

Notes

Paper: Applied Zoology – I (Paper I / ZO-232)

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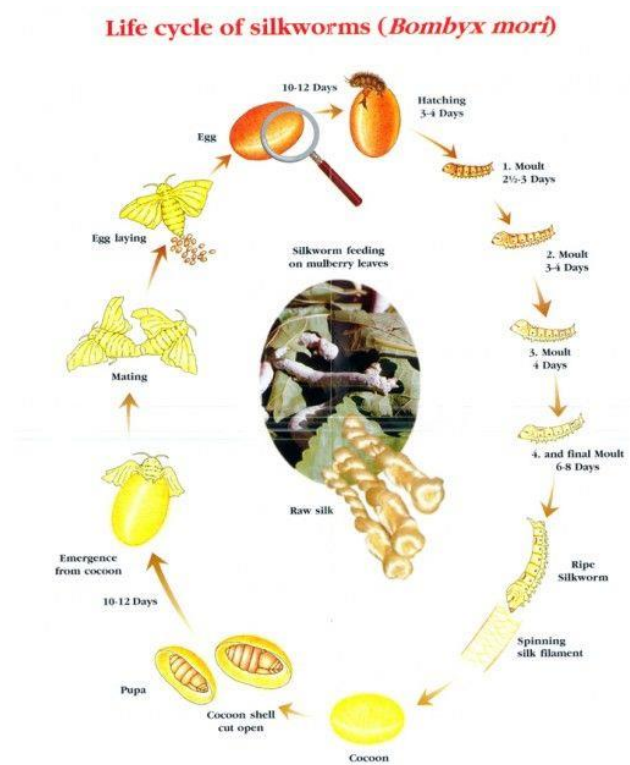
Class: S.Y.B.Sc.

Section: Sericulture

Topic: Life Cycle and External Morphology

LIFE CYCLE OF BOMBYX MORI

The silkworm undergoes is **Holometabolous** i.e. it shows **complete metamorphosis** and passes through four morphological stages i.e. **egg, larva, pupa and adult**.



Duration of Life stages:

Egg (Embryonic period): 11-14 days

Larva: 24-28 days

Pupa: 12-15 days

Adult: 6-10 days

1. Egg Stage:

The duration of egg stage in the life cycle depends on **diapausing or non-diapausing eggs**. The **temperature (24-25°C)** provided during incubation **favours the embryonic development of the egg to larva**.

2. Larval Stage:

This stage is important in sericulture. The larval life of the worm is divided into five respective stages known as **5 Instars and 4 moults**. **Instar stage is the feeding period**. The **first three instars** are referred as “**young age**” or “**Chawki worms**” and **fourth and fifth instars** as “**late age**” worms. **Moulting refers to shedding of old skin** and forming a new skin. The each moulting period lasts for 15 to 30 hrs. Growth that takes place in each instar. Larva sheds off its skin to enter new instar stage. **Before shedding the skin it stops feeding**. Silkworm larva start feeding on mulberry leaves soon after hatching. After reaching the certain growth first moult and second instar, second moult and third instar, third moult and fourth instar, fourth moult and fifth instar occur. During this long period of feeding the larvae **grows to 8,000 to 10,000 times** compared to newly hatched worm. At the end of the final instar larva stops feeding and is ready to spin the cocoon.

3. Pupa:

The mature and ripen worms spin the cocoon immediately after moulting and completes the spinning process in 48-72 hrs. In another day or two the worm transforms into pupa within the cocoon.

4. Adult:

Adult moth exhibits **sexual dimorphism** like larvae and pupa. These moths are ready to copulate immediately after emergence. Adults’ **life span** is **very short** and last for 3-10 days depending on the season and races. Female lays more than **350 eggs** at a time and the cycle continues.

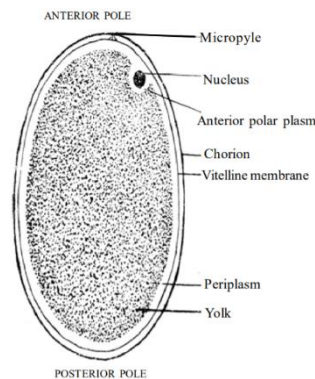
External morphology of Life stages of silkworm

Morphology is the **study of external characters** of an animal. It helps us to **identify** the animal and also to know the **different functional significance** of the organs (or) structures found. The domestic silkworm undergoes complete metamorphosis (Holometabolous) and passes through four morphological stages i.e. egg, larva, pupa and adult.

1. Egg

The silkworm eggs are **tiny and weigh around 2000 eggs to a gram**. It measures **1-1.3 mm in length** and **0.9 – 1.2 mm in width**.

The **protective covering** of the egg is called **Chorion**, which has an **opening called micropyle at the anterior end**. There is a **thin membrane called Vitelline membrane** inside the chorion. The vitelline membrane **covers the protoplasm and the yolk**. The yolk is not present throughout the egg but present just below the vitelline membrane. A thin layer of cytoplasm does not contain the yolk and this portion is called the **Periplasm** which is particularly thick around the micropyle. This area is called an **anterior polarplasm** and contains the **egg nucleus**.



2. Larvae

The newly hatched larva is black or dark brown in colour measuring about quarter of an inch i.e. 3 mm in length. Fully grown larvae are 6-8 cm in length. The body is densely covered with bristles. As the larva grows by passing moults to enter into later instars the body changes morphological characteristics and becomes smooth and light in colour due to rapid stretching of cuticular skin. The body has 3 divisions i.e., head, thorax, abdomen.

A. Head region:

It is **large** and bears **mandibulate** mouth parts and **3 pairs of ocelli**. Ocelli are simple eyes to detect the movement.

A hook like structure is present for extrusion of silk from inner silk gland. It is called as **spinneret**.

B. Thorax:

Thorax consists of three body segments called the **pro-meso and metathorax**. Each of the three thoracic segments carries **ventrally a pair of legs** each comprising in turn three jointed segments. These are the **true legs** which are conical in shape and carry sharp distal claws. Claws are for holding mulberry leaves while feeding.

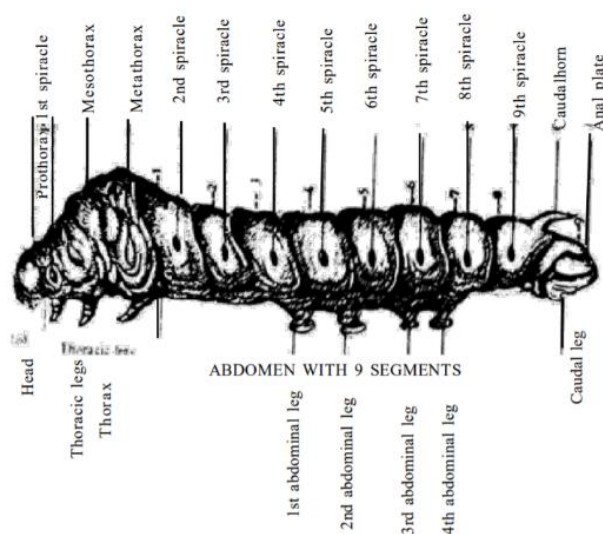
C. Abdomen:

The abdomen is comprised of **eleven body segments** although only nine can be distinguished and the **last three are fused** together to form the apparent ninth segment, the anal plate and the caudal legs.

3rd, 4th, 5th, 6th and 9th abdominal segments bear psuedolegs.

A series of **respiratory spiracles** are present on either lateral side of abdomen.

The larval life lasts for 3-4 weeks. During which it sheds its skin for 4 times. This process is called **moulting**.

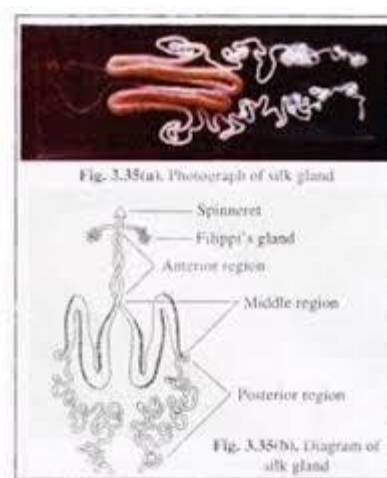


Silk gland:

A pair of sac like glands called as silk glands develop when the larvae matures. These are modified salivary glands. It has 3 distinct regions: posterior, middle and anterior

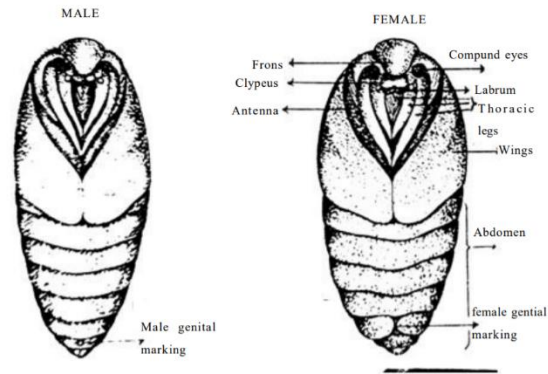
- i. Posterior region secretes fibroin.
- ii. Middle region secretes sericin.
- iii. Anterior region only transports the assembled silk to the spinneret.

There are 2 opening from which a filament is secreted each called as “brin”. These 2 brins are bind together to form a single silk filament.



3. Pupae:

Fully grown larva **stop feeding** and find a place for attachment. Now the larva is ready to spin the cocoon. This takes about 3 days. The cocoon is formed from secretion called silk filaments from silk glands. It is a **clear viscous fluid, but when exposed to air, it hardens** to give a silk fibre. 2 brins are secreted which are glued by sericin protein or silk gum to form a silk filament. It is also called as **seric bane**. It is about **500meter long and 0.02 mm wide**. Temperature and humidity influence the cocoon formation. **Cocoon provides protection to pupa**. Pupal stage is generally a **resting, inactive stage**. This is called pupating. At last there is **formation of adult organs**. Pupa is white in color but gradually changes its color to **dark brown and hardens**. Ten of the abdominal segments are seen on the ventral side when nine are seen from dorsal side. Seven pairs of spiracles are found in first seven segments and last pair is non-functional.



4. Adult stage:

The adult moth emerging from the pupa is incapable to fly. It **does not feed** during its **short adult life**. The body of the moth is composed of three distinct segments i.e., Head, Thorax and Abdomen. The adult body surface is **covered with scales**.

A. Head:

The **compound eyes** are situated on the either side of the head. The **ocelli are absent**. The **antennae are conspicuous, large and bi-pectinate**.

B. Thorax:

The thorax consists of three segments namely **pro, meso and meta thorax**. The meso thorax is the largest and is pentagonal. There are **three pairs of thoracic legs**, one pair on each of the three thoracic segments. Each of the thoracic leg consists of five segments. The **meso and meta thorax bear two pairs of wings**, the front pair overlapping with the hind pair when the moth is in the resting position

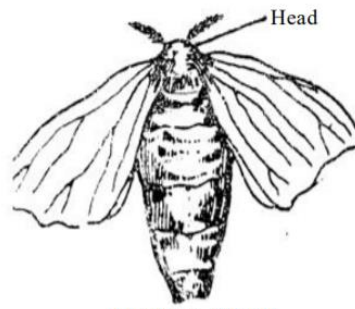
C. Abdomen:

In the **male adult eight abdominal segments** are visible, in the **female seven segments**. There are **six pairs of spiracles** present laterally on either side of the body.

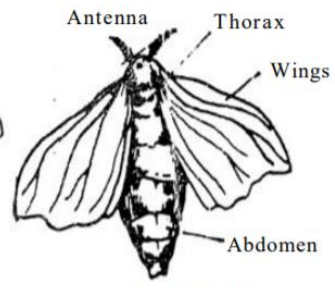
Morphologically the female and the male can be distinguished in the adult stage. The **female has comparatively smaller antennae, its body and the abdomen are fatter, larger and it is generally less active than the male moth**.

At the caudal end, the **male moth has a pair of hooks known as harpes**, whereas the **female moth has a knob like projection with sensory hairs**.

These differences help to a large extent in separating the sexes for preparation of hybrid eggs



FEMALE MOTH



MALE MOTH