

Project



॥ ज्ञानम् परम् ध्येयम् ॥

Shri Shivaji Education Society, Amravati's

SHRI SHIVAJI SCIENCE & ARTS COLLEGE, CHIKHALI
Dist. Buldana

Internal Assessment - Assignment / Project Report / Seminar

Name of the Student Ku. Gauri Rajendra Bholane

Class B.Sc. II (Sem. IV)

Academic Session : 20 21 - 20 22

Marks Obtained : $\frac{04}{04}$



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CERTIFICATE

Name of Department: Zoology

Academic Session : 20 21 - 20 22

This is to certify that this ~~Assignment/Project Report/Practical Book~~, Contains the Bonafide Record of ~~Shri/Kumari/Shrimatt~~ Gauri Rajendra Bholame of B.Sc. II (Semester IV) during the academic Session 20 21 - 20 22.

The Topic of the assignment / Project Report is Silkworm : Types
and Life Cycle

Dated 13 / 04 / 20 22

Signature of the Teacher

who guide / taught the Examinee.

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Project Title

Silkworm : Types and Life Cycle

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INTRODUCTION

Sericulture is the science that deals with the production of silk by rearing of silkworm. Silk originating in the spittle of an insect is a natural fibrous substance and is obtained from pupal nests or cocoons spun by larvae known as silkworm. The silk is preferred over all other types of fibres due to its remarkable properties like water absorbency, heat resistance, dyeing efficiency, and luster. Factors mainly influence the physiology of insects are temperature and humidity.

Silkworm is one of the most important domesticated insects, which produces luxuriant silk thread in the form of cocoon by consuming mulberry leaves during larval period. The growth and development of silkworm is greatly influenced by environmental conditions. Throughout this process, the silkworms are looked after & are fed leaves from specific plants (usually Mulberry plants). Rearers must ensure the Silkworms get plenty of food during their larval growth to ensure complete metamorphosis. Thus, sericulture includes cultivating & maintaining these food plants as well (Moriculture). But then again there are some kinds of silk whose threads are produced by wild or semi-wild silkworms. They feed on leaves of trees like som & oak in open forests. Once the silkworms have completed their larval cycles they turn into pupae, similar to chrysalis in butterflies, after wrapping themselves up with fine threads in a cocoon. The rearers harvest the cocoons once the pupae reaches its maturity phase (before they emerge as moths). The harvesting process is called rearing.

Types of Silkworm

Four of the most well known silk varieties found in India are Mulberry, Eri, Muga and Tasar. Each silk is reared in its own different ways and processes and its own unique properties. They belongs to

Phylum : Arthropoda

Class : Insecta

Order : Lepidoptera

1. Bombyx Mori (Mulberry Silk)

Bombyx mori, the domestic silk moth, is an insect from the moth family Bombycidae. It is the closest relative of Bombyx mandarina, the wild silk moth. The silkworm is the larva or caterpillar of a silk moth. It is an economically important



insect, being a primary producer of silk. A silkworm's preferred food are white mulberry leaves, though they may eat other mulberry species and even the osage orange. Domestic silk moths are entirely dependent on humans for reproduction, as a result of millennia of selective breeding. The pale larva has a characteristic posterior (caudal) horn. It attains a maximum length of 75 mm (about 3 inches) during a 45-day growing period. Pupation occurs within a cocoon that is made of one continuous white or yellow strand of silk averaging about 915 metres (1,000 yards) long. This filament is preserved intact for commercial use by killing the pupa with hot air or steam. Silkworms whose genomes have been genetically modified through the introduction

of spider silk genes produce silk that is stronger, tougher, and more elastic than that produced by domesticated silkworms.

2. *Antheraea mylitta* (Tasar Silk)

Antheraea paphia, known as the South India small tussore, the tasar silkworm and vanya silkworm is a species of moth of the family Saturniidae found in India and Sri Lanka. The bulk of the literature on this species uses a junior synonym, *Antheraea*



mylitta, rather than the correct name, *A. paphia*. It is one of a number of tasar silkworms, species that produce Tussar silk, a kind of wild silk that is made from the products of saturniid silkworms instead of the domesticated silkworm (*Bombyx mori*). The male is reddish or yellowish. Costal brown and grey fascia of forewings reaching the apex. Females may be pinkish-brown or bright-yellowish fawn; their hyaline and ocellated spots are larger than the males. Larvae are green colored with paired dorsal series of yellow humps. The cocoon is brownish grey, hard, and oval, attached to the host plant by a silken peduncle. Larvae of this species feed mainly on Terminalia trees (e.g. *Terminalia tomentosa*, *T. arjuna*) and on *Shorea robusta*. Tussar silk from this and related species of wild silkworms is a different color from domesticated silkworm silk, and it is coarser and stronger, making it more favorable in some applications.

3. *Antheraea assamensis* (Muga Silk)

Antheraea assamensis, known as the muga silkworm as a larva and Assam silk moth as an adult, is a moth of the family Saturniidae. It is found in Assam in northeast India where 99% of its production occurs. The Muga silk worm is multivoltine and passes



through four moults and five instar stages. Generally 4-5 crops are raised in a year. Muga silkworm is a polyphagous insect. It feeds on the leaves of several kinds of trees, but *Machilus bombycine* (Vern. som) and *Litsaea polyantha* (Vern. soalu) are the two principal host food plants of muga silkworm. The host plants are cultivated through propagation by seeds or vegetatively by air layering. The plants are trained and pruned regularly. Like other Lepidopterans, muga silkworm is a holometabolous insect passing through a complete metamorphosis from egg (Koni) to adult (Chakari) stage through two intermediate stages of larva (Polu) and Pupa (Leta). The entire life cycle lasts for about 50 days in summer and 120 days in winter. The wings and body of the male moth are copper brown to dark brown, while those of female, yellowish to brown. Both pair of wings bears eye spots. Besides colouration, the male moth can be distinguished from the female by its slightly smaller size, slender abdomen, bushy antennae and sharply curved forewing tips. It is a semi-domesticated species in the sense that only the larval stage is spent in open, and the ripening worms are brought indoors for spinning the cocoons.

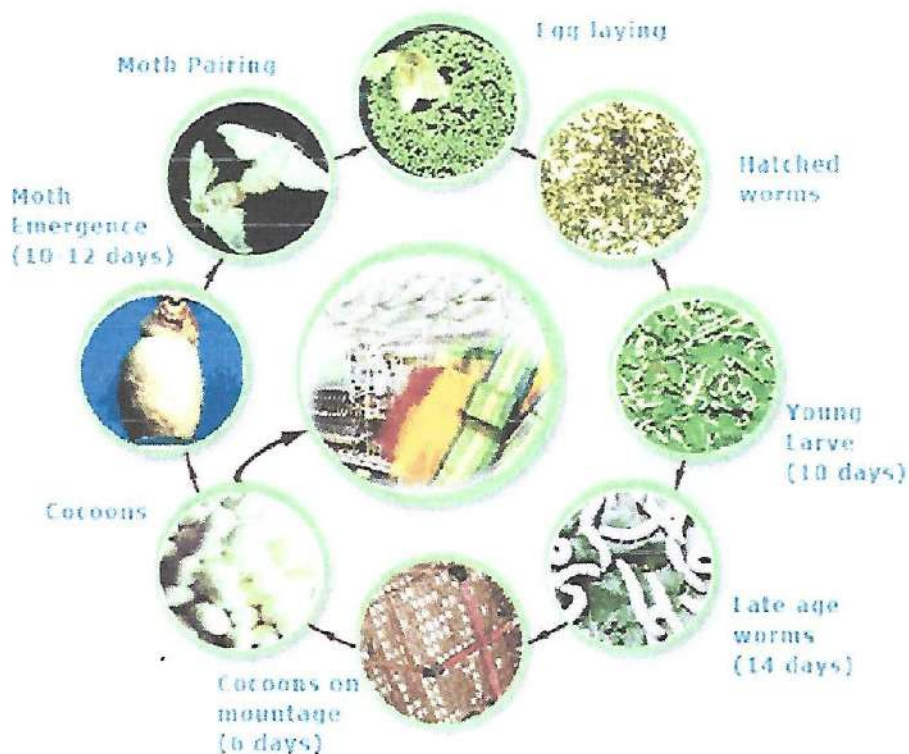
4. *Philosamia ricini* (Eri Silk)

Eri silkworm, *Philosamia ricini* is multivoltine and their cocoons are open mouthed. The Eri silkworm *Philosamia ricini*, is also known as Endi or Errandi and it belonging to family saturniidae. It is one of the commercially exploited silkworm species and can be reared indoors



throughout the year to produce silk. The silk produced by *Philosamia ricini* is called Eri silk. Eri silkworm is a polyphagous insect and feeds on the leaves of several food plants viz, Castor, Tapioca, Wild castor, Papaya, Barkesseru, Kesseru. Although, Eri silkworm is known to feed on the leaves of more than 30 host plant species but among them Castor is considered as the principal host plant. The Ricini moth has a brown wing colour in different shades of brown and has a beautiful black stripe along the wings. They also have yellow spots and lines on the wings. At the tip of the wings is a small eye spot meant to distract predators. The body of the moth is white with brown stripes. The male moth is smaller than the female moth and bears bushy antennae and a smaller abdomen. The moths are nocturnal in habit.

Life Cycle of Mulberry-Silk Moth (*Bombyx mori*)



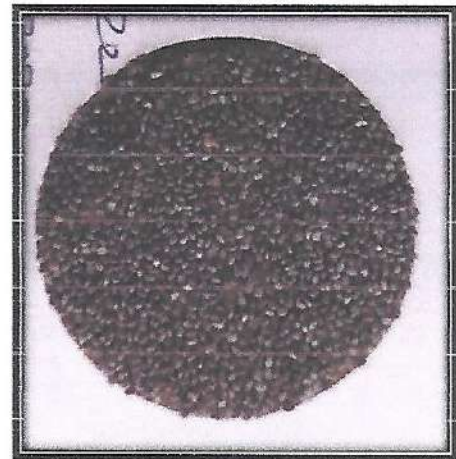
The moths *Bombyx mori* are pale, cream or ashy white in colour. They are about 2.5-3 cm. long, robust and covered with small hairs. The body is well divided into head, thorax and abdomen. The head being big in size with well-marked big compound eyes and a pair of plumose antennae. Thorax is strong muscular three-segmented structure provided with spiracles 2 pair of wings and three pair of legs. The wings are about 4-6 cm.

When expanded fully but the muscles associated with it are not strong. So they cannot fly for long, instead they walk. The wings are well ornamented with dark and faint brown demarkatism bands. The abdomen is covered with scales and is highly extended in females whereas narrow, slender and cylindrical in males. They mate only few hours after their birth and start laying eggs. The sexes are separate and sexual dimorphism is clean. The males are smaller and tender whereas the females are bigger and stout. Both the sexes do not feed. The females have life

span of 2-3 days whereas males have even less days to live and sometimes die during copulation. The copulation takes about 3-4 hours. Once copulated the female can lay eggs, all fertilized, till she dies, There is no need for further copulation.

Eggs and Oviposition of Mulberry-Silk Moth (*Bombyx mori*)

The female moth lays about 350-550 eggs at a time, just after fertilization. The eggs are minute, rounded and laid in clusters on the upper surface of the leaves. These eggs are well protected by means of gelatinous glue, which makes them to stick with the substratum. The newly laid eggs can be recognized by means of their pale yellow or cream coloured, unornamented structure but soon after



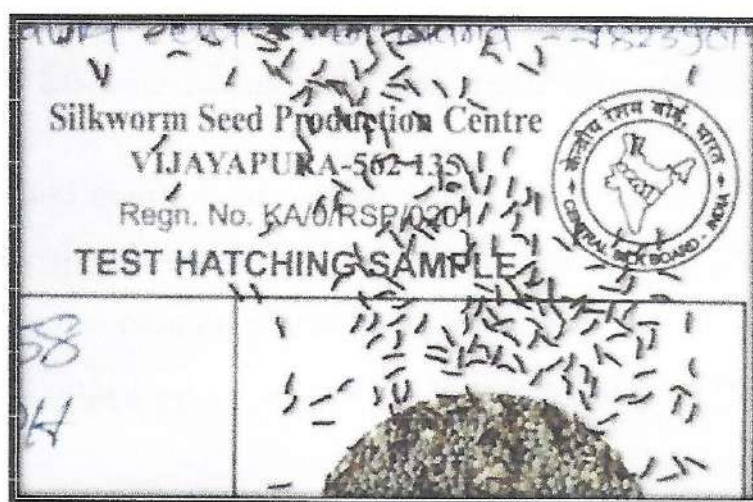
their oviposition, as they come in contact with fresh air they become dry and hard and their colour is changed from pale yellow to dark brown or black. This is a symptom that they are fertilized eggs. The viability of the egg depends upon the duration of copulation and number of eggs laid by the female. In the same way the number of eggs laid depends upon the health of the female moth. The adult female does not eat so the number of eggs laid depends directly on the larval health which later on develops as the female. In case the female is feeble and sick she will lay only few eggs which may have low percentages of hatchability as against the well fed and healthy female moth.

The eggs are very susceptible to temperature, light and humidity. In optimum temperature of 65°F-75°F they hatch within a period of 7-10 days provided they are well ventilated and in open shady place otherwise the period of hatching

increases. In extreme adverse atmospheric conditions they take more than 10 days and are in dormant stages. Period of incubation also depends upon the genetic condition of the female, in case the moth completes only one brood a year. The incubation period is increased but in case of *B. mori* the incubation days are not more.

Larvae

The newly emerged larvae are minute, slender, tender, pale yellow or cream coloured with dark brown head and biting and chewing type of mouthparts. They move rapidly in search of food and are voracious feeder. They



grow rapidly in size and eat continuously. A break in the food supply directly means the death of larva and loss in production of silk. The amount of silk produced is directly proportional to the feeding of larva. Healthier the larvae maximum is the output. The newly hatched larvae are about 3 mm. in length which move very fast but the full grown larva is about 6-7 cm. dark, dull coloured and thick like thumb. The body well segmented and marked with beautiful spots like other Lepidoptera larvae it also bears pseudo legs and moves in search of fresh leaves.

The tender newly hatched larvae prefer newly formed leaves whereas the old and well-developed larvae can eat any old or new leaf. Total larval period varies according to the climatic conditions like humidity, temperature and photoperiod but in case all the above cause are favourable they take about 21-35



days for their full development and moult 4 times each after an interval of 6-7 days. The last instar larva looks robust with a horn on the dorsal side in the posterior region which becomes more prominent when disturbed. The last instar larva possesses a pair of well-developed salivary gland on the lateral side of the body, which opens in the mouth.

The fully formed 5th instar larva undergoes some physiological changes and becomes restless. It is done due to certain intrinsic hormonal reasons. Now the larva stops feeding and migrates on one

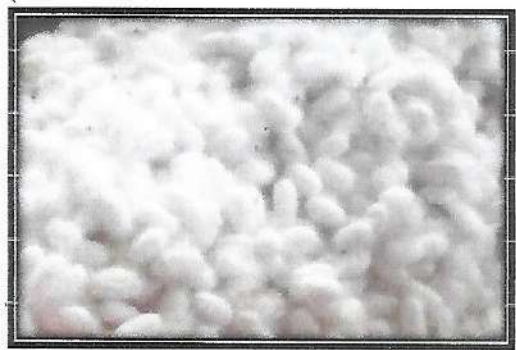


side. It prefers dark shady places particularly the corners or the points, which are at an angle. It moves its head in whirling position. It constantly and rapidly rotates its head at its axis and in the meantime the saliva comes out through a small pore known as spinneret. The spinneret is located on the tip of hypo-pharynx in the

mouth. There is a continuous flow of saliva through this pore which when exposed to fresh air becomes dry and hard and is known as silk. This silk is wrapped round the body almost at an average speed of one round per second. This is done for a period of 2-3 days and the larva is enveloped in a case made up of thread which look like a reel larva of the silken thread.

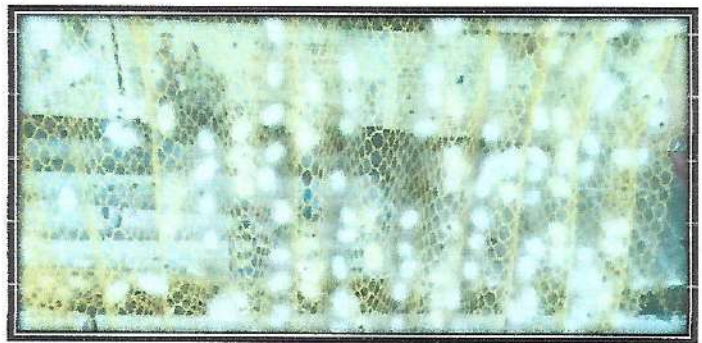
Cocoon

In these two-three days the larva remains without food and is actively engaged in spinning the silk. This reel of thread is called cocoon which provided a soft bed for the larva to pupate. The thread on the outer side of the cocoon is generally mixed and unarranged



while the thread in the lower strata pure without any contamination and is arranged in an organized manner.

The total length of the thread spun by a larva varies from 1000-1500 meter which measures about 0.3-0.5 gm. The colour of cocoon depends upon the species of the moth and the leaf they are fed

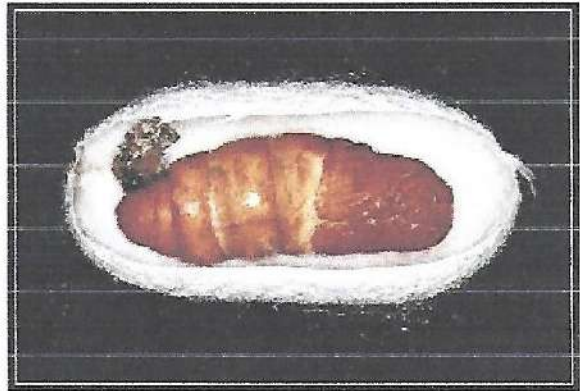


with. It ranges from pure white, cream to pale yellow and dirty white or dirty yellow and thickness of the thread also depends upon the species of the moth.

Thus total cocoon formation takes about 3-4 days and then the larva is changed into pupa.

Pupa

Once the cocoon formation is over, the larvae moult inside and transform into pupae. This is known as pupation. Pupal stage is also called as resting or inactive stage in the life cycle of silkworm. Actually it is a transitional stage during which some changes take place in the body of mature larvae (ripe worms).



Before transforming into proper pupa, the mature larvae pass through a prepupal stage during which dissolution (histolysis) of many larval organs like silk gland, moulting gland, abdominal appendages take place.

Pupal period ranges from 6-12 days after which the adult imago comes out. It cuts open the thread and emerges out, sits on the cocoon, spreads its wings and then is ready for copulation. The adult produces certain alkaline fluid which softens the thread and the moth pushes out of cocoon.

Total life cycle is completed in about 35-50 days.

Moth

The moth – the adult phase of the lifecycle – is not capable of functional flight, in contrast to the wild *B. mandarina* and other *Bombyx* species, whose males fly to meet females and for evasion from predators. Some may emerge with the ability to lift off and stay airborne, but sustained flight cannot



be achieved. This is because their bodies are too big and heavy for their small wings. Silk moths have a wingspan of 3–5 cm (1.2–2.0 in) and a white, hairy body. Females are about two to three times bulkier than males (for they are carrying many eggs), but are similarly colored. Adult Bombycidae have reduced mouthparts and do not feed.



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