. **Silk** is one of the precious products of **sericulture**, which is majorly used in **textile industries** in the preparation of **fabrics and garments, parachutes, parachute cords, fishing lines**, etc.
4. **Silk protein** is utilized in the preparation of medicines like **ointments and cosmetics**.
5. **Vermiculture technology** is applied in **agriculture** to produce **vermicompost**; the vermicompost is used as **organic manure** to **enhance the highest yield**.
6. **Rearing of bivalve molluscs** in the **pearl culture** to produce **valuable pearls**.
7. From **the fish culture**, various commercial products are produced and marketed like **fish meat, fish oil, liver oil, fish flour**, etc.

8. **Dairy forming** is the **raising of livestock's** like **bulls, cows, buffaloes, goats, etc.** for the production of **milk** and **milk products** (like butter, ghee, curd and buttermilk), **meat, wool, fur/hair, etc.**
9. In **poultry keeping**, fowls are reared for **eggs** and **flesh**.
10. In **leather industries**, the **skin** of **cow, buffalo, goat, sheep**, are used as raw material for the manufacture of **clothings, purses, bags, shoes, belts, etc.**

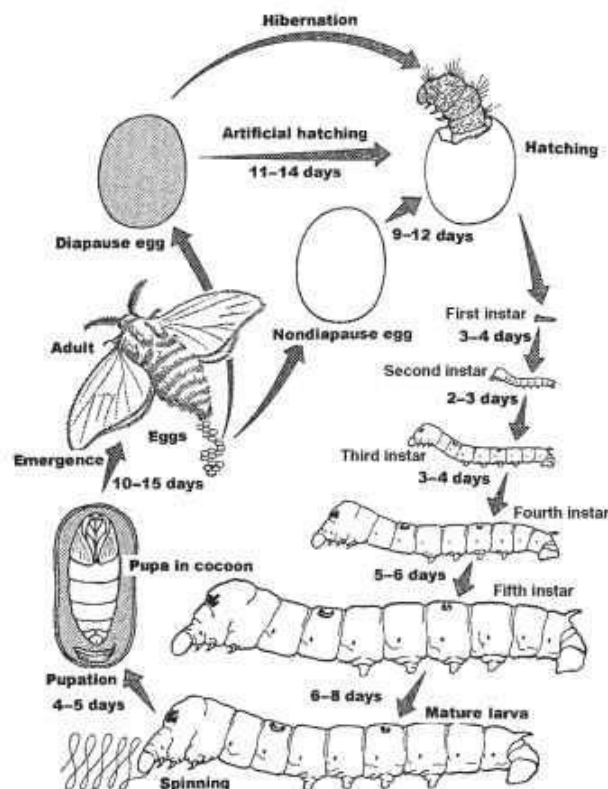
DEFINITIONS:

1. **VERMICULTURE:** 'Rearing of earthworms scientifically for composting organic wastes into valuable nutrient' is known as **vermiculture**.
2. **APICULTURE:** 'Domestication of honey bees for the collection of honey, bee wax and pollen' is known as **apiculture**.
3. **PEARL CULTURE:** 'Rearing of bivalve molluscs (oyster) which are implanted with graft tissue (piece of mantle tissue of other oyster) and nucleus (small particle of molluscs shell) for the production of pearl' is known as **pearl culture**.
4. **POULTRY:** 'Rearing of fowl for eggs and flesh' is known as **poultry**.
5. **DIARY:** 'Raising of female cattle for milk production' is known as **dairy farming**.
6. **SERICULTURE:** 'Rearing of silkworms for the production of silk' is known as **sericulture**.

MORPHOLOGY AND LIFE CYCLE OF BOMBYX MORI:

1. The adult *Bombyx mori* is about 2.5 cm in length and pale creamy white in colour.
2. Due to heavy body and feeble (weak) wings, flight is not possible by the female moth.
3. *Bombyx mori* is unisexual (having male and female individuals) and do not feed during its short life span of 2-3 days.
4. **Fertilization:** fertilization is internal preceded by copulation. Just after emergence, male moth copulates with female for about 2-3 hours and male will die after copulating with female.
5. **Egg laying:** just after copulation, female starts egg laying which is completed in 1-24 hours. A moth can lay 400-500 eggs depending upon the climate and the supply of food (during the caterpillar stage). The egg laying is always in clusters and covered with gelatinous secretion of the female moth which helps them in proper attachment.
6. **Eggs:** the eggs are rounded and white in colour. With development of embryo day-by-day the eggs become darker and darker.

7. **Hatching:** after the ten days of incubation the eggs hatch into larva called **caterpillar**. After hatching the caterpillars need continuous supply of food because they are **voracious feeders**.
8. **Caterpillar:** the newly hatched caterpillar is about 0.3 cm in length and is pale yellow-white in colour, called **black ant**. The larval stage consists of five instars. The larva undergo moulting, after 1st, 2nd, 3rd and 4th moulting, caterpillar changed into 2nd, 3rd, 4th and 5th instars respectively. It takes about **21-25 days** after hatching. The fully grown caterpillar is 7.5 cm in length and weighs about 4-6 gm.
9. **Pupa:** the caterpillars stop feeding and move towards corner among the leaves and secrete a sticky fluid from the silk gland and the fluid hardens on exposure to the air and wrapped around the body of the caterpillar in the form of a covering called cocoon.
10. **Cocoon:** cocoon is the white coloured bed of the pupa whose outer threads are irregular and inner threads are regular. The length of continuous thread secreted by a caterpillar for the formation of cocoon is about 1000-1200 meters which requires three days to complete. The pupal stage lasts for 10-12 days and the pupae cut the cocoon and emerge into adult moth.
11. **Emergence of imago:** the silkworm within the cocoon secretes an alkaline fluid to moisten its one of the ends. As a result of this moistened end becomes soft where the threads are cut open (hydrolysed) by the silkworm. Finally a hole is formed through which a feeble adult moth squeezes out of the cocoon.



REARING OF SILKWORM:

The rearing of silkworm refers to the growing of silkworms in an ideal environment to produce cocoon for silk.

For the successful rearing the following requirements are needed.

- a) Adequate supply of mulberry leaves
- b) Labours
- c) Rearing house
- d) Rearing house must be concrete building with ceiling of wood
- e) Rearing appliances- rearing stand, rearing trays, chop sticks, feather, leaf basket, leaf chamber, chopping board, chopping knife, mountage, etc.

The rearing of silkworm from egg to cocoon stage is as follows;

1. Emergence of moth and fertilization:

- a. For the production of commercial eggs loose from of cocoons are used and collective mother examination is done. Then they are kept for mass emergence.
- b. When kept for mass emergence at room temperature, mass emergence of adults takes place.
- c. Male are very much active whereas the female which are loaded with eggs are incapable of flying.
- d. Male moths start moving around the female and copulate for about three hours.
- e. One male cannot fertilize more than two females. Now the fertilized females are subjected to egg laying.

2. Egg laying:

- a. Just after the fertilization, female starts egg laying and in the duration of 24 hours it completes egg laying process. The eggs laid by one female are about 400-500 eggs.
- b. These eggs are stored at 40C under laboratory condition.
- c. The eggs (seeds) are supplied to the rearers.

3. Hatching:

- a. For the proper hatching of seeds (eggs) advanced techniques have been developed in which eggs are collected and kept with mulberry leaves in rearing trays.
- b. The rearing trays are stalked in the rearing stand and the legs of the stand must be kept on ant wells. The ant wells are filled with water so that insects may not crawl and damage the hatching eggs.
- c. The eggs are moved with the help of feather to avoid damaging.

- d. Rearers should be careful that hatching must be coincided with the best season of the mulberry.

4. Development of larvae and maintenance:

- a. The mulberry leaves supplied to the 1st and 2nd instar larvae should be young and well chopped because they are very tender in nature.
- b. The 3rd instar larvae may feed even on chopped hard leaves but 4th and 5th instar larvae can feed easily on leaves also.
- c. It is essential to clean the bed of the caterpillar once in a day for 3rd, 4th and 5th instars.
- d. The taste of the leaf is lost due to rapid loss of moisture, so rearer should be careful to stop loss of moisture from the leaf after harvesting. So it is advisable to keep the leaves wrapped in wet clothes.
- e. Fully grown 5th instar larva stops feeding and undergoes pupation and settles to a corner among the mulberry leaves and starts secreting sticky fluid.

5. Spinning of the cocoons

- a. This is the period when the caterpillar stops feeding and starts to secrete a pasty substance from the silk gland.
- b. In this condition worms should be picked up and transferred to the spinning trays (mountages) and kept in a position of slope (slanting) to the sun for a short period.
- c. Within three days spinning is over and the cocoon is formed and this is the last phase of the rearing of silkworm.

NON-MULBERRY SILKWORMS:

Non-mulberry silkworm is a type of silkworm which does not feed on mulberry leaves hence, the name non-mulberry silkworms. But they feed upon castor leaves.

There are three types of non-mulberry silkworms as follows;

1. Eri silkworm

- The name 'eri' derived from Assamese word 'era', which means 'castor'.
- It is also known as **endi** or **errandi** in India.
- *Philosamia ricini* is the scientific name for eri silkworm.
- Eri silkworm belongs to the **genus Philosamia**.
- The eri silk's **natural colour** is **white to very light cream** or **dull yellow colour**.
- The **fibre is not continuous**.
- Therefore **proper reeling is not possible**.
- They **monophagous, feeds on cassava leaves** (castor).

2. Muga silkworm

- *Antheraea assamensis*, known as the muga silkworm.
- Muga silkworm belongs to **genus Antheraea**.
- It is found in **Assam** in North-East India where **99% production occurs**.
- It has a **natural yellow-golden tint** with **glossy texture**.
- The silk is **very tough**.
- The muga silkworm is **polyphagous**, feeds on **som** and **soalu leaves**.

3. Tasar silkworm

- *Antheraea mylitta*, known as tasar silkworm.
- Tasar silk worm belongs to **genus Antheraea**.
- The genus *Antheraea* includes **Chinese, Japanese** and **Indian tasar silkworms**.
- They are **univoltine** or **bivoltine**.
- Cocoons may **be easily reeled**.
- They **feed on leaves of Terminalia** and several other minor host plants.

VERMICULTURE:

‘Rearing of earthworms scientifically for composting organic wastes into valuable nutrient’ is known as **vermiculture**.

DIFFERENT SPECIES OF EARTHWORMS USED FOR VERMICULTURE:

Dendrobaena veneta

Lampito mauritii

Lumbricus rubellus

Perionyx excavates

Eisenia fetida

COMPOSITION OF VERMICOMPOST:

1. The vermicompost is **odourless** and have **neutral pH** of 7.
2. The vermicompost contains **minerals, vitamins, mucus, enzymes, hormones, moisture** and **microbes**.
3. The minerals are of **micronutrients** and **macronutrients**. The micronutrients include **manganese, boron, zinc**, etc. and the macronutrients include **carbon, nitrogen, potassium**, etc.

4. It contains enzymes such as **protease, amylase, lipase, cellulase** and **chitinase**.
5. The compost contains **thick population of microbes**.
6. It contains hormones like **auxins, gibberellins**, etc.
7. The **mucus** secreted by the earthworm also present in the worm casts.

IMPORTANCE OF VERMICOMPOST:

1. The vermicompost is a very good **organic fertilizer** and **soil conditioner**.
2. It **improves soil fertility**.
3. It **increases aeration** in the soil.
4. It **provides porosity** to the soil.
5. It **improves moisture holding capacity** of the soil.
6. The **water holding capacity of vermicompost is 9 times greater** than that of the natural soil.
7. The burrowing action of the earthworms **enhances the permeability of water into the soil**.

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