

WELCOME


ALL S.Y.B.Sc. STUDENTS

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M.Sc.B.Ed.

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S.Y.B.Sc.	Semester I	Semester II	Credits
C.C.	ZO - 231 Animal Diversity III	ZO - 241 Animal Diversity IV	2 + 2
 C.C.	ZO - 232 Applied Zoology I	ZO - 242 Applied Zoology II	2 + 2
C.C.	ZO - 233 Zoology Practical Paper	ZO - 243 Zoology Practical Paper	2 + 2

New Credits Pattern and Mark distributions as per semester

First Semester

Paper	Semester III Course Code & Course	Credits	No of Hours	Marks (Internal + University)
I	ZO - 231 Animal Diversity III	2	30	15+35 =50
II	ZO - 232 Applied Zoology I	2	30	15+35 =50
III	ZO - 233 Zoology Practical Paper	2	14 Practicals	15+35 =50

Second Semester

Paper	Semester IV Course Code & Course	Credits	No of Hours	Marks (Internal + University)
I	ZO - 241 Animal Diversity IV	2	30	15+35 =50
II	ZO - 242 Applied Zoology II	2	30	15+35 =50
III	ZO - 243 Zoology Practical Paper	2	14 Practicals	15+35 =50

Applied Zoology I and II

Objectives :

1. To understand the basic life cycle of the honeybees, beekeeping tools and equipment.
2. To learn for managing beehives for honey production and pollination.
3. To understand the basic information about fishery, cultural and harvesting methods of fishes.
4. To understand fish preservation techniques.
5. To understand the biology, varieties of silkworms and the basic techniques of silk production and harvesting of cocoons.
6. To learn the different silkworm species and their host plants.
7. To study types of agricultural pests and Major insect pests of agricultural importance.
8. To study Pest control practices.

Learning Outcomes of the course:

1. The learner understands the basics about beekeeping tools, equipment, and managing beehives.
2. The learner understands the basic information about fishery, cultural and harvesting methods of fishes and fish preservation techniques.
3. The learner understands the biology, varieties of silkworms and the basic techniques of silk production.
4. The learner understands the types of agricultural pests, Major insect pests of agricultural importance and Pest control practices.

Course Title - Applied Zoology I

Course Code - ZO - 232

Semester III 2 Credits - 30 lectures

Unit-1-Sericulture:

1.1 An introduction to Sericulture, Study of different types of silk moths, their distribution, Taxonomic position and varieties of silk produced in India : Mulberry, Tassar, Eri and Muga silk moths.

1.2 External Morphology and life cycle of *Bombyx mori*.

1.3 Cultivation of mulberry :

a) Varieties for cultivation,

b) Rain fed and irrigated mulberry cultivation- Fertilizer schedule, Pruning methods and leaf yield.

1.4 Harvesting of mulberry :

a) Leaf plucking, b) Branch cutting, c) Whole shoot cutting.

1.5 Silk worm rearing :

- a) Varieties for rearing,
- b) Rearing house,
- c) Rearing techniques,
- d) Important diseases and pests.

1.6 Preparation of cocoons for marketing.

1.7 Post harvest processing of cocoons :

- a) Stiffling, sorting, storage, deflossing and riddling,
- b) Cocoon cooking, reeling equipment and rereeling, washing and polishing.

1.8 Biotechnological and biomedical applications of silk.

An introduction to Sericulture:

The rearing of silkworms for the production of raw silk is known as **sericulture**. **Sericulture** is the art of rearing silk worms under artificial or domesticated conditions and extraction of the silk fiber from their cocoon.

Sericulture is an agro-based industry. It involves rearing of silkworms for the production of raw silk, which is the yarn obtained out of cocoons spun by certain species of insects. Cultivation to feed the silkworms that spin silk cocoons and reeling the cocoons to unwind the silk filament for value added advantages like process and weaving are the major activities of sericulture. Silk has been blended with the life and culture of the Indians.

Silk is the most elegant textile in the world with natural radiance, and inherent affinity for dyes, high absorbance, lightweight weight, soft touch and high sturdiness and called the “Queen of Textiles” the world over Sericulture business provides employment to roughly 8.25 million persons in rural and semi-urban areas in India throughout 2015-16.

It stands for livelihood opportunity for millions owing to high employment oriented, low capital intensive and remunerative nature of its production.

Study of different types of silk moths, their distribution:

Types of Silk:

Moths belonging to families Saturniidae and Bombycidae of order Lepidoptera and class Insecta produce silk of commerce. There are many species of silk-moth which can produce the silk of commerce, but only few have been exploited by man for the purpose. Mainly four types of silk have been recognised which are secreted by different species of silk worms.

Mulberry Silk:

This silk is supposed to be superior in quality to the other types due to its shining and creamy white colour. It is secreted by the caterpillar of *Bombyx mori* which feeds on mulberry leaves.

Tasar Silk:

It is secreted by caterpillars of *Antheraea mylitta*, *A. paphia*, *A. royeli*, *A. pernyi*, *A. proylei* etc. This silk is of coppery colour. They feed on the leaves of Arjun, Asan, Sal, Oak and various other secondary food plants.

Eri Silk:

It is produced by caterpillars of *Attacus ricini* which feed on castor leaves. Its colour is also creamy white like mulberry silk, but is less shining than the latter.

Munga Silk:

It is obtained from caterpillars of *Antheraea assama* which feeds on Some, Champa and Moyankuri

Study of different types of silk moths, their distribution:

TYPES OF SILK

<u>SILK TYPE</u>	<u>SILKWORM</u>	<u>HOST PLANT</u>	<u>DISTRIBUTION</u>
Mulberry silk	<i>Bombyx mori</i>	<i>Morus alba</i> <i>M. Indica</i> <i>M. Serrata</i> <i>M. Lattifolia</i>	Europe China USA
Tropical tasar silk	<i>Antheraea mylitta</i>	<i>Terminalia tomentosa</i> (asan or yen) <i>T. Arjuna</i> (arjun) <i>Shorea robusta</i> (sal)	Tropical forest zone ranging from Bihar Jharkhand to Karnataka
Temperate tasar silk	<i>A. proylei</i> <i>A. roylei</i>	<i>Quercus serrata</i> (oak)	Sub Himalayan region and n-eastern India
Muga silk	<i>A. Assama</i>	<i>Machilus bombycina</i> (som) <i>Litsaea polyantha</i> (soalu)	Brahmaputra valley
Eri or errandi silk	<i>Philosamia ricini</i>	<i>Castor</i> , <i>Ricinus communis</i> (kesseru)	Assam and eastern parts of India

Order: Lepidoptera

Mulberry silk moth



Tasar silk moth



Muga silk moth



Eri silk moth

Kingdom: Animalia
Phylum: Arthropoda
Class: Insecta
Order: Lepidoptera
Family: Bombycidae
Genus: *Bombyx*
Species: *mori*

Silk moths



Male



Female

LIFE CYCLE OF BOMBYX MORI

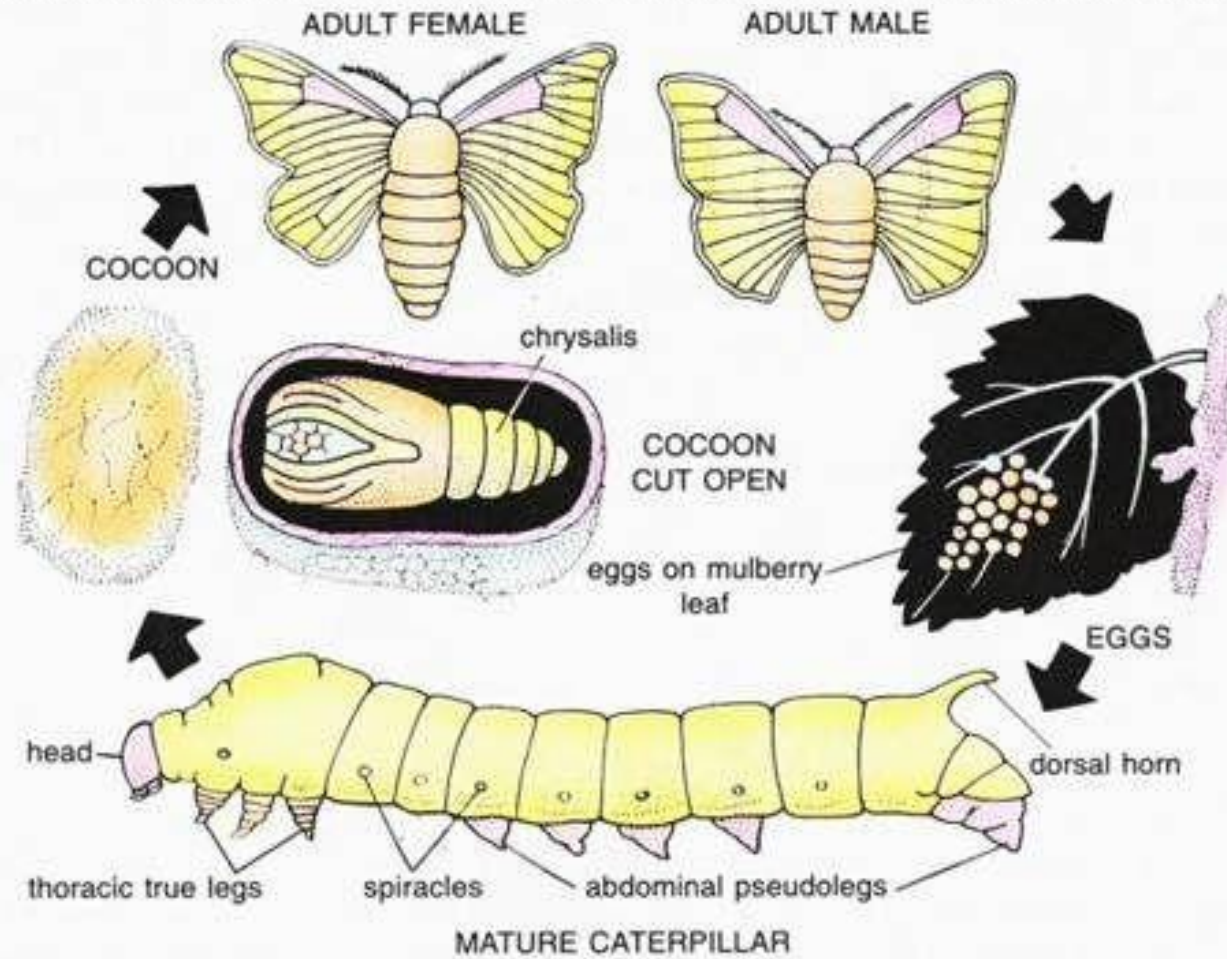


Fig. 78.1. *Bombyx mori*. (Silkworm). Life history.



Life Cycle of *Bombyx mori*:

The life cycle of *Bombyx mori* demonstrates the most advanced form of metamorphosis. The serial progressions of four distinct stages of development complete one generation of the species; egg, larvae, pupa and adult.

Eggs:

Egg is the first stage of a silkworm's life cycle. The female moth lays an egg about the size of an ink dot during summer or the early fall. The egg remains in dormant stage until spring arrives. The warmth of the spring stimulates the egg to hatch. The egg of *Bombyx mori* is a very small and hard structure; about the size of a pin head and resembling a poppy seed. The egg shell provides a protective covering for embryonic development. When first laid, an egg light yellow. A fertile ovum darkens to a blue-gray within a few days.

Larva:

The larva is the vegetative stage where growth takes place. The larva of *Bombyx mori*, commonly called a silkworm, is host specific to mulberry. During growth, the larva molts 4 times. The period between successive molts is called an instar. The silk worm, upon hatching, is about 1/8th of an inch and extremely hairy.

Young silkworms can only feed on tender mulberry leaves. However, during the growth phase they can eat tougher mulberry leaves as well. The larval stage lasts for about 27 days and the silkworm goes through five growth stages called instars, during this time. During the first molting, the silkworm sheds all its hair and gains a smooth skin.



Pupa:

As the silkworm prepares to pupate, it spins a protective cocoon. About the size and color of a cotton ball, the cocoon is constructed from one continuous strand of silk, perhaps 1.5 km long (nearly a mile). The silk cocoon serves as protection for the pupa. Cocoons are shades of white, cream and yellow depending on silkworm genetics. After a final molt inside the cocoon, the larva develops into the brown, chitin covered structure called the pupa. Metamorphic changes of the pupa result in an emerging moth.

If the silkworms are allowed to mature and break through the cocoon, the silk would be rendered useless for commercial purposes. So the encased insect is plunged into boiling water to kill the inhabitant and dissolve the glue holding the cocoon together. The end of the silk is then located and the cocoon unwound onto a spindle to be made into thread.



Cocoon:

Cocoon is the stage in which the larva spins silk threads around it, to protect itself from its predators. The larva traps itself inside the cocoon in order to pupate. The color of the cocoon varies, depending upon what the silkworm eats. It can range from white to golden yellow. The second molting occurs inside the cocoon, when the larva turns into a brown pupa. It takes about 2-3 weeks for the pupa to metamorphose into an adult moth.



Adult:

The adult stage completes the life cycle of *Bombyx mori*. It is the reproductive stage where adults mate and females lay eggs. Moths are flightless and lack functional mouth parts, so are unable to consume the food/nutrition.

Once the adult moth comes out of its cocoon, its only purpose is to find a member of the opposite sex, and mate. Males are larger than females and more active. They flap their wings rapidly to attract the females. Within 24 hours of mating, the male moth dies, while the female lays abundant eggs, after which it dies as well. There on, a new silkworm life cycle begins.

